ISSN: 1305-9319 e-ISSN: 1305-9327 Number: 1 Volume: 22 Year: 2026

MEDICAL JOURNAL OF BAKIRKÖY

www.bakirkoytip.org

ISSN: 1305-9319 e-ISSN: 1305-9327 Number: 1 Volume: 22 Year: 2026

MEDICAL JOURNAL OF BAKIRKÖY

Medical Journal of Bakırköy of is an official scientific Journal of University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital (BMJ)

It is published quarterly as 4 issues every year (March, June, September, December).

Please refer to the journal's webpage **(https://bakirkoymedj.org/)** for "Journal Policies" and "Instructions to Authors".

The editorial and publication processes of the journal are shaped in accordance with the guidelines of the ICMJE, WAME, CSE, COPE, EASE, and NISO. The journal conforms with the Principles of Transparency and Best Practice in Scholarly Publishing (doaj.org/bestpractice). The Medical Journal of Bakırköy is indexed in **Web of Science; Emerging Sources Citation Index (ESCI), TUBITAK ULAKBIM TR Index, Scopus, EBSCO – Academic Search Complete, J-Gate, Embase, CINAHL Complete, ScopeMed, WorldCat, Infobase, Ulrich's Database, Ideal Online, Türkiye Atıf Dizini, Türk Medline** and **CNKI**.

The journal is published online.

Owner: University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital

Responsible Manager: Meral Mert

Publisher Contact
Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1 34093 İstanbul, Türkiye
GSM: +90 530 177 30 97
E-mail: info@galenos.com.tr/yayin@galenos.com.tr
Web: www.galenos.com.tr **Publisher Certificate Number:** 14521

Printing Date: March 2026
ISSN: 1305-9319 **E-ISSN:** 1305-9327
International scientific journal published quarterly.

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Med J Bakirkoy 2026;22(1):1-7
DOI: 10.4274/BMJ.galenos.2025.2024.9-9

Review

Current Treatment Strategies in Psoriatic Arthritis

Psöriatik Artritte Güncel Tedavi Stratejileri

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ABSTRACT

Psoriatic arthritis (PsA) is seen in 20% of psoriasis patients and sometimes manifests before dermatological signs of psoriasis. PsA usually has a favorable prognosis, but in some patients, it can cause a disabling form of arthropathy. Furthermore, patients with PsA may have multiple comorbidities like cardiovascular disease, gout, metabolic syndrome, anxiety, and depression. Hence, effective treatment is important. There are multiple newly developed biological and targeted agents aiming to improve the quality of life and reduce disability. Non-steroidal anti-inflammatory drugs, local/systemic steroids, conventional disease-modifying anti-rheumatic drugs, tumor necrosis factor inhibitors, interleukin (IL)-17 inhibitors, Janus kinase inhibitors, apremilast, and IL-12/23 inhibitors are drugs that can be used for different domains of PsA. There are still newly developping agents under investigation.

Keywords: Psoriatic arthritis, psoriasis, biological agents, treatment, management

ÖZ

Psöriatik artrit (PsA) psöriazisli hastaların %20'sinde görülebilen bir romatizmal hastalıktır ve bazen cilt bulgularından önce ortaya çıkar. Genellikle iyi prognozlu olmasına rağmen bazen engelliliğe neden olabilir. PsA'lı hastalar eş zamanlı kardiyovasküler hastalıklar, gut, metabolik sendrom, anksiyete ve depresyon gibi komorbiditelere sahip olabilirler. Bu nedenle etkili tedavi önem arz etmekte olup yeni geliştirilen biyolojik ve hedefe yönelik ajanlarla hayat kalitesi iyileştirilebilir ve engellilik azaltılabilir. Steroid olmayan anti-enflamatuvar ilaçlar, lokal ve sistemik steroidler, konvansiyonel hastalık modifiye edici ilaçlar, tümör nekroz faktör inhibitörleri, interlökin (IL)-17 inhibitörleri, Janus kinaz inhibitörleri, apremilast, IL-12/23 inhibitörleri farklı tutulum şekillerinde kullanılabilir. Bazı yeni ajanlar ise henüz araştırma aşamasındadır.

Anahtar Kelimeler: Psöriatik artrit, psöriazis, biyolojik ajanlar, tedavi, yönetim

INTRODUCTION

Psoriatic arthritis (PsA), a chronic inflammatory musculoskeletal disease, is seen in approximately 20% of psoriasis patients and it is one of the a member of the spondyloarthropathies. It causes peripheral arthritis, entesitis, sacroiliitis, dactylitis, spondylitis, nail and skin involvement, and has diverse clinical pictures which sometimes makes diagnosis tough even for experts (Figure 1) (1).

Psoriasis, which is a relatively common condition with a prevalence of approximately 2% in the adult population, is well-documented; however, data about PsA frequency is very limited, which may be due to the lack of widely accepted classification or diagnostic criteria. PsA is rare in childhood and the geriatric period (2). In 15% of PsA patients, musculoskeletal findings might emerge before dermatological signs, causing delay in diagnosis (1).

Underestimation of PsA symptoms may cause a delay in the diagnosis. PsA usually has a favourable prognosis but can also cause deforming destructive arthropathy (shortening or telescoping of digits, fusion of joints) like rheumatoid arthritis and reduced quality of life, social isolation and disability (3). In addition, PsA can cause some extra-articular manifestations like uveitis, inflammatory bowel disease, cardiovascular disease, metabolic syndrome, hypertension, diabetes mellitus, and hyperlipidemia. Hence, early diagnosis and treatment are crucial in improving clinical outcomes and reducing joint damage. Fortunately,

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Cite as: Bıçkıcı Ö, Kozanoğlu E. Current treatment strategies in psoriatic arthritis. Med J Bakirkoy. 2026;22(1):1-7

Received: 28.09.2024
Accepted: 28.04.2025
Publication Date: 12.03.2026

there are multiple treatment options providing effective management (2). Goals of treatment include: alleviation of symptoms, improvement of joint functions, and prevention of comorbidities (1). Discovery of novel inflammatory pathways and development of new agents targeting these pathways has provided effective treatment of PsA (4).

Management requires a multidisciplinary approach including rheumatologists who care primarily for musculoskeletal involvement of the disease. Collaboration between the patient and the physician during treatment decision-making is important. Extra-articular findings and comorbidities should also be taken into account. Treatment should aim to reach remission or low disease activity (LDA) in long-standing disease, consisting of follow-ups at 3-month intervals, according to recent guidelines (treat-to-target strategy) (5). It would be rational to determine involved structures (peripheral arthritis, axial disease, dactylitis, enthesitis, skin or nail) and manage the medical treatment appropriately (6).

CLINICAL AND RESEARCH CONSEQUENCES

Therapeutical Agents Used in PsA

European Alliance of Associations for Rheumatology (EULAR, 2023), Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA, 2021), British Society for Rheumatology (BSR, 2022), and American College of Rheumatology/National Psoriasis Foundation (ACR/NPF, 2018) developed evidence-based recommendations for both pharmacological and non-pharmacologic treatment of PsA (5,7-9). Non-steroidal anti-inflammatory drugs (NSAIDs), systemic or local glucocorticoids, conventional synthetic disease-modifying anti-rheumatic drugs (csDMARD), tumor necrosis factor (TNF) inhibitors and newly developed biological agents are available choices in different conditions of the disease (Table 1) (7,10,11).

ACR/NPF 2018 recommended using TNF inhibitors over interleukin (IL)-17 inhibitors, IL-12/23 inhibitors, and oral small molecules like methotrexate, leflunomide, sulfasalazine, cyclosporine, and apremilast in the treatment of naive active PsA patients. In this guideline, 6% of recommendations were strong and 96% of them were conditional (9). EULAR 2023 guidelines recommended a csDMARD in patients with poor prognosis and polyarthritis. Glucocorticoids and NSAIDs were recommended as adjunctive therapy. In patients with an inadequate response to one csDMARD therapy, EULAR recommends the use of a biologic DMARD (bDMARD). In axial disease, EULAR recommended using NSAIDs, and for patients with inadequate response, the use of bDMARDs was recommended (5). BSR 2022 guideline proposed domain specific recommendations, which mainly consisted

Figure 1. Dactylitis in the 2nd toe in a patient with PsA
PsA: Psoriatic arthritis

Table 1. Drugs available for PsA management

Type	Name
	NSAIDs, local and systemic steroids
Conventional synthetic DMARDs	• Methotrexate • Leflunomide • Sulfasalazine
Biological DMARDs	• Anti-TNF agents (adalimumab, certolizumab pegol, golimumab, etanercept, infliximab) • Anti-IL-12/23 (ustekinumab) • Anti-IL-17A (secukinumab, ixekizumab) • Anti-IL-17A/F (bimekizumab) • Anti-CTLA4 (abatacept) • Anti-IL-23-p19 (guselkumab, risankizumab)
Targeted synthetic DMARDs	• JAK inhibitors • Tofacitinib • Upadacitinib • PDE4 inhibitor: apremilast

NSAIDs: Non-steroidal anti-inflammatory drugs, TNF: Tumor necrosis factor, IL: Interleukin, JAK: Janus kinase, DMARDs: Disease modifying antirheumatic drugs, PDE4: Phosphodiesterase 4, CTLA4: Cytotoxic T-lymphocyte antigen 4, PsA: Psoriatic arthritis

of csDMARD as a first line in peripheral involvement, with step up to bDMARD if response was inadequate. In axial disease, it has been recommended that NSAIDs be used as the first choice, and TNF inhibitors, IL-17 inhibitors, or Janus kinase (JAK) inhibitors be used for intolerants/inadequate responders (8). The GRAPPA 2021 guidelines proposed strong recommendations, for different domains of disease. GRAPPA expert group recommended csDMARD, TNF inhibitors, IL-17, IL-23, JAK, phosphodiesterase 4 (PDE4) inhibitors for peripheral disease and NSAIDs, TNF, IL-17, and JAK inhibitors for active axial disease (7). Lifestyle recommendations were proposed in BSR 2022 and ACR/NPF 2018 guidelines (8,9). The treat to target strategy was recommended in ACR/NPF 2018, EULAR 2023, and BSR 2022. LDA or remission achievement was primarily aimed at achieving through the treat-to-target strategy (5,8,9).

Although various theories are proposed, the pathogenesis of PsA is not clearly recognized today. Multiple environmental factors (smoking, infections, stress, etc.,) in the presence of genetic susceptibility (genes like human leukocyte antigen B27, B08) are possible activators of innate and adaptive immune systems that take a role in the pathogenic processes of PsA. Emerging targeted drugs effective against these different pathological axes demonstrated promising results in the management of the disease (12).

Patients who had predominatly peripheral disease, NSAIDs, intra articular and systemic glucocorticoids can be used while csDMARDs like methotrexate, leflunomide and sulfasalazine are first line options with preference of methotrexate in those with significant skin involvement. Oral methotrexate 10 mg weekly can be initiated and gradually increased up to 20 mg weekly. It is important to keep in mind that methotrexate is associated with an increased risk of hepatic fibrosis in patients with obesity or diabetes mellitus. In patients with low skin burden, leflunomide 20 mg daily, can be used as an alternative to methotrexate. Sulfasalazine 2-3 grams daily is another option in patients with mild psoriatic skin involvement. Gastrointestinal adverse effects are the main reason for discontinuation of the drug. Systemic glucocorticoids are used for severe flare unresponsive to NSAIDs, but are suggested to be tapered slowly as rapid reductions are associated with erythrodermic or pustular flares. For axial disease, NSAIDs (at the higher end of the dose range, for example, indomethacin tablet up to 150 mg), physiotherapy and TNF inhibitors, as well as IL-17 and JAK inhibitors, are used for NSAID unresponders (5,7-9).

Pathogenesis of PsA and Targeted Therapies

The pathogenetic process starts with the activation of antigen-presenting cells (APC) by genetic predisposition and environmental factors. After the secretion of several cytokines, such as IL-1, IL-6, IL-17, IL-22, IL-23, and TNF-α, by APCs, T lymphocyte activation takes place, and the pathological process of PsA proceeds (12).

IL-17A, which is involved in the pathogenesis of PsA, causes synovial tissue proliferation, inflammation and bone resorption (13). T lymphocytes differentiate into T helper 17 cells and secrete IL-17 (predominantly IL-17A isoform), facilitated by the key cytokine IL-23 [p19 and p40 (shared with IL-12) subunits]. Also, it was shown that IL-23 levels are increased in synovial tissue and skin of PsA patients (14). PDE4 enzyme converts cyclic adenosine monophosphate (AMP) to AMP, causing an increase in inflammatory cytokine expression (15). JAKs affect some of the cytokines important in the pathogenesis of PsA, like interferon-γ, IL-12, IL-22, IL-23, and IL-6 (16). Tyrosine kinase 2 (TYK-2), a JAK, mediates signaling by IL-23 (17). Recently developed targeted therapies generally act on these pathways.

Secukinumab

Secukinumab is a selective and direct inhibitor of IL-17A (18). EULAR/GRAPPA recommends it for uncontrolled axial or peripheral disease, and this agent was also found to be effective in skin involvement (5,7). A randomised,-placebo controlled phase 3 study (ULTIMATE) showed significantly reduced clinical and sonographic enthesitis/synovitis scores PsA patients in the secukinumab group at 12 weeks, reaching a plateau at week 52 (19). In the CHOICE study (double blind, randomized), ACR 20% (ACR20) response rates of biologic-naive PsA patients at week 16 were found to be significantly higher in the secukinumab group compared to the placebo (20).

Bimekizumab

Bimekizumab, an IL-17F and IL-17A inhibitor, is approved for PsA in Europe. In a recent systematic review [66 studies, evaluating 22 biologic/targeted synthetic (b/ts) DMARDs] and network meta-analysis (41 studies), bimekizumab was found to be effective on skin involvement. According to network meta-analysis, for minimal disease activity (MDA), bimekizumab 160 mg/4 weeks was ranked first in b/ts-DMARD naive patients and second in TNF-inhibitor experienced patients. The safety profile was similar to other b/ts DMARDs (21). In a study including active PsA patients (n=347), at week 16, MDA was achieved in 44% of the bimekizumab group versus 6% in the placebo group.

After switching to bimekizumab in the placebo group, MDA was 47% in the bimekizumab group and 33% in the bimekizumab switched group. Bimekizumab was superior to placebo in skin, nails, joints, dactylitis and enthesitis domains in patients who were inadequent responder/intolerant to TNF inhibitors. The most common adverse events were oral candidiasis, nasopharyngitis, and urinary tract infection. Efficacy was sustained from week 16 to 52 in the bimekizumab group (22).

Ixekizumab

Ixekizumab is an IL-17A inhibitor, which was previously shown to be effective on multiple domains of PsA. The SPIRIT study, including 566 patients with PsA, showed significant joint and skin improvement in ixekizumab group than in adalimumab patients at week 52. Safety issues were similar to previous results (infections and injection site reactions) (23,24). In another study, the ixekizumab group achieved the treatment target more significantly than the placebo group with disease activity indices at week 24 (25). A phase-III study involving patients who were non-responders to or intolerant of TNF inhibitors showed that significantly more patients in the ixekizumab group than in the placebo group achieved ACR50, MDA, disease activity in PsA (DAPSA) ≤14, and Psoriasis Area And Severity Index (PASI) 100 at week 24, which persisted through week 52 (26).

Risankizumab

Risankizumab blocks the p19 subunit of IL-23, and is approved for PsA in many countries. In a phase III KEEPsAKE 1 study, 940 patients unresponsive/intolerant to csDMARDs, were randomized to risankizumab and placebo groups (subcutaneous 150 mg risankizumab vs placebo on weeks 0, 4, and 16). At week 24, more patients in the risankizumab group had improved significantly more than those in the placebo group regarding the ACR20 response. ACR50 and ACR70 response rates were also significantly higher in the risankizumab group. Joint, skin, and nail findings of PsA patients had benefited from continuous risankizumab treatment, and radiological progression was slower as well (27). Another phase III study, KEEPsAKE 2 trial, showed improvement of PsA signs and symptoms (joint, skin, fatigue) which were maintained for 52 weeks in patients inadequately responsive/intolerant to csDMARD/bDMARD. The long-term safety profile was consistent through week 52 (28). In a meta-analysis of 6 randomized controlled studies, risankizumab group had significantly more ACR20 response rates than placebo, PASI scores were lower at 24th weeks. Serious adverse events between two groups were not significantly different (29).

Guselkumab

Guselkumab targets the p19 unit of IL-23 and is approved for psoriasis and PsA. In the DISCOVER-2 trial, 652 patients were randomized to guselkumab and placebo groups. Stable improvements in ACR20, 50, 70 scores, and the enthesitis and dactylitis resolution scores were observed at the 100th week (30). Among the 285 participants of the COSMOS study, a significantly higher number of patients in the guselkumab group had an ACR20 response regarding skin, joint, and functional scores, than the placebo group (31). Data from DISCOVER-1 and 2 studies showed more patients in the guselkumab group had reached DAPSA LDA, DAPSA remission, and MDA at week 24 (32). Studies consisting of TNF inhibitor naive and experienced patient groups showed low rates of adverse events in both groups up to two years of follow-up (33).

Ustekinumab

Ustekinumab is a monoclonal antibody blocking both IL-12 and 23. In phase 3 PSUMMIT 1 and 2 studies, ustekinumab treated patients showed higher ACR20, 50, 70, DAS28-C-reactive protein responses and remission rates than placebo group at 24th weeks. Besides, complete resolution of enthesitis and dactylitis was higher in the ustekinumab group at week 24 (34). The pooled results from these two studies demonstrated greater changes in the modified Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) scores in the ustekinumab group than in the placebo group at week 24 (35). Concomitant methotrexate administration was not associated with the increased efficacy of ustekinumab (36).

Upadacitinib

Upadacitinib is a JAK inhibitor selectively effective on JAK-1. In a randomized controlled trial, Mease et al. (37) investigated its effectiveness in patients with PsA. Patients with upadacitinib had more ACR20 responses than placebo at week 12. MDA score was higher in the upadacitinib group at the 24th week. Rates of adverse events were similar between placebo and 15 mg upadacitinib groups (37). In a study comparing upadacitinib with adalimumab, ACR20, 50, 70 and MDA responses were higher in the upadacitinib group than in the adalimumab group at 24 weeks (38). In another study in patients with axial disease, the upadacitinib 15 mg group showed greater BASDAI and Ankylosing Spondylitis Disease Activity Score responses than placebo (39). Phase 3 studies of SELECT-PsA 1 and 2 demonstrated that upadacitinib was effective in all clinical manifestations of PsA. In addition, adverse effects like cardiovascular events, malignancy, venous thromboembolism did not increase with upadacinitib (40).

Filgotinib

Filgotinib is a newly developed oral agent under investigation for PsA. It selectively blocks JAK-1. In a phase 2 study, namely, the EQUATOR trial, filgotinib 200 mg was significantly superior to placebo in terms of improvements in active domains (peripheral arthritis, psoriasis, and enthesitis) of PsA . Furthermore, ACR20 response rates at week 16 were significantly higher in the filgotinib group than in the placebo. Filgotinib also significantly improved the quality of life of the patients more than the placebo group. Only one patient in the filgotinib group had herpes zoster infection (41).

Deucravacitinib

Deucravacitinib is an oral selective TYK-2 inhibitor. A phase 2 trial (203 patients) showed significantly higher ACR20 response rates and better quality of life scores with deucravacitinib 6 mg once daily than placebo at week 16. The most common adverse events were reported as upper respiratory tract infections, diarrhea, and headache (17).

Brepocitinib

Brepocitinib is a TYK-2/JAK-1 inhibitor that primarily affects the IL-12 and 23 signaling pathways. The phase-II study of the brepocitinib group, with 218 patients, showed higher ACR20, 50, 70, Psoriasis Severity Index scores, and MDA response rates at week 16 than the placebo. Response rates were improved or sustained through week 52. Mild/moderate infections were reported in the brepocitinib group (42).

Tofacitinib

Tofacitinib is an oral JAK inhibitor, and its efficacy and safety in active PsA were shown in phase 3 studies. Improvement in enthesitis generally increased over time (43). Its efficacy was greater than that of the placebo in PsA, regardless of concomitant methotrexate dose. Tofacitinib 5 mg was more efficacious with methotrexate >15 mg/week, (headache was more common), than <15 mg/week (44).

Apremilast

The oral PDE4 inhibitor apremilast (30 mg) was associated with significant ACR response rates in patients with PsA, and these rates were sustained at week 260. Swollen and tender joint counts, enthesitis, dactylitis, and psoriasis skin lesions were domains that benefited. The most common adverse effects reported were diarrhea, nausea, headache, and upper respiratory tract infections (45).

Abatacept

It is a selective T cell co-stimulation modulator and approved for PsA. It had efficient responses in PsA activity and reduced structural damage, psoriasis, enthesitis, and dactylitis. It has greater response rates in patients with poor prognostic factors (high disease activity and progressive disease) (46). Abatacept infusion also caused significant reductions in magnetic resonance imaging scores of synovitis and tenosynovitis of PsA patients more than placebo group (47).

CONCLUSION

PsA can frequently cause functional impairment or disability, eventually impairing the patients' quality of life. NSAIDs and glucocorticoids are used for musculoskeletal relief, but csDMARDs and bDMARDs are cornerstones of management. Besides lifestyle modification and non-pharmacologic recommendations, there are multiple current successful agents, and new drugs under investigation. Future research focusing on the pathophysiological mechanisms will help to better understand the disease and lead to the development of new therapeutic agents.

FOOTNOTES

Authorship Contributions

Consept: Ö.B., EK., Design: Ö.B., EK., Data Collection or Processing: Ö.B., EK., Analysis or Interpretation: Ö.B., EK., Literature Search: Ö.B., EK., Writing: Ö.B., EK.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Liu JT, Yeh HM, Liu SY, Chen KT. Psoriatic arthritis: epidemiology, diagnosis, and treatment. World J Orthop. 2014;5:537.
2. Ogdie A, Coates LC, Gladman DD. Treatment guidelines in psoriatic arthritis. Rheumatology (Oxford). 2020;59(Suppl 1):i37-i46.
3. Gladman DD, Antoni C, Mease P, Clegg DO, Nash P. Psoriatic arthritis: epidemiology, clinical features, course, and outcome. Ann Rheum Dis. 2005;64(suppl 2):14-7.
4. Krakowski P, Gerkowicz A, Pietrzak A, Krasowska D, Jurkiewicz A, Gorzelak M, et al. Psoriatic arthritis-new perspectives. Arch Med Sci. 2019;15:580-9.
5. Gossec L, Kerschbaumer A, Ferreira RJ, Aletaha D, Baraliakos X, Bertheussen H, et al. EULAR recommendations for the management of psoriatic arthritis with pharmacological therapies: 2023 update. Ann Rheum Dis. 2024;83:706-19.
6. Gladman DD, Ritchlin C. Treatment of psoriatic arthritis. UpToDate [Internet]. Waltham, MA: UpToDate Inc.; 2020 [accessed 2020 Sep 23].

7. Coates LC, Soriano ER, Corp N, Bertheussen H, Callis Duffin K, Campanholo CB, et al. Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA): updated treatment recommendations for psoriatic arthritis 2021. Nat Rev Rheumatol. 2022;18:465-79.
8. Tucker L, Allen A, Chandler D, Ciurtin C, Dick A, Foulkes A, et al. The 2022 British Society for Rheumatology guideline for the treatment of psoriatic arthritis with biologic and targeted synthetic DMARDs. Rheumatology (Oxford). 2022;62:487.
9. Singh JA, Guyatt G, Ogdie A, Gladman DD, Deal C, Deodhar A, et al. Special article: 2018 American College of Rheumatology/ National Psoriasis Foundation Guideline for the Treatment of Psoriatic Arthritis. Arthritis Care Res (Hoboken). 2019;71:2-29.
10. Coates LC, Helliwell PS. Psoriatic arthritis: state of the art review. Clin Med (Lond). 2017;17:65.
11. Ritchlin CT, Colbert RA, Gladman DD. Psoriatic arthritis. N Engl J Med. 2017;376:957-70.
12. Azuaga AB, Ramírez J, Cañete JD. Psoriatic arthritis: pathogenesis and targeted therapies. Int J Mol Sci. 2023;24:4901.
13. Mease P, van der Heijde D, Landewé R, Mpofu S, Rahman P, Tahir H, et al. Secukinumab improves active psoriatic arthritis symptoms and inhibits radiographic progression: primary results from the randomised, double-blind, phase III FUTURE 5 study. Ann Rheum Dis. 2018;77:890-7.
14. Östör A, Van den Bosch F, Papp K, Asnal C, Blanco R, Aelion J, et al. Efficacy and safety of risankizumab for active psoriatic arthritis: 24-week results from the randomised, double-blind, phase 3 KEEPsAKE 2 trial. Ann Rheum Dis. 2022;81:351-8.
15. Edwards CJ, Blanco FJ, Crowley J, Birbara CA, Jaworski J, Aelion J, et al. Apremilast, an oral phosphodiesterase 4 inhibitor, in patients with psoriatic arthritis and current skin involvement: a phase III, randomised, controlled trial (PALACE 3). Ann Rheum Dis. 2016;75:1065-73.
16. Mease P, Hall S, FitzGerald O, van der Heijde D, Merola JF, Avila-Zapata F, et al. Tofacitinib or adalimumab versus placebo for psoriatic arthritis. N Engl J Med. 2017;377:1537-50.
17. Mease PJ, Deodhar AA, van der Heijde D, Behrens F, Kivitz AJ, Neal J, et al. Efficacy and safety of selective TYK2 inhibitor, deucravacitinib, in a phase II trial in psoriatic arthritis. Ann Rheum Dis. 2022;81:815-22.
18. Brembilla NC, Boehncke WH. Revisiting the interleukin 17 family of cytokines in psoriasis: pathogenesis and potential targets for innovative therapies. Front Immunol. 2023;14:1186455.
19. D'Agostino MA, Carron P, Gaillez C, Conaghan PG, Naredo E, López-Rdz A. Effects of secukinumab on synovitis and enthesitis in patients with psoriatic arthritis: 52-week clinical and ultrasound results from the randomised, double-blind ULTIMATE trial with open label extension. Semin Arthritis Rheum. 2023;63:152259.
20. Nguyen T, Churchill M, Levin R, Valenzuela G, Merola JF, Ogdie A, et al. Secukinumab in United States biologic-naïve patients with psoriatic arthritis: results from the randomized, placebo-controlled CHOICE study. J Rheumatol. 2022;49:894-902.
21. Mease PJ, Gladman DD, Merola JF, Nash P, Grieve S, Laliman-Khara V, et al. Comparative efficacy and safety of bimekizumab in psoriatic arthritis: a systematic literature review and network meta-analysis. Rheumatology (Oxford). 2024;63:1779-89.
22. Coates LC, Landewé R, McInnes IB, Mease PJ, Ritchlin CT, Tanaka Y, et al. Bimekizumab treatment in patients with active psoriatic arthritis and prior inadequate response to tumour necrosis factor inhibitors: 52-week safety and efficacy from the phase III BE COMPLETE study and its open-label extension BE VITAL. RMD Open. 2024;10:e003855.
23. Smolen JS, Mease P, Tahir H, Schulze-Koops H, de la Torre I, Li L, et al. Multicentre, randomised, open-label, parallel-group study evaluating the efficacy and safety of ixekizumab versus adalimumab in patients with psoriatic arthritis naïve to biological disease-modifying antirheumatic drug: final results by week 52. Ann Rheum Dis. 2020;79:1310-9.
24. Deodhar AA, Combe B, Accioly AP, Bolce R, Zhu D, Gellett AM, et al. Safety of ixekizumab in patients with psoriatic arthritis: data from four clinical trials with over 2000 patient-years of exposure. Ann Rheum Dis. 2022;81:944-50.
25. Coates LC, Smolen JS, Mease PJ, Husni ME, Merola JF, Lespessailles E, et al. Comparative performance of composite measures from two phase III clinical trials of ixekizumab in psoriatic arthritis. RMD Open. 2022;8:e002457.
26. Kirkham B, Sesin C, Gellett AM, Sprabery AT, Lin CY, Turkiewicz A. Improvement from ixekizumab treatment in patients with psoriatic arthritis who have had an inadequate response to one or two TNF inhibitors. Rheumatology (Oxford). 2021;60:4367-72.
27. Kristensen LE, Keiserman M, Papp K, McCasland L, White D, Lu W, et al. Efficacy and safety of risankizumab for active psoriatic arthritis: 52-week results from the KEEPsAKE 1 study. Rheumatology (Oxford). 2023;62:2113-21.
28. Östör A, Van den Bosch F, Papp K, Asnal C, Blanco R, Aelion J, et al. Efficacy and safety of risankizumab for active psoriatic arthritis: 52-week results from the KEEPsAKE 2 study. Rheumatology (Oxford). 2023;62:2122-9.
29. Su QY, Zhou HN, Xia GM, Zhang RY, Tian HY, Su C, at al. Efficacy and safety of risankizumab in patients with psoriatic arthritis: a systematic review and meta-analysis of randomized controlled trials. Rheumatol Ther. 2024;11:227-37.
30. McInnes IB, Rahman P, Gottlieb AB, Hsia EC, Kollmeier AP, Xu XL, et al. Long-term efficacy and safety of guselkumab, a monoclonal antibody specific to the p19 subunit of interleukin-23, through two years: results from a phase iii, randomized, double-blind, placebo-controlled study conducted in biologic-naive patients with active psoriatic arthritis. Arthritis Rheumatol. 2022;74:475-85.
31. Coates LC, Gossec L, Theander E, Bergmans P, Neuhold M, Karyekar CS, et al. Efficacy and safety of guselkumab in patients with active psoriatic arthritis who are inadequate responders to tumour necrosis factor inhibitors: results through one year of a phase IIIb, randomised, controlled study (COSMOS). Ann Rheum Dis. 2022;81:359-69.
32. Coates LC, Ritchlin CT, Gossec L, Helliwell PS, Rahman P, Kollmeier AP, et al. Guselkumab provides sustained domain-specific and comprehensive efficacy using composite indices in patients with active psoriatic arthritis. Rheumatology (Oxford). 2023;62:606-16.
33. Rahman P, Boehncke WH, Mease PJ, Gottlieb AB, McInnes IB, Shawi M, et al. Safety of guselkumab with and without prior tumor necrosis factor inhibitor treatment: pooled results across 4 studies in patients with psoriatic arthritis. J Rheumatol. 2023;50:769-80.
34. McInnes IB, Chakravarty SD, Apaolaza I, Kafka S, Hsia EC, You Y, et al. Efficacy of ustekinumab in biologic-naïve patients with psoriatic arthritis by prior treatment exposure and disease duration: data from PSUMMIT 1 and PSUMMIT 2. RMD Open. 2019;5:e000990.
35. Helliwell PS, Gladman DD, Chakravarty SD, Kafka S, Karyekar CS, You Y, et al. Effects of ustekinumab on spondylitis-associated endpoints in TNFi-naïve active psoriatic arthritis patients with physician-reported spondylitis: pooled results from two phase 3, randomised, controlled trials. RMD Open. 2020;6:e001149.
36. Koehm M, Rossmanith T, Foldenauer AC, Herrmann E, Brandt-Jürgens J, Burmester GR, et al; MUST Investigator Group. Methotrexate plus ustekinumab versus ustekinumab monotherapy in patients with active psoriatic arthritis (MUST): a randomised, multicentre, placebo-controlled, phase 3b, non-inferiority trial. Lancet Rheumatol. 2023;5:e14-23.

37. Mease PJ, Lertratanakul A, Anderson JK, Papp K, Van den Bosch F, Tsuji S, et al. Upadacitinib for psoriatic arthritis refractory to biologics: SELECT-PsA 2. Ann Rheum Dis. 2021;80:312-20.
38. McInnes IB, Kato K, Magrey M, Merola JF, Kishimoto M, Pacheco-Tena C, et al. Upadacitinib in patients with psoriatic arthritis and an inadequate response to non-biological therapy: 56-week data from the phase 3 SELECT-PsA 1 study. RMD Open. 2021;7:e001838corr1.
39. Baraliakos X, Ranza R, Östör A, Ciccia F, Coates LC, Rednic S, et al. Efficacy and safety of upadacitinib in patients with active psoriatic arthritis and axial involvement: results from two phase 3 studies. Arthritis Res Ther. 2023;25:56.
40. Marchesoni A, Citriniti G, Girolimetto N, Possemato N, Salvarani C. Upadacitinib for the treatment of adult patients with active psoriatic arthritis. Expert Rev Clin Immunol. 2024;20:423-34.
41. Orbai AM, Ogdie A, Gossec L, Tillett W, Leung YY, Gao J, et al. Effect of filgotinib on health-related quality of life in active psoriatic arthritis: a randomized phase 2 trial (EQUATOR). Rheumatology (Oxford). 2020;59:1495-504.
42. Mease P, Helliwell P, Silwinska-Stanczyk P, Miakisz M, Ostor A, Peeva E, et al. Efficacy and safety of the TYK2/JAK1 inhibitor brepocitinib for active psoriatic arthritis: a phase IIb randomized controlled trial. Arthritis Rheumatol. 2023;75:1370-80.
43. Mease PJ, Orbai AM, FitzGerald O, Bedaiwi M, Dona L Fleishaker, Mundayat R, et al. Efficacy of tofacitinib on enthesitis in patients with active psoriatic arthritis: analysis of pooled data from two phase 3 studies. Arthritis Res Ther. 2023;25:153.
44. Kivitz AJ, FitzGerald O, Nash P, Pang S, Azevedo VF, Wang C, et al. Efficacy and safety of tofacitinib by background methotrexate dose in psoriatic arthritis: post hoc exploratory analysis from two phase III trials. Clin Rheumatol. 2022;41:499-511.
45. Wells AF, Edwards CJ, Kivitz AJ, Bird P, Guerette B, Delev N, et al. Apremilast monotherapy for long-term treatment of active psoriatic arthritis in DMARD-naïve patients. Rheumatology (Oxford). 2022;61:1035-43.
46. Mease PJ, McInnes IB, Strand V, FitzGerald O, Ahmad HA, Elbez Y, et al. Poor prognostic factors in predicting abatacept response in a phase III randomized controlled trial in psoriatic arthritis. Rheumatol Int. 2020;40:1021-8.
47. Østergaard M, Bird P, Pachai C, Du S, Wu C, Landis J, et al. Implementation of the OMERACT psoriatic arthritis magnetic resonance imaging scoring system in a randomized phase IIb study of abatacept in psoriatic arthritis. Rheumatology (Oxford). 2022;61:4305-13.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):8-17
DOI: 10.4274/BMJ.galenos.2024.2024.9-8

Research

Rate and Associated Factors of the Intention to Leave the Current Job among Resident Physicians Working in A University Hospital: A Preliminary Study

Bir Üniversite Hastanesinde Çalışan Asistan Hekimlerin Mevcut İşlerinden Ayrılma Niyeti Oranları ve İlişkili Faktörler: Bir Ön Araştırma

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ABSTRACT

Objective: Türkiye is experiencing a significant physician attrition with departure of young physicians. This study aimed to assess the rate and associated factors of intention to leave (ITL) among resident physicians working in a university hospital.

Methods: A cross-sectional, questionnaire-based survey was conducted with the actively working resident physicians in a government university hospital. Data were collected using five different questionnaires during face-to-face interviews: a questionnaire for sociodemographic data, the Turkish versions of the work-family conflict (WFC) and family-work conflict (FWC), Job Satisfaction Inventory (JSI), Copenhagen Burnout Inventory, and the Intention To Turnover Scale (ITS). Correlation and regression analysis determined factors associated with the ITL.

Results: 45.8% of the residents would quit their jobs if they had any chance, and 41.8% had recently thought more often about quitting their jobs. 12.2% of the residents were actively looking for a new job, and 43.4% planned to quit. Marital status, having children, compulsory service history, working hours, number of shifts at the weekends, income status, institution satisfaction, satisfaction with the area of specialization, JSI scores, WFC-FWC scores and burnout scores were found to be correlated with ITS scores. Among these factors, total job satisfaction, FWC, and work-related burnout scores predicted ITL the current job independently among these physicians.

Conclusion: Resident physicians have a high ITL their current jobs. The main contributing factors were decreased job satisfaction, FWC, and work-related burnout. Improvement of job satisfaction and work conditions, and implementation of family-friendly practices are essential to better retain these physicians.

Keywords: Intention to leave, resident physicians, job satisfaction, burnout, work-family balance

ÖZ

Amaç: Türkiye'de genç hekimlerin gidişiyle ciddi bir hekim kaybı yaşanmaktadır. Bu çalışmada bir üniversite hastanesinde görev yapan asistan hekimlerin işten ayrılma niyeti oranları ve ilişkili faktörlerin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Ankete dayalı, kesitsel olarak planlanan bu çalışma bir devlet üniversitesi hastanesinde aktif olarak görev yapan asistan doktorlarla yapıldı. Veriler, yüz yüze görüşmelerde beş farklı anket kullanılarak toplandı: Sosyodemografik verilere yönelik anket, iş-aile ve aile-iş çatışmaları ölçeklerinin Türkçe versiyonu (İAÇ-AİÇ), İş Doyumu Envanteri (İDE), Kopenhag Tükenmişlik Envanteri ve işten ayrılma niyeti ölçeği (İAN). Korelasyon ve regresyon analizi, işten ayrılma niyetiyle ilişkili faktörleri belirledi.

Bulgular: Asistanların %45,8'i, fırsat olsa işten ayrılacağını, %41,8'i ise son dönemde işten ayrılmayı daha sık düşündüğünü belirtti. Asistanların %12,2'si aktif olarak yeni iş arıyordu ve %43,4'ü işten ayrılmayı planlıyordu. Medeni durum, çocuk sahibi olma, zorunlu hizmet geçmişi, çalışma saatleri, hafta sonu vardiya sayısı, gelir durumu, kurum memnuniyeti, uzmanlık alanından memnuniyet, İDE puanları, İAÇ-AİÇ puanları ve tükenmişlik puanlarının İAN ile ilişkili olduğu belirlendi. Bu faktörlerden toplam iş tatmini, aile-iş çatışması ve işle ilgili tükenmişlik puanları bu hekimlerin mevcut işten ayrılma niyetleri ilişkili bağımsız faktörler olarak bulunmuştur.

Sonuç: Asistan hekimlerin mevcut işlerinden ayrılma niyetleri oldukça yüksektir. Katkıda bulunan ana faktörler iş tatmininin azalması, AİÇ ve işle ilgili tükenmişliktir. Bu hekimlerin gitmemeleri ve elde tutulmaları için iş tatmininin ve çalışma koşullarının iyileştirilmesi ve aile dostu uygulamaların hayata geçirilmesi şarttır.

Anahtar Kelimeler: İşten ayrılma niyeti, asistan doktor, mesleki tatmin, tükenmişlik, iş-aile dengesi

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Cite as: Yıldız H, Aytan E, Opçin E, Nebioğlu Yıldız M. Rate and associated factors of the intention to leave the current job among resident physicians working in a university hospital: a preliminary study. Med J Bakirkoy. 2026;22(1):8-17

Received: 27.09.2024
Accepted: 18.12.2024
Publication Date: 12.03.2026

INTRODUCTION

Türkiye is currently experiencing significant physician attrition that leads to the increasing departure of young Turkish physicians abroad. A recent countrywide multicenter study reported that 70.7% of medical students have emigration intentions (1). The "working conditions in the country" were reported to be the main push factor (1). Türkiye already has a physician shortage, with 1.9 doctors per 1,000 people, less than many Organization for Economic Co-operation and Development countries: the average is 3.5/1,000 (2). Numerous socioeconomic, personal, interpersonal, and organizational factors contribute to this tendency to emigrate.

The practice of medicine has always been challenging. It requires extensive medical school education, additional postgraduate resident training, and many years of practice to gain adequate experience. In modern times, physicians are confronted with lengthy, inflexible working hours, many night shifts, frequent overtime, a heavy workload, stressful working environments, emotional contacts, inadequate hospital resources, conflicts with patients and patients' families, and economic issues (3). The response of the physicians to these conditions varies greatly. Some of them burn out from this stressful environment, feel unable to continue their work, and want to leave their current job. In Türkiye, almost no empirical study assessed this topic among physicians; however, the rate of physicians who want to leave their jobs ranges from 3.2% to 53.7% (4) in developed countries. A national survey study reported this rate as 20.5% among Chinese physicians (5) and 14.5% among Taiwanese physicians (6).

The departure of physicians from jobs decreases access to healthcare for the population. In addition, recruiting and training new physicians is not easy, as the training period is longer and more expensive than in other occupations. Retaining physicians has become an essential issue for the continuation of health services. Studies show that intention to leave (ITL) is a vital precursor of actual leaving (7); and underlying reasons must be understood for prevention. Therefore, it is crucial to study physicians' ITL in order to identify the high-risk group for early intervention before leaving occurs.

The time of medical specialization is considered the most challenging period during a physician's career (8). This residency period directly follows graduation from medical school and usually has a heavy workload with high demands and limited job control. Also, this stage of life is the family-founding and child-having stage, which may also contribute to work-family conflict (WFC) and family-work conflict (FWC) (9).

The explanatory factors of ITL the current job are usually grouped under demographic factors, family or personal domain, working hours and conditions, job-related well-being, and career aspects (4). The present study aims to assess the rate and associated factors of ITL among resident physicians working in a university hospital, including the above-mentioned explanatory factors.

METHODS

The study was designed as a cross-sectional, questionnaire-based survey conducted at Mersin University Hospital between 1 December 2023 and 31 January 2024. The inclusion criteria were being actively working as a resident physician at Mersin University Hospital and agreeing to contribute to the study. There were 496 actively working resident physicians and all were invited to participate. Of these, 371 responded and completed the questionnaires. Informed consent was obtained from all of the responders. Data were collected using five different questionnaires during face-to-face interviews with two researchers. The questionnaires were selected to assess all possible explanatory factors: demographic characteristics, family/personal space, working time, salary and job satisfaction. The study was approved by Mersin University Clinical Research Ethics Committee (approval no: 2023/824, date: 05.12.2023).

The first questionnaire included questions regarding the resident physicians' sociodemographic data, working conditions, and income status. Sociodemographic data included age, gender, marital status, parenthood, area of speciality, professional status, personnel cadre, weekly working hours, number of night shifts during weekdays and weekends, income status, institution satisfaction, satisfaction with the area of specialization and satisfaction with the salary. Satisfaction was assessed with a three-question scale: not satisfied, neither satisfied nor dissatisfied, and satisfied.

The second questionnaire was the Turkish version of the WFC-FWC inventory. The original WFC-FWC inventory was developed by Netemeyer et al. (10). The questionnaire is composed of two subscales, WFC-FWC, and each includes five items and uses a 5-point Likert response scale (from "strongly agree" to "strongly disagree"). The values of the WFC-FWC Scales are calculated as the sum of the responses to the five items, with five being the lowest and 25 being the highest score. The higher scores represent more conflict. The Turkish version was adapted and validated by Kolbaşı and Bağcı (11) with a Cronbach alpha of 0.88 for WFC and 0.89 for FWC. The Cronbach alpha values for WFC and FWC were calculated as 0.896 and 0.852 in the present study.

The third questionnaire was the Job Satisfaction Inventory developed by Kuzgun et al. (12) in 2005. It consists of 20 items and uses a 5-point Likert scale (from "never" to "always"). High scores on the scale mean that the individual's job satisfaction is high. The Cronbach alpha value of the original inventory was reported to be 0.91, and in the present study, it was found to be 0.876.

The fourth questionnaire was the Turkish version of the Copenhagen Burnout Inventory (CBI) developed by Kristensen et al. (13) in 2005. This inventory consists of 19 items and assesses burnout across three domains: personal, work-related, and client (patient in the present study)-related burnout (14). The Turkish version was adapted and validated by Bakoğlu et al. (14) with Cronbach alpha values of 0.903, 0.857, and 0.669 for personal burnout, work-related burnout and patient-related burnout domains, respectively. It uses a 5-point Likert scale (from "never: 0 points" to "always: 100 points"), and higher scores indicate a higher level of burnout symptoms. A total domain score is obtained, by taking the average scores for each question within each domain. A total domain score of 50 points or higher is considered a moderate-to-high degree of burnout (13). The Cronbach alpha values for personal, work-related, and patient-related burnout domains were calculated as 0.885, 0.867 and 0.838, respectively, in the present study.

The fifth questionnaire was the Intention to Turnover Scale (ITS), developed by Rosin and Korabik (15) in 1995, translated to Turkish, and validated by Tanrıöver (16) in 2005 with a Cronbach's alpha value of 0.930. The scale was revised by Torun (17) with a Cronbach alpha value of 0.835, and this revised form was used in the present study. The questionnaire consists of 4 items and uses a 5-point Likert scale (from "strongly disagree" to "strongly agree"). The fourth question, "I do not plan to quit my job", is scored in reverse. The higher scores indicate an increased ITL the current job. "Strongly agree" and "agree" were considered positive for the first three questions, and "strongly disagree" and "disagree" were considered affirmative for the last question. The Cronbach alpha value was found to be 0.825 in the present study.

Statistical Analysis

Statistical analysis was accomplished with IBM SPSS Statistics version 21 (IBM Corp., Armonk, NY, USA). The normality of the data was analyzed with the Kolmogorov-Smirnov test and histograms. Descriptive data were expressed as percentages, means and standard deviations. T-tests and one-way analysis of variance (ANOVA) tests were used where appropriate to compare normally distributed parametric data. For post hoc comparisons of ANOVA, the Bonferroni test was used. Correlation analysis was used to determine the variables related to the ITS scores. Regression analysis was conducted with the significant variables. A p-value of <0.05 was considered to be significant.

RESULTS

The response rate was 74.8% among all the resident physicians working in the hospital; the sociodemographic characteristics of the 371 responding physicians are shown in Table 1. The mean age was 29.8±3.3 years, and more than half of the residents, 50.7%, were younger than 30. The male-to-female ratio was almost equal (1.07), and 55.5% were married. Most of the residents were living in rented houses (70.9%), and among those who were married, 85.4% of the spouses were working. Seventeen residents (4.6%) had completed residency training in a main specialty and had passed an examination to get training in a subspecialty. 55.5 percent of the residents were working in internal medicine sciences departments, and 40.2 percent were working in surgical departments. Türkiye has two main bodies administering residency programs for Turkish physicians: The Council of Higher Education and the University of Health Sciences. After medical school, physicians are obligated to complete a compulsory service in different parts of the country for a limited time if they do not pass the examination for residency. In the enrolled population, 55.5% of the residents were in the University of Health Sciences program. There were only eight physicians (2.2%) from various foreign countries. 79.5% of the Turkish physicians had completed their compulsory service obligations. 46.1% of the attendants worked more than 60 hours per week. The average number of night shifts during weekdays and weekends in a month were 3.8±1.6 shifts and 1.9±0.8 shifts, respectively. 43.7% of the residents reported that their income was less than their expenses, and only 2.2% were satisfied with their salaries. Satisfaction with the institution and the area of specialization was reported to be 29.6% and 42.96%, respectively (Table 1).

Table 2 shows the residents' responses to the ITS questions. It was found that 45.8% of the residents would quit their jobs if they had any chance, and 41.8% had recently been thinking more often about quitting their jobs (Table 2). 12.2% of the residents were actively looking for a new job, and 43.4% planned to quit their jobs (Table 2).

Comparisons of the ITSv scores between the groups, based on residents' characteristics, are shown in Table 3. The total ITS score was significantly higher in married residents than in single residents: 11.71±4.4 vs. 10.61±4.1, $p<0.004$. The total score was higher among residents who do not have

Table 1. Sociodemographic characteristics of the resident physicians

	Number	%
Age cohort		
Up to 29 years	188	50.7
30-34	168	45.3
35-39	11	2.9
40 years and older	4	1.1
Gender		
Male	192	51.8
Female	179	48.2
Marital status		
Single	160	43.1
Married	206	55.5
Divorced	5	1.3
Having children		
No	133	35.8
Yes	78	21
Owing a house		
Own a house	108	29.1
Rent a house	263	70.9
Spouse's employment status		
Working	176	85.4
Not working	30	14.6
Professional status		
Resident	354	95.4
Resident of subspeciality	17	4.6
Department of specialization		
Fundamental medical sciences	16	4.3
Internal medicine sciences	206	55.5
Surgical medical sciences	149	40.2
Personnel cadre (work contract)		
The council of higher education	157	42.3
University of health sciences	206	55.5
Foreign country	8	2.2
Compulsory service history		
Yes	295	79.5
No	76	20.5
Weekly working hours		
Less than 40	6	1.6
40-59	194	52.3
60-79	134	36.1
More than 80	37	10
Number of night shifts during weekdays in a month	3.8±1.6	
Number of shifts in the weekends in a month	1.9±0.8	
Income status		
Income less than expenses	162	43.7
Income just covers expenses	141	38
Income more than expenses	68	18.3
Institution satisfaction		
Not satisfied	118	31.8
Neither satisfied nor dissatisfied	143	38.5
Satisfied	110	29.6

Table 1. Continued

	Number	%
Satisfaction of the area of specialization		
Not satisfied	94	25.3
Neither satisfied nor dissatisfied	119	32.1
Satisfied	158	42.6
Satisfaction with the salary		
Not satisfied	324	87.3
Neither satisfied nor dissatisfied	39	10.5
Satisfied	8	2.2

Table 2. The resident physicians' responses to the Intention to Turnover Scale questions

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
If I had the chance, I would quit my job	13.6%	22.9%	17.5%	17.0%	28.8%
Recently, I've been thinking about quitting my job more often	12.1%	27.2%	18.9%	20.5%	21.3%
I am actively looking for a new job	45.0%	30.5%	12.4%	6.5%	5.7%
I do not plan to quit my job	18.9%	14.3%	23.5%	25.1%	18.3%

Table 3. The comparisons of the Intention to Turnover Scale scores between the groups based on resident physicians' sociodemographic characteristics

Characteristics	Total intention to leave score±SD	p-value
Age (years)		
Up to 29 years 30-34 35-39 40 years or older	11.14±3.9 11.55±4.7 8.36±2.9 10.25±5.1	0.108
Gender		
Male Female	11.29±4.7 11.11±3.9	0.791
Marital status		
Single Married Divorced	10.61±4.1 11.71±4.4 11.20±1.1	0.048 1 vs. 2: 0.04
Having children		
Yes No	10.87±4.9 12.09±4.0	0.069
Spouse's employment status		
Working Not working	11.88±4.6 10.60±3.9	0.073
Owing a house		
Own a house Rent a house	10.70±4.4 11.45±4.2	0.129
Professional status		
Resident Resident of subspeciality	11.22±4.3 11.47±3.6	0.818
Department of specialization		
Fundamental medical sciences Internal medicine sciences Surgical medical sciences	13.0±4.5 11.0±4.2 11.37±4.4	0.179

Table 3. Continued

Characteristics	Total intention to leave score±SD	p-value
Personnel cadre (work contract)		
The council of higher education University of health sciences Foreign country	11.17±4.4 11.35±4.2 9.63±4.37	0.523
Compulsory service history		
Yes No	11.57±4.3 9.95±4.1	0.003
Weekly working hours		
Less than 40 40-59 60-79 More than 80	7.2±3.8 10.7±3.9 11.54±4.4 13.32±5	0.001 1 vs. 4: 0.006 2 vs. 4: 0.005
Income status		
Income less than expenses Income just covers expenses Income more than expenses	12.01±4.3 11.18±4.4 9.47±3.8	<0.001 1 vs. 3: <0.001 2 vs. 3: 0.002
Institution satisfaction		
Not satisfied Neither satisfied nor dissatisfied Satisfied	12.7±4.4 11.36±3.9 9.47±4.12	<0.001 1 vs. 2: 0.026 1 vs. 3: <0.001 2 vs. 3: 0.001
Satisfaction of the area of specialization		
Not satisfied Neither satisfied nor dissatisfied Satisfied	14.1±3.9 11.8±3.9 9.1±3.7	<0.001 1 vs. 2: <0.001 1 vs. 3: <0.001 2 vs. 3: <0.001
Satisfaction with the salary		
Not satisfied Neither satisfied nor dissatisfied Satisfied	11.40±4.3 10.23±3.7 9.25±5.1	0.116
Personal burnout		
Score <50 Score ≥50	7.78±3.2 12.38±4	<0.001
Patient-related burnout		
Score <50 Score ≥50	7.20±3.3 11.92±4.1	<0.001
Work-related burnout		
Score <50 Score ≥50	7.41±3.4 12.11±4	<0.001

SD: Standard deviation

any children (12.09±4.0 vs. 10.87±4.9) and whose spouses were working (11.88±4.6 vs. 10.60±3.9). However, these differences were not significant. ITL was greater among residents who completed their compulsory service tasks (11.57±4.3 vs. 9.95±4.1; p=0.003). Total ITS scores were significantly higher for residents working more than 80 hours than for those working less than 60 hours. There was no difference in total ITS scores between residents working 60 to 79 hours per week and more than 80 weeks concerning total ITS scores. The scores were found to be significantly lower in residents whose income was more than their expenses when compared to those whose income was less than or just covering their expenses (9.47±3.8 vs. 12.01 4.3, p<0.001; 9.47±3.8 vs. 11.18±4.4, p=0.002). The residents who were satisfied with the institution and the area of specialization, had significantly lower total ITS scores than those who were not satisfied and neither satisfied nor dissatisfied. The personal, patient-related,

and work-related burnout scores were ≥50 in 75.2%, 85.4%, and 81.4% of the resident physicians, and the mean total ITL scores were significantly higher in these physicians (Table 3). Work-related burnout is "the degree of physical and psychological fatigue and exhaustion that the person perceives as related to his/her work" (13). This domain assesses work-related fatigue with seven questions. 66.5% of the residents responded "often" or "always" to the two questions: "Do you feel burnt out because of your work?" and "Is your work emotionally exhausting?"

Factors that were significantly correlated with the total ITS scores are depicted in Table 4. Being married, having children, having non-completed compulsory service tasks, income status, satisfaction with income, satisfaction with the area of specialization, and total job satisfaction scores were negatively correlated with the total ITS scores (Table 4). Weekly working hours, number of weekend shifts per month, WFC scores, FWC scores, patient-related burnout scores, personal-related burnout scores, and work-related burnout scores were positively correlated with the total ITS scores (Table 4). Among these significantly correlated parameters, only total job satisfaction scores, FWC scores, and work-related burnout scores were independent predictors of the ITS scores (Table 5).

DISCUSSION

This study shows that the assessed resident physicians have a high ITL their current jobs, and about 1 in every 8 of them not only planned to quit, but also had already been looking for another job. Although most of them were not satisfied with their salaries and had more expenses than income, the main contributing factors for the ITL were job dissatisfaction, WFC, and work-related burnout.

Intention to quit is the tendency to deliberately leave the organization in a conscious and planned manner (18). Medical doctors are accomplished individuals who have undergone many selective examinations in every population and have a pivotal role in the healthcare system. Therefore, the departure of doctors from jobs risks decreasing healthcare delivery capacity. In addition, the burden of increased demand for clinical care shifts to the remaining physicians. This would eventually lead more physicians to leave their jobs, causing a vicious cycle. Studies showed that ITL is a vital precursor of actual turnover (4). The

Table 4. Factors significantly correlated with the total Intention to Turnover Scale scores

Variables	Correlation coefficient	p-value
Marital status (married: 1, single: 2, divorced: 3)	-0.120	0.021
Having children (no: 1, yes: 2)	-0.141	0.04
Compulsory service history (yes: 1, no: 2)	-0.150	0.004
Weekly working hours	0.208	<0.001
Number of shifts in the weekends in a month	0.165	0.004
Income status (I<E: 1, I~E: 2, I>E: 3)	-0.2	<0.001
Institution satisfaction (NS: 1, NS/DS: 2, S: 3)	-0.301	<0.001
Satisfaction of the area of specialization (NS: 1, NS/DS: 2, S: 3)	-0.472	<0.001
Total job satisfaction score	-0.716	<0.001
Work-family conflict score	0.441	<0.001
Family-work conflict score	0.324	<0.001
Patient-related burnout score	0.520	<0.001
Personal-related burnout score	0.583	<0.001
Work-related burnout score	0.632	<0.001

I<E: Income less than expenses, I~E: Income just covers expenses, I>E: Income more than expenses, NS: Not satisfied, NS/DS: Neither satisfied nor dissatisfied, S: Satisfied

Table 5. Regression analysis for the factors associated with the Intention to Turnover Scale scores

Interval	B	SE	Beta	t	p-value	95% CI	Confidence
Total job satisfaction score	-0.192	0.023	-0.557	-8.26	<0.001	-0.238	-0.146
Family-work conflict score	0.212	0.053	0.20	3,97	<0.001	0.106	-0.318
Work-related burnout score	0.049	0.025	0.192	1.99	0.049	0	-0.0097

CI: Confidence interval, SE: Standard error

reported rate of intent to leave among physicians ranged from 11.8% to 22% in five developed countries (4). However, these studies were conducted before the coronavirus disease 2019 pandemic. In a recent study from the United States of America conducted during the pandemic, 32.6% of 15 890 physicians reported ITL (19). Our study expands the literature by providing novel information about the prevalence of ITL among Turkish resident physicians. The rate of ITL among Turkish physicians has yet to be studied, the rate of ITL among the residents only has not been assessed in the literature before. Residency is a unique, lengthy, and rigorous training period during a medical career, and continuing the medical career is associated with how successfully residents manage the demanding work-life balance of medicine. In the present study, the rate of ITL was found to be 43.4% among the residents. Additionally, 12.2% were actively looking for a new job.

Studies have shown that burnout is associated with increased physician turnover (7). Several organizational, social, and job-related factors result in feelings of burnout, which interrupt coping with personal and interpersonal demands (20) and lead to quitting clinical practice. The prevalence of burnout among physicians has been reported to range from 0% to 86.2% (21). This comprehensive range results from the heterogeneity in the criteria used to measure burnout, and there is still no consensus on the best way. The CBI, developed to overcome criticisms of the widely used Maslach Burnout Inventory (13) and being freely obtainable, was used in the present study. The burnout rates were considerably high in all domains, and ITL scores significantly increased among these residents experiencing burnout. However, among the three domains, only the work-related burnout domain was found to be an independent predictor of residents' ITL. Extended working hours and night shifts are reported to elevate stress, fatigue, and risk of burnout (22). Lin et al. (23) also showed that burnout rates increase 1.5 times faster after reaching 60, 74, and 84 hours of work per week in healthcare professionals. Similarly, ITS scores were higher in residents working more than 80 hours per week. Long, heavy working hours that usually involve inflexible schedules, the presence of numerous and irregular shiftwork including weekends, a stressful hospital environment, emotional and economic issues, and patients' and patient-related issues all contribute together to feelings of burnout that increase the risk of ITL among the residents.

Job satisfaction is an important feeling that strengthens commitment and plays a role in physician retention (24). It is reported to mediate between the workplace and workers' ITL (25). This study confirmed that job satisfaction is negatively correlated with ITL among resident physicians, consistent with previous studies. Satisfaction with the institution and area of specialization was associated with lower total ITS scores. In particular, job satisfaction is one of the independent predictors of turnover intention in these young physicians. These findings show that residents' welfare and job satisfaction must be improved to prevent resident turnover. Increasing physician satisfaction rates is not difficult as physicians derive high internal satisfaction levels due to intrinsic rewards such as societal respect and the fulfilment derived from positively impacting lives (26).

Family work is a form of inter-role conflict that describes the conflict arising from family obligations that disturb one's work. It occurs when the pressure from the family and work domains is mutually incompatible (27). According to scarcity theory, a person's resources are limited, and time devoted to the requirements of one role makes it difficult to fulfil the requirements of another. Therefore, spending more energy, and time on family roles necessitates spending less on work (28). Marital obligations, responsibilities for children and childcare, and economic issues are family obligations. Family time commitment and family-related emotional distress are shown to be positively associated with FWC (29). This conflict between family and job demands is found to be another independent predictor of ITL among the residents. The residents devote more energy to their family obligations and want to quit their jobs when there is a high incompatibility between family and work.

This study is the first that assesses the prevalence and factors associated with ITL among resident physicians in Türkiye. The response rate was high. Reliability analysis of the included inventories indicated they were all reliable with high internal consistency coefficients (Cronbach's alpha >0.8).

Study Limitations

However, some limitations should be addressed. The study is a single-centre study, which is the main limitation limiting the generalizability of the results. The study's cross-sectional design is another potential limitation as absolute causal effects cannot be assessed, and findings cannot be generalized. The data were obtained with self-reported questionnaires and could not be cross-validated. Responses might have been influenced by method bias. Therefore, absolute objectivity cannot be claimed.

CONCLUSION

This cross-sectional study describes the prevalence of ITL among resident physicians working in a government university hospital and identifies factors associated with

this intention. A large percentage of the residents reported their ITL their current jobs. This intention is related to many factors, including marital status, having children, compulsory service history, working hours, number of shifts at the weekends, income status, institution satisfaction, satisfaction with the area of specialization, and personal burnout scores. None of these factors independently predicts the ITL in the residents. Instead, one by one, the combination of these factors, which are components of total job satisfaction, FWC and work-related burnout, predicts ITL the current job among these physicians.

This research indicates that organizational and work-design interventions should be implemented to improve job satisfaction among resident physicians. Public health policymakers should consider the underlying factors and take measures that will positively affect the satisfaction of this population. Improving work conditions and implementing family-friendly practices to enhance the appeal of the hospital workplace are essential to better retain these physicians.

ETHICS

Ethics Committee Approval: The study was approved by Mersin University Clinical Research Ethics Committee (approval no: 2023/824, date: 05.12.2023).

Informed Consent: Informed consent was obtained from all of the responders.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: H.Y., E.O., Concept: H.Y., E.A., M.N.Y., Design: H.Y., E.A., M.N.Y., Data Collection or Processing: H.Y., E.O., Analysis or Interpretation: H.Y., E.A., M.N.Y., Literature Search: H.Y., E.A., Writing:H.Y., E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Eser E, Cil E, Sen Gundogan NE, Col M, Yildirim Ozturk EN, Thomas DT, et al. Push and pull factors of why medical students want to leave Türkiye: a countrywide multicenter study. Teach Learn Med. 2023:1-13.
2. Socha-Dietrich K, Dumont J. International migration and movement of doctors to and within OECD countries-2000 to 2018: developments in countries of destination and impact on countries of origin. Paris, France: OECD Publishing; 2021.
3. O'Connor K, Muller Neff D, Pitman S. Burnout in mental health professionals: a systematic review and meta-analysis of prevalence and determinants. Eur Psychiatry. 2018;53:74-99.
4. Degen C, Li J, Angerer P. Physicians' intention to leave direct patient care: an integrative review. Hum Resour Health. 2015;13:74.
5. Zhang C, Hu L, Ma J, Wu S, Guo J, Liu Y. Factors determining intention to leave among physicians in tertiary hospitals in China: a national cross-sectional study. BMJ Open. 2019;9:e023756.
6. Tsai YH, Huang N, Chien LY, Chiang JH, Chiou ST. Work hours and turnover intention among hospital physicians in Taiwan: does income matter? BMC Health Serv Res. 2016;16:667.
7. Hamidi MS, Bohman B, Sandborg C, Smith-Coggins R, de Vriee P, Albert MS, et al. Estimating institutional physician turnover attributable to self-reported burnout and associated financial burden: a case study. BMC Health Serv Res. 2018;18:851.
8. Serrano K. Women residents, women physicians and medicine's future. WMJ. 2007;106:260-5.
9. Fuss I, Nübling M, Hasselhorn HM, Schwappach D, Rieger MA. Working conditions and work-family conflict in German hospital physicians: psychosocial and organisational predictors and consequences. BMC Public Health. 2008;8:353.
10. Netemeyer RG, Boles JS, McMurrian R. Development and validation of work–family conflict and family-work conflict scales. J Appl Psychol. 1996;81:400-10.
11. Kolbaşı E, Bağcı Z. İş-aile ve aile- iş çatışması ile iş tatmini arasındaki ilişki: imalat sektöründe bir araştırma. Avrasya Sosyal ve Ekonomi Araştırmaları Derg. 2018;5:157-68.
12. Kuzgun Y, Aydemir Sevim S, Hamamcı Z. Mesleki doyum ölçeğinin geliştirilmesi. Turk Psychol Couns Guid J. 1999;2:14-8.
13. Kristensen TS, Borritz M, Villadsen E, Christensen KB. The Copenhagen Burnout Inventory: a new tool for the assessment of burnout. Work Stress. 2005;19:192-207.
14. Bakoğlu RE, Yıldız S, Yiğit İ, Taştan Boz İ. Tükenmişliği ölçmede alternatif bir araç Kopenhag tükenmişlik envanterinin Marmara Üniversitesi akademik personeli üzerine uyarlanması. Yönetim Dergisi: İstanbul Üniversitesi İşletme Fakültesi İşletme İktisadı Enstitüsü. 2009;20.
15. Rosin H, Korabik K. Organizational experiences and propensity to leave: a multivariate investigation of men and women managers. J Vocat Behav. 1995;46:1-16.
16. Tanrıöver Ü. The effects of learning organization climate and self-directed learning on job satisfaction, affective commitment and intention to turnover [Master's thesis, Marmara Universitesi (Turkey)].
17. Torun Y. The meditation effect of organizational cynicism on employee empowerment and turnover intention relationship: a research on organizational cynicism scale development. [Master's thesis, Marmara Universitesi (Turkey)].
18. Sökmen A, Şimşek T. Örgütsel bağlılık, örgütle özdeşleşme, stres ve işten ayrılma niyeti ilişkisi: bir kamu kurumunda araştırma. Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Derg. 2016;18:606-20.
19. Ligibel JA, Goularte N, Berliner JI, Bird SB, Brazeau CMLR, Rowe SG, et al. Well-being parameters and intention to leave current institution among academic physicians. JAMA Netw Open. 2023;6:e2347894.
20. Leiter MP. Burnout as a crisis in professional role structures: measurement and conceptual issues. Anxiety Stress Coping. 1992:5:79-93.
21. Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of burnout among physicians: a systematic review. JAMA. 2018;320:1131-50.
22. Hanganu B, Lorga M, Pop LM, Loan BG. Socio-demographic, professional and institutional characteristics that make Romanian doctors more prone to malpractice complaints. Medicina (Kaunas). 2022;58:287.

23. Lin RT, Lin YT, Hsia YF, Kuo CC. Long working hours and burnout in health care workers: non-linear dose-response relationship and the effect mediated by sleeping hours-a cross-sectional study. J Occup Health. 2021;63:e12228.
24. Dewa CS, Loong D, Bonato S, Thanh NX, Jacobs P. How does burnout affect physician productivity? A systematic literature review. BMC Health Serv Res. 2014;14:325.
25. Iverson RD. An event history analysis of employee turnover: the case of hospital employees in Australia. Hum Resour Manag Rev. 1999;9:397-418.
26. Ali Jadoo SA, Aljunid SM, Dastan I, Tawfeeq RS, Mustafa MA, Ganasegeran K, et al. Job satisfaction and turnover intention among Iraqi doctors - a descriptive cross-sectional multicentre study. Hum Resour Health. 2015;13:21.
27. Kinnunen U, Mauno S. Antecedents and outcomes of work-family conflict among employed women and men in Finland. Hum Relat. 1998;51:157-77.
28. Goode WJ. A theory of role strain. Am Sociol Rev. 1960;25:483-96.
29. Frone M, Yardley J, Markel K. Developing and testing an integrative model of the work-family interface. J Vocat Behav. 1997;50:145-67.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):18-24
DOI: 10.4274/BMJ.galenos.2025.2024.9-7

Research

The Relationship Between Anxiety and Depression Levels of Orthopedic Traumatology Patients and the Perception of Nursing Care

Ortopedi ve Travmatoloji Hastalarının Anksiyete ve Depresyon Düzeyleri ile Hemşirelik Bakım Algısı Arasındaki İlişki

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ABSTRACT

Objective: This study aims to investigate the relationship between the anxiety and depression levels of orthopedic traumatology patients and the perception of nursing care.

Methods: This study, which had a descriptive and correlational design, included 231 patients hospitalized in the orthopaedics and traumatology clinic between August 2019 and September 2019. Data were collected using the data form, the Hospital Anxiety and Depression Scale (HADS), and the Patient's Perception of Nursing Care Scale. Number Cruncher Statistical System 2007 (Kaysville, Utah, USA) was used to analyze the data.

Results: The average score of the "anxiety" sub-scale of the HADS among the patients participating in the study was 6.80±4.36; the "depression" sub-scale mean score was 6.35±4.10. The mean score of the Patient's Perception of Nursing Care Scale was found to be 69.71±9.44 points. The HADS "anxiety" sub-scale scores of women were found to be higher than those of men. The HADS anxiety and depression sub-scale scores of patients whose income is less than their expenses were found to be higher than those of the other patients ($p<0.01$).

Conclusion: Patients' perceptions of nursing care were positive. Patients with low levels of anxiety and depression had higher satisfaction with nursing care. It is thought that the results of the study will play an important role in guiding nurses to define anxiety and depression in orthopedic traumatology patients and increasing the quality of patient care in the preoperative and postoperative periods.

Keywords: Perception, anxiety, depression, patient perception of care, nursing care

ÖZ

Amaç: Bu çalışmanın amacı ortopedi ve travmatoloji hastalarının anksiyete ve depresyon düzeyleri ile hemşirelik bakımı algıları arasındaki ilişkiyi incelemektir.

Gereç ve Yöntem: Tanımlayıcı ve ilişki arayıcı tipte tasarlanan bu çalışmaya, Ağustos 2019 ile Eylül 2019 tarihleri arasında ortopedi ve travmatoloji kliniğinde yatan 231 hasta dahil edildi. Veriler; veri formu, Hastane Anksiyete ve Depresyon Ölçeği (HADS) ve Hastanın Hemşirelik Bakımı Algısı Ölçeği kullanılarak toplandı. Verilerin analizinde Number Cruncher Statistical System 2007 (Kaysville, Utah, ABD) programı kullanıldı.

Bulgular: Araştırmaya katılan hastaların HADS "anksiyete" alt boyut puan ortalaması 6,80±4,36; "depresyon" alt boyut puan ortalaması 6,35±4,10'dur. Hastanın Hemşirelik Bakımını Algılama Ölçeği puan ortalaması 69,71±9,44 puan olarak belirlendi. Kadınların HADS "anksiyete" alt boyut puanları erkeklere göre daha yüksek bulundu. Geliri giderinden az olan hastaların HADS "anksiyete" ve "depresyon" alt boyut puanları diğer hastalara gore daha yüksek bulundu ($p<0,01$).

Sonuç: Hastaların hemşirelik bakımına ilişkin algıları olumludur. Anksiyete ve depresyon düzeyi düşük olan hastaların hemşirelik bakımından memnuniyetleri daha yüksektir. Çalışma sonuçlarının ortopedi ve travmatoloji hastalarında anksiyete ve depresyonun tanımlanmasında, ameliyat öncesi ve sonrası dönemde hasta bakım kalitesinin artırılmasında hemşirelere rehberlik etmede önemli rol oynayacağı düşünülmektedir.

Anahtar Kelimeler: Algı, anksiyete, depresyon, hasta bakım algısı, hemşirelik bakımı

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Received: 23.09.2024
Accepted: 04.03.2025
Publication Date: 12.03.2026

Cite as: Çalışkan F, Seller A, Başaran SH, Bayrak A. The relationship between anxiety and depression levels of orthopedic traumatology patients and the perception of nursing care. Med J Bakirkoy. 2026;22(1):18-24

INTRODUCTION

Patients hospitalized for health problems may experience physiological, psychological, and social problems due to the course of the disease, hospital environment, procedures, etc., (1,2). One of the most important problems experienced by orthopedic traumatology patients is restricted movement (3,4). Therefore, patients may become partially or fully dependent on the nurse in their life activities (3). In addition, uncertainty about the day of surgery, postoperative pain, and fear of death are quite common in these patients. This can cause patients and their relatives to experience negative emotions such as anxiety and depression (5). In addition, before the surgical procedure, patients may have negative feelings including fear, helplessness, hopelessness, anxiety, and depression due to issues such as not being able to wake-up, deterioration of body integrity, loss of organs or tissues, and problems with sexual life (6-8). Especially, patients with restricted mobility who undergo surgical procedures, such as those in orthopedic traumatology, need high-quality nursing care, in order to cope with these changes and the negative emotions they experience. In addition, patients should be informed and educated by nurses before and after the procedure in order to reduce these negative feelings and thoughts.

One of the criteria for determining the quality of nursing care is the patient's satisfaction level. Patients' perceptions of nursing care are affected by factors such as the patient's age, educational status, cultural characteristics, and the information and training provided by nurses (9,10). There is a limited number of studies examining the perceptions of orthopedic traumatology patients towards anxiety, depression, and nursing care (8,11).

This study aims to examine the relationship between the anxiety and depression levels of orthopedic traumatology patients and the perception of nursing care. It is thought that the results of the study will play an important role in guiding nurses in defining anxiety and depression in orthopedic traumatology patients and increasing the quality of patient care in the preoperative and postoperative periods. At the same time, the aim is to contribute to the literature by planning and implementing educational programs for patients in the preoperative and postoperative process, within the scope of the nurse's educator role.

METHODS

The study has a descriptive and correlational design. In this study, after the approval of the Clinical Research Ethics Committee of the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital (approval no: 2019-13-07, date: 08.07.2019), patients who underwent any orthopedic surgery between August 2019 and September 2019 were evaluated. The patients included in the study were those who were hospitalized for at least five days in the orthopedics and traumatology clinic of our hospital. They were able to communicate and did not have a psychiatric history. We conducted this study with 231 patients who were selected using a simple random sampling technique and met the inclusion criteria, and were accepted to participate in the study. The research sought answers to the following questions:

1. What are the anxiety levels of orthopedics and traumatology patients and the affecting factors?

2. What are the depression levels and the affecting factors in orthopedic traumatology patients?

3. Is there a relationship between the anxiety and depression levels of orthopedic traumatology patients and their perceptions of nursing care?

The data form was developed by the researchers. The form contained nine closed-ended and one open-ended questions prepared to gather information about the patient's gender, marital status, education status, occupation, income status, previous hospitalization, chronic disease, and presence of a companion. In addition, the Hospital Anxiety and Depression Scale (HADS) and Patient's Perception of Nursing Care Scale (PPNCS) were used in this study (12-15).

The patients were given the data form, HADS, and PPNCS together, and they were instructed to mark the most appropriate statements against each item in the data collection form and to fill them in completely. The researcher read the questions to the patients who were unable to fill out the data collection forms themselves and filled the forms in line with the patients' answers. To avoid bias in the study, the researchers did not wear a nurse's uniform during data collection. Additionally, the data were collected by a researcher who did not work in the orthopedics and traumatology clinic. Verbal and written informed consent was obtained from the patients who agreed to participate in the study.

Statistical Analysis

The Number Cruncher Statistical System 2007 program (Kaysville, Utah, USA) was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, first quartile, third quartile, frequency, percentage, minimum, maximum) were used when evaluating the study data. The suitability of quantitative data for normal

distribution was tested by the Shapiro-Wilk test and graphical examinations. The Mann-Whitney U test was used for comparisons between two groups of non-normally distributed quantitative variables. The Kruskal-Wallis and the Dunn-Bonferroni tests were used for comparisons between groups of more than two non-normally distributed quantitative variables. Spearman correlation analysis was used to evaluate the relationships between quantitative variables. Statistical significance was accepted as $p<0.05$.

RESULTS

We present in Table 1 the demographic characteristics of the patients, including their hospitalization and chronic disease status, as well as companion information.

We found the average score of the patients participating in the study in the HADS "anxiety" sub-scale to be 6.80±4.36 points (range 0-19). The mean score on the "depression" sub-scale was found to be 6.35±4.10 points (range 0-19). We found the mean total score of the PPNCS to be 69.71±9.44 points (range 21-75) (Table 2).

According to the marital status, educational status, previous hospitalization, and chronic illness, the scores of the patients from the HADS "anxiety" and "depression" sub-scales and the total score of the PPNCS do not show a statistically significant difference ($p>0.05$) (Table 2).

The scores of the women participating in the study in the HADS "anxiety" sub-scale were found to be statistically significant and higher than those of the men ($p=0.018$). The scores they got from the "depression" sub-scale of HADS and the scores they got from the total of the PPNCS did not show a statistically significant difference ($p>0.05$) (Table 3).

A statistically significant difference was found between the scores of the patients participating in the study in the HADS "anxiety" sub-scale according to their income levels ($p=0.001$). As a result of the pairwise comparisons made to determine the differences in scores, the scores of the patients whose income is less than their expenses were found to be significantly higher than those whose income is either more than or equal to their expenses ($p=0.004$, $p=0.005$, $p<0.01$; respectively). A statistically significant difference was found between the scores of the patients in the HADS "depression" sub-scale according to their income status ($p=0.001$). As a result of the pairwise comparisons made to determine the difference, the scores of the patients whose income is less than their expenses were found to be significantly higher than those whose income is more than their expenses, and those whose income is equal to their expenses ($p=0.013$, $p=0.004$, $p<0.01$; respectively).

Table 1. The demographic characteristics of the patients

		n (%)
Gender	Female	107 (46.3)
	Male	124 (53.7)
Marital status	Married	151 (65.4)
	Single	44 (19.0)
	Widowed/divorced	36 (15.6)
Education status	Literate	29 (12.6)
	Primary school	112 (48.5)
	High school	56 (24.2)
	University	25 (10.8)
	Illiterate	9 (3.9)
Occupation	Homemaker	75 (32.5)
	Worker	61 (26.4)
	Officer	13 (5.6)
	Farmer	7 (3.0)
	Self-employment	56 (24.2)
	Unemployed	14 (6.1)
	Retired	5 (2.2)
Income status	Income is less than their expenses	76 (32.9)
	Income is equal to their expenses	134 (58.0)
	Income is more than their expenses	21 (9.1)
Previous hospitalization	Yes	159 (68.8)
	No	72 (31.2)
How many days if previous hospitalization	Mean±SD	18.16±30.71
	Median (min-max)	7 (1-200)
Cronic disease	Yes	63 (27.3)
	No	168 (72.7)
	Hypertension	30 (47.6)
	Rheumatism	4 (6.3)
	Heart disease	7 (11.1)
	Goiter	5 (7.9)
	Diabetes	22 (34.9)
	Cancer	2 (3.2)
	Cholesterol	2 (3.2)
	Asthma	5 (7.9)
	Parkinson disease	2 (3.2)
	Other	8 (12.8)
Presence of a companion	With a companion	222 (96.1)
	Without a companion	9 (3.9)
If there is a companion, stay with her/him (n=222)	Stays constantly	178 (80.2)
	Stays at certain hours	44 (19.8)

SD: Standard deviation, Min: Minimum, Max: Maximum

No statistically significant difference was found between the scores of the patients in the total PPNCS when grouped by income status (p>0.05) (Table 3).

The scores of the patients with a companion in the HADS "anxiety" sub-scale were found to be statistically significantly higher than those without a companion (p=0.049). According to the status of the companion, the scores of the patients from the HADS "depression" sub-scale and their total scores from the PPNCS do not show a statistically significant difference (p>0.05) (Table 4).

A statistically significant and weak negative correlation was found between the scores of the patients in the HADS sub-dimensions ["anxiety" (r=-0.214; p=0.001) and "depression" (r=-0.168; p=0.010)] and the PPNCS total scores, indicating that as anxiety and depression scores increased, PPNCS total scores decreased (r=-0.214; p=0.001) (Table 5).

DISCUSSION

Hospitalized patients experience some psychological, social, and physiological changes, which affect patients' expectations and perceptions about nursing care (1,3,16).

In the study by Aletto et al. (17), with orthopedics and traumatology patients, the mean hospital stay was 12.2±5 days in 2018 and 10.8±3.7 days in 2019, and in the study by Koç et al. (18), with orthopedics and traumatology patients,

Table 2. Comparison of HADS and PPNCS scores by gender

		Gender		p-value
		Female (n=107)	Male (n=124)	
HADS-anxiety score	Mean±SD	7.63±4.63	6.08±3.99	0.018[a*]
	Median (min-max)	7 (0-18)	5 (0-19)	
HADS-depression score	Mean±SD	6.65±4.27	6.08±3.95	0.383[a]
	Median (min-max)	6 (0-19)	5.5 (0-16)	
PPNCS total score	Mean±SD	70.84±7.58	68.73±10.72	0.162[a]
	Median (min-max)	74 (37-75)	73 (21-75)	

[a]: Mann-Whitney U test, *: p<0.05, SD: Standard deviation, HADS: Hospital Anxiety and Depression Scale, PPNCS: Patient's Perception of Nursing Care Scale, Min: Minimum, Max: Maximum

Table 3. Comparison of HADS and PPNCS scores by income status

		Income status			p-value
		Income is less than their expenses (n=76)	Income is equal to their expenses (n=134)	Income is more than their expenses (n=21)	
HADS-anxiety score	Mean±SD	8.12±4.05	6.37±4.55	4.76±2.61	0.001[b**]
	Median (min-max)	7.5 (0-19)	6 (0-18)	4 (1-10)	
HADS-depression score	Mean±SD	7.71±4.11	5.81±4.02	4.81±3.31	0.001[b**]
	Median (min-max)	8 (0-19)	5 (0-16)	5 (0-13)	
PPNCS total score	Mean±SD	69.88±8.78	69.63±10.01	69.57±8.3	0.652[b]
	Median (min-max)	74 (28-75)	74 (21-75)	74 (42-75)	

[b]: Kruskal-Wallis test, **: p<0.001, SD: Standard deviation, HADS: Hospital Anxiety and Depression Scale, PPNCS: Patient's Perception of Nursing Care Scale, Min: Minimum, Max: Maximum

Table 4. Comparison of HADS and PPNCS scores by presence of a companion

With a companion (n=63)		Presence of a companion		p-value
		Without a companion (n=168)		
HADS-anxiety score	Mean±SD	6.91±4.39	4±2.12	0.049[a*]
	Median (min-max)	7 (0-19)	4 (0-8)	
HADS-depression score	Mean±SD	6.36±4.11	5.89±4.01	0.797[a]
	Median (min-max)	6 (0-19)	5 (0-11)	
PPNCS total score	Mean±SD	69.59±9.58	72.78±3.73	0.380[a]
	Median (min-max)	74 (21-75)	75 (64-75)	

[a]: Mann-Whitney U test, *: p<0.05, SD: Standard deviation, HADS: Hospital Anxiety and Depression Scale, PPNCS: Patient's Perception of Nursing Care Scale, Min: Minimum, Max: Maximum

Table 5. The relationship of HADS anxiety and depression sub-dimensions with PPNCS

		PPNCS total score
HADS-anxiety score	**r‡**	-0.214
	p	0.001**
HADS-depression score	**r‡**	-0.168
	p	0.010*

‡: Spearman's correlation coefficient, *: p<0.05, **: p<0.001, HADS: Hospital Anxiety and Depression Scale, PPNCS: Patient's Perception of Nursing Care Scale

it was 13.18±4.48 days. It was determined that 68.8% of the patients in our study had been hospitalized before, and they were hospitalized for an average of 18.16±3.71 days. Since orthopedics and traumatology patients require long-term nursing care, hospitalization times can be long.

The mean HADS "anxiety" sub-scale score of the patients participating in the study was 6.80±4.36, and the mean score of the "depression" sub-scale was 6.35±4.10. These results show that the patients participating in the study had low levels of anxiety and depression. We estimate that the low levels of anxiety and depression, despite the patients' long hospitalization, can be attributed to 96.1% having a companion. There are studies showing that education reduces anxiety and depression experienced by patients (19,20). Therefore, this result suggests that nurses in the clinic that conducted the study provided education for patients and their relatives and that this education was effective in reducing the anxiety and depression of the patients.

In the study, the mean PPNCS total score of the patients was determined as 69.71±9.44 points. The study shows that the patients are satisfied with the nursing care, as indicated by scores between 15 and 75 on the scale. In addition, it was found that the items that the patients most frequently agreed with were "I felt that I was well taken care of by the nurses" and "Nurses made me feel comfortable during my treatment." The following statements from different studies highlight patient perceptions of care: In the study of Aydın and Kaşıkçı (21), "They immediately took care of my requests"; in the study of Kol et al. (22), "I am sure that the nurses will be there for me when I need it"; and in the study of Zhao and Akkadechanunt (23), "I felt that I was well taken care of thanks to the nurses." They also found that they agreed with the item "Nurses were with me when I needed them" and that patients perceived their nursing care as high quality. This finding suggests that nurses determine and meet the expectations and needs of patients, and that a relationship of trust is established between nurses and patients. At the same time, patients' satisfaction with nursing care also shows that nursing care is of high quality.

The HADS "anxiety" sub-dimension score of women participating in the study was found to be higher than that of men. The HADS "depression" sub-dimension score and the total PPNCS did not differ significantly. Anxiety and depression are more common in women than men (24,25). Also, Hermanns et al. (26) stated that women had higher scores in their study. Similar results were obtained in our study.

In our study, the HADS "anxiety" and "depression" sub-dimension scores of the patients whose income was less than their expenses were found to be higher than the other patients. The fact that income is less than expenditure causes people to experience economic difficulties and increases their stress levels. Being hospitalized and receiving health services bring an economic burden to individuals and can cause working people to experience the risk of job loss (27). Therefore, we believe that findings from the study suggest patients hospitalized in orthopedics and traumatology clinics with a low income experience more anxiety and depression than those with a higher income level, due to factors such as meeting health expenses and not being able to work during hospitalization.

In our study, the scores of the patients with a companion in the HADS "anxiety" sub-scale were found to be higher than those without a companion. Hospitalized patients receive emotional support from their companions. Orthopedic patients especially need psychosocial support to cope with negative emotions such as anxiety caused by hospitalization and illness. Social support has a positive effect on coping with patients' psychosocial problems (11,28,29). On the other hand, we think that this result obtained in the study is because the majority of the patients (96.1%) had a companion.

In our study, it was observed that as the anxiety and depression levels of the patients increased, their satisfaction with nursing decreased. Similar results were obtained in the study conducted by Buldan and Kurban (11). The psychological needs of patients should also be taken into consideration while providing nursing care. Efforts should be made to determine and eliminate the problems that lead to anxiety and depression in these patients. Thus, we think that patients with low levels of anxiety and depression will have higher satisfaction with nursing care.

Study Limitations

The limitations of our study, especially the study being conducted with inpatients in an orthopedics and traumatology clinic of a training and research hospital, limit the generalizability of the findings.

CONCLUSION

In this study, it was determined that the majority of the patients had a companion, and their anxiety and depression levels were low. On the other hand, it was observed that women experienced higher anxiety than men. It has been determined that orthopedics and traumatology patients whose income is less than their expenses have a higher risk of anxiety and depression than patients with a higher income level. In addition, it was observed that patients perceived nursing care positively, and patients with low anxiety and depression levels, had higher satisfaction with nursing. In accordance with this result, nurses are recommended to plan and implement patient education by taking into account the patients' positive perceptions of care and low levels of anxiety and depression while providing care.

This study indicates that, as the anxiety and depression levels of the patients increased, their satisfaction with nursing decreased. The findings obtained in the study may contribute to increasing the quality of orthopedic traumatology patients' care in the preoperative and postoperative periods. At the same time, it may contribute to nurses' planning and implementation of patient education for all orthopaedic traumatology patients in the preoperative and postoperative process.

ETHICS

Ethics Committee Approval: In this study, after the approval of the Clinical Research Ethics Committee of the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital (approval no: 2019-13-07, date: 08.07.2019), patients who underwent any orthopedic surgery between August 2019 and September 2019 were evaluated.

Informed Consent: Verbal and written informed consent was obtained from the patients who agreed to participate in the study.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: F.Ç., A.S., Consept: F.Ç., A.S., Design: F.Ç., A.S., Data Collection or Processing: F.Ç., A.S., Analysis or Interpretation: F.Ç., A.S., S.H.B., A.B., Literature Search: F.Ç., S.H.B., A.B., Writing: F.Ç., A.S., S.H.B., A.B.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Alzahrani N. The effect of hospitalization on patients' emotional and psychological well-being among adult patients: an integrative review. Appl Nurs Res. 2021;61:151488.
2. Basak F, Hasbahceci M, Guner S, Sisik A, Acar A, Yucel M, et al. Prediction of anxiety and depression in general surgery inpatients: Aa prospective cohort study of 200 consecutive patients. Int J Surg. 2015;23:18-22.
3. Braimah RO, Ukpong DI, Ndukwe KC, Akinyoola L. Self-esteem following maxillofacial and orthopedic injuries: preliminary observations in sub-Saharan Africans. Oral Maxillofac Surg. 2019;23:71-6.
4. Kocaçal Güler E, Eşer S. Nurse's role in patient participation in care. Fırat Sağlık Hizmetleri Dergisi. 2008;3:104-11.
5. Gosens T, den Oudsten BL. Psychology in orthopedics and traumatology: an instructional review. EFORT Open Rev. 2023;8:245-52.
6. Bahayi K, Attaallah W, Yardımcı S, Bulut H, Özten E. Depression, anxiety, sexual dysfunction and quality of life in patients with ileostomy or colostomy. Turk J Colorectal Dis. 2018;28:69-75.
7. Gök F, Hergül FK. Determination of level of anxiety and depression of patients hospitalized in surgery clinics. Istanbul University Institute of Health Sciences Journal of Advanced Research in Health Sciences. 2020;3:195-206.
8. Hernández-Palazón J, Fuentes-García D, Falcón-Araña L, Roca-Calvo MJ, Burguillos-López S, Doménech-Asensi P, et al. Assessment of preoperative anxiety in cardiac surgery patients lacking a history of anxiety: contributing factors and postoperative morbidity. J Cardiothorac Vasc Anesth. 2018;32:236-44.
9. Dikmen Y, Yılmaz D. Patient's perceptions of nursing care-a descriptive study from Turkey. Ann Nurs Pract. 2016;3:1048.
10. Zaghini F, Fiorini J, Piredda M, Fida R, Sili A. The relationship between nurse managers' leadership style and patients' perception of the quality of the care provided by nurses: cross sectional survey. Int J Nurs Stud. 2020;101:103446.
11. Buldan Ö, Kurban NK. Relationship between nursing care perceptions, with anxiety-depression levels of chronic disease cases and affecting factors. Dokuz Eylul Univ Fac Nurs Elec J. 2018;11:274-82.
12. Aydemir Ö, Guvenir T, Kuey L, Kultur S. Validity and reliability of Turkish version of hospital anxiety and depression scale. Turk Psikiyatri Derg. 1997;8:280-7.
13. Ipek Coban G, Kasikci M. Reliability and validity of the scale of patient perception of hospital experience with nursing care in a Turkish population. J Clin Nurs. 2010;19:1929-34.
14. Dozier AM, Kitzman HJ, Ingersoll GL, Holmberg S, Schultz AW. Development of an instrument to measure patient perception of the quality of nursing care. Res Nurs Health. 2001;24:506-17.
15. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand. 1983;67:361-70.
16. Fauske L, Lorem G, Grov EK, Bondevik H. Changes in the body image of bone Sarcoma survivors following surgical treatment-a qualitative study. J Surg Oncol. 2016;113:229-34.
17. Aletto C, Aicale R, Pezzuti G, Bruno F, Maffulli N. Impact of an orthogeriatrician on length of stay of elderly patient with hip fracture. Osteoporosis Int. 2020;31:2161-6.
18. Koç S, Büker N, Şavkın R, Kiter E. The effect of independence and depression levels of orthopedic and traumatology patients on satisfaction with nursing care. Kartal Training and Research Hospital Journal. 2012;23:130-6.

19. Andersen BL, Lacchetti C, Ashing K, Berek JS, Berman BS, Bolte S, et al. Management of anxiety and depression in adult survivors of cancer: ASCO guideline update. J Clin Oncol. 2023;41:3426-53.
20. Koc MA, Akyol C, Gokmen D, Aydın D, Erkek AB, Kuzu MA. Effect of prehabilitation on stoma delf-care, anxiety, depression, and quality of life in patients with stomas: a randomized controlled trial. Dis Colon Rectum. 2023;66:138-47.
21. Aydın M, Kaşıkçı M. Patients' perceptions of nursing care. J Nurs Res Dev. 2019;21:14-24.
22. Kol E, Geçkil E, Arıkan C, İlter M, Özcan Ö, Şakırgün E, et al. Examination of nursing care perception in Turkey. Acıbadem University Health Sciences Journal. 2017;8:163-72.
23. Zhao SH, Akkadechanunt T. Patients' perceptions of quality nursing care in a Chinese hospital. Int J Nurs Midwifery. 2011;3:145-9.
24. Civantos AM, Byrnes Y, Chang C, Prasad A, Chorath K, Poonia SK, et al. Mental health among otolaryngology resident and attending physicians during the COVID-19 pandemic: national study. Head Neck. 2020;42:1597-609.
25. Eaton NR, Keyes KM, Krueger RF, Balsis S, Skodol AE, Markon KE, et al. An invariant dimensional liability model of gender differences in mental disorder prevalence: evidence from a national sample. J Abnorm Psychol. 2012;121:282-8.
26. Hermanns N, Kulzer B, Krichbaum M, Kubiak T, Haak T. Affective and anxiety disorders in a German sample of diabetic patients: prevalence, comorbidity and risk factors. Diabet Med. 2005;22:293-300.
27. Coenen P, Hulsegge G, Daams JG, van Geenen RC, Kerkhoffs GM, van Tulder MW, et al. Integrated care programmes for sport and work participation, performance of physical activities and quality of life among orthopaedic surgery patients: a systematic review with meta-analysis. BMJ Open Sport Exerc Med. 2020;6:e000664.
28. Maselesele VM, Idemudia ES. The role of social support in the relationship between mental health and posttraumatic stress disorder amongst orthopaedic patients. Curationis. 2013;36:E1-7.
29. Wu KT, Lee PS, Chou WY, Chen SH, Huang YT. Relationship between the social support and self-efficacy for function ability in patients undergoing primary hip replacement. J Orthop Surg Res. 2018;13:150.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):25-32
DOI: 10.4274/BMJ.galenos.2025.2025.1-8

Research

Evaluation of Patients with Idiopathic Normal Pressure Hydrocephalus Undergoing Surgical Treatment Using the Evans Index and Mini-Mental Status Examination

İdiopatik Normal Basınçlı Hidrosefali Tanısı ile Cerrahi Tedavi Uygulanan Hastaların Evans İndeksi ve Mini Mental Durum Testi ile Değerlendirilmesi

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ABSTRACT

Objective: Normal pressure hydrocephalus (NPH) is a chronic, progressive condition primarily affecting elderly patients. Based on etiology, NPH is categorized into two subtypes: secondary NPH and idiopathic NPH (iNPH). This study focused only on patients with iNPH, aiming to identify critical considerations in diagnosis, treatment, and postoperative follow-up.

Methods: This retrospective study analyzed data from 45 patients diagnosed with iNPH who underwent programmable ventriculoperitoneal shunt implantation between 2016 and 2024. Parameters evaluated included patient demographics, presenting symptoms, duration of symptoms before surgery, comorbidities, preoperative and postoperative Evans indices, shunt pressures, urinary incontinence, gait improvement, changes in preoperative subarachnoid space, ventricular dimensions, postoperative complications, and Mini-Mental State Examination (MMSE) scores.

Results: The findings underscored the importance of multidisciplinary follow-up in elderly patients with comorbidities, the role of MMSE scores in assessing cognitive status preoperatively and postoperatively, and the limited utility of the Evans index as a postoperative marker. Adjusting shunt pressure was shown to play a crucial role in minimizing complications.

Conclusion: In this highly sensitive patient population, timely and appropriate shunt surgery significantly enhances quality of life and reduces caregiver burden.

Keywords: Hydrocephalus, ventriculoperitoneal shunt, postoperative follow-up

ÖZ

Amaç: Normal basınçlı hidrosefali (NPH), yaşlı hastalarda görülen ve sürekli ilerleyen kronik bir hastalıktır. Hastalığın nedenine bağlı olarak, iki alt tipe ayrılır; ikincil NBH ve primer veya idiyopatik NBH (iNBH). Bu çalışmada sadece iNPH'li hastalara odaklanılmış olup, tanı, tedavi ve ameliyat sonrası takipte kritik hususların belirlenmesi amaçlanmıştır.

Gereç ve Yöntem: 2016-2024 tarihleri arasında 45 iNPH tanısı alan ve proglamlanabilir ventrikülöperitoneal şant implante edilen hastalar retrospektif olarak değerlendirildi. Hastaların cinsiyetleri, yaşları, şikayetleri, operasyona kadarki şikayet süreleri, ek hastalıkları, preoperatif ve postoperatif Evans indeksleri, şant basınçları, idrar inkontinansı ve yürümelerindeki düzelmeleri, preoperatif subaraknoid mesafede artış olup olmadığı, postoperatif ventrikül boyutlarında genişleme olup olmadığı, postoperatif komplikasyonlar ve preoperatif ve postoperatif yapılan Mini Mental Durum Muayenesi (MMDM) değerlendirildi.

Bulgular: Özellikle comorbiditeleri olan yaşlı hastaların multidisipliner takip edilmesi, preoperatif ve postoperatif dönemdeki takiplerinde MMDM skorlarının önemi, preoperatif önemli tanı kriteri olan Evans indeksinin postoperatif anlamlı bir belirteç olmadığı, şant basıncı ayarının hastaların komplikasyon gelişmemesindeki önemini ortaya koymaya çalıştık.

Sonuç: Oldukça hassas özellikler taşıyan bu hasta grubunda başarılı, zamanında ve endikasyonlara göre uygulanacak şant cerrahisi, hastaların yaşam kalitesini önemli ölçüde artırabilir ve sonuç olarak onlara bakanların yükünü hafifletebilir.

Anahtar Kelimeler: Hidrosefali, ventrikülöperitoneal şant, postoperatif izlem

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Received: 13.01.2025
Accepted: 08.04.2025
Publication Date: 12.03.2026

Cite as: Başaran Gündoğdu E, Ali A. Evaluation of patients with idiopathic normal pressure hydrocephalus undergoing surgical treatment using the Evans index and mini-mental status examination. Med J Bakirkoy. 2026;22(1):25-32

INTRODUCTION

Idiopathic normal pressure hydrocephalus (iNPH) is a chronic, progressive condition commonly seen in the elderly. First described in 1964 by Colombian neurosurgeon Salomón Hakim Doe (1911-2008) and subsequently detailed by Hakim and American neurosurgeon Raymond D. Adams (1911-2008) in 1965, NPH is characterized by ventriculomegaly with normal cerebrospinal fluid (CSF) pressure. It is classified into secondary NPH (sNPH) and iNPH subtypes, with iNPH often presenting without an identifiable cause.

iNPH is commonly associated with intracranial hemorrhage, craniocerebral trauma (e.g., traumatic brain injury), purulent-inflammatory processes within the cranial cavity, and prior brain surgeries. Despite these associations, the exact etiology of iNPH remains controversial, with vascular, biomechanical, hereditary, inflammatory, and metabolic factors being frequently implicated. Moreover, reliable biological markers for iNPH have yet to be identified. The condition is characterized by a classic clinical triad: gait disturbances, dementia, and urinary incontinence (1,2). According to the largest prevalence study, iNPH occurs in 0.2% of individuals aged 70-79 and 5.9% of those over 80 years (3).

Radiologically, ventriculomegaly is the most significant finding in iNPH, with an Evans index exceeding 0.3. Additional features include widening of the Sylvian fissure, steepening of the callosal angle, narrowing of the high parietal convexity, and widening of the subarachnoid spaces. However, these radiological findings are not exclusive to iNPH as they are present in 64% of NPH cases with a positive predictive value of 77% and a negative predictive value of 25.9% (4).

Neurology and neurosurgery must collaborate to diagnose NPH accurately. Distinguishing NPH from other conditions that cause progressive dementia and present with similar clinical symptoms, such as atherosclerotic encephalopathy, is particularly challenging. Accurate diagnosis is critical before initiating shunt treatment, as it prevents unnecessary surgical interventions and associated complications. Importantly, iNPH, a condition seen predominantly in older adults, is considered a treatable psychomotor disorder. For these patients, shunt surgery plays a vital role in improving their quality of life.

METHODS

This retrospective study evaluated 45 patients diagnosed with iNPH and treated with programmable ventriculoperitoneal (VP) shunts between 2016 and 2024. Patients with sNPH were excluded. Ethics committee approval was obtained before data collection. Patient data were retrieved from hospital records, outpatient clinic evaluations, and information provided by the relatives.

Data collected included demographic characteristics, presenting symptoms, duration of symptoms before surgery, comorbidities, preoperative and postoperative Evans indices, shunt pressures, and outcomes related to urinary incontinence and gait improvement. Additionally, the presence of preoperative subarachnoid space expansion, postoperative ventricular dimension changes, complications, and Mini-Mental State Examination (MMSE) scores was recorded.

All patients underwent comprehensive evaluations by neurology and neurosurgery teams before surgery. The diagnosis of iNPH was confirmed, and patients were closely monitored by both departments postoperatively. Each patient received an implantable programmable VP shunt.

Furthermore, the study statistically analyzed patient survival rates in the presence of shunt-related complications. Preoperative and postoperative Evans index, and MMSE scores were compared, and percentage changes in Evans index values were evaluated in relation to postoperative recovery outcomes.

The study was approved by the Ethics Committee of University of Health Sciences Türkiye, Bursa High Specialization Training and Research Hospital (approval no: 2024-TBEK 2024/06-01, date: 12.06.2024). Written informed consent was obtained from all participants or their legal guardians.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 28.0.0.0 (IBM Corp., USA). The Shapiro-Wilk test was used to assess the normality of variable distribution. Normally distributed variables were reported as mean±standard deviation, whereas nonnormally distributed variables were presented as median (minimum-maximum). Since the data did not follow a normal distribution, the Mann-Whitney U test was used for comparing numerical variables between independent groups, while the Wilcoxon signed-rank test was applied for dependent groups. Categorical variables were expressed as counts and percentages. Relationships between variables were analyzed using Spearman's correlation coefficient. A two-tailed p-value of <0.05 was considered statistically significant.

RESULTS

Among the 45 patients included in the study, 27 (60%) were male, and 18 (40%) were female. The mean age of

the cohort was 70.04±7.15 years (range: 46-85 years). The mean follow-up period was 2.48 years, and the mean duration of complaints before surgery was 12.00 (range: 6.00-48.00 months). All patients underwent implantation of programmable VP shunts, with a median shunt pressure of 100 mmH_2O (range: 100-130 mmH_2O). During the follow-up period, 15 (33.3%) patients died due to unrelated health complications (Tables 1 and 2).

The primary complaints reported were as follows: 36 (80%) patients presented with the triad of gait disturbance, dementia, and urinary incontinence; six (13.3%), patients reported gait disturbance alone; one (2.22%), patient exhibited the triad with imbalance; one (2.22%), patient presented with headache and gait disturbance; and one (2.22%), patient showed a combination of gait and speech disorders (Table 1).

Table 1. Patient characteristics

Variable	Descriptive statistics
Age (year)*	70.04±7.15
Gender‡	
Female Male	18 (40) 27 (60)
Complaint period† (months)	12.00 (6.00-48.00)
Shunt pressure (mmH_2O)	100.00 (100.00-130.00)
Patient complaints	
Triad‡	36 (80.0)
Walking disorders‡	6 (13.3)
Triad and imbalance‡	1 (2.22)
Headache and walking disorders‡	1 (2.22)
Walking disorders and speech disorders‡	1 (2.22)

*: Mean±standard deviation, †: Median (minimum-maximum), ‡: n (%)

Table 2. Patient comorbidities, survival and shunt complications of the patients

Comorbidity	n	%
Parkinson's disease	4	8.89
Dementia	6	13.33
Epilepsy	3	6.67
Cognitive disorders	2	4.44
Cerebrovascular disease	9	20.00
Hypertension	15	33.33
Diabetes	12	26.67
Bipolar disorder	2	4.44
Anxiety disorder	3	6.67
Coronary artery disorder	8	17.78
Depression	3	6.67
Alzheimer's disease	3	6.67
Exitus	15	33.3
Shunt complications	6	13.3

The most common comorbidities observed were hypertension in 15 (33.33%) patients and diabetes in 12 (26.67%) patients, followed by cerebrovascular disease in nine (20%), coronary artery disease in eight (17.78%), dementia in six (13.33%), Parkinson's disease in four (8.89%), epilepsy, anxiety disorder, depression, and Alzheimer's disease each in three (6.67%). Cognitive disorders and bipolar disorder were noted in two (4.44%) patients each (Table 2).

Preoperative imaging showed subarachnoid space expansion in 30 (66.7%) patients, partial expansion in 14 (31.1%) patients, and no expansion in one (2.22%) patient (Table 3). Postoperatively, gait disturbance improved in 40 (88.9%) patients, and urinary incontinence improved in 22 (48.9%) patients. An increase in ventricular dimensions was observed in 18 (40%) patients (Table 3), and complications occurred in six (13.3%) patients (Table 2). Subdural hemorrhage was reported in four (66.7%) patients, and shunt dysfunction required revision in two patients (Table 3). The shunt pressures of our patients who developed subdural hemorrhage were set to 110 mmH_2O. To address subdural hemorrhage, shunt pressures were increased to 130 mmH_2O in five patients, and no further hemorrhages were observed following this adjustment.

Preoperative and postoperative Evans index values were 0.34 (range: 0.20-0.72) and 0.34 (range: 0.21-0.65), respectively, with no significant difference noted (p=0.821). Preoperative MMSE values were 19.00 (range: 5-26), while postoperative values were 15.50 (range: 7-26); this change showed no significant difference (p=0.506). While Evans index values decreased in 20 patients, an increase was noted in 25 patients (Table 4). Notably, despite increased Evans index values in 25 patients, 21 showed improvements in walking ability, and 13 experienced improved urinary incontinence.

Table 3. Postoperative outcomes

Variable		n	%
Improvement in walking		40	88.9
Improvement in urinary incontinence		22	48.9
Increase in postoperative ventricular size		18	40.0
Enlargement of subarachnoid spaces (preoperative)	No	1	2.2
	Yes	30	66.7
	Partially	14	31.1
Postoperative complications	Subdural hemorrhage	4	66.7
	Shunt revisions	2	33.3
	Total	6	100.0

These findings suggest that the Evans index is not a reliable predictor of clinical benefits from shunt treatment.

When postoperative Evans indices were analyzed in relation to walking improvement, urinary incontinence, increases in ventricular dimensions, preoperative subarachnoid space expansion, and shunt complications, only the increase in ventricular dimensions showed statistical significance ($p<0.001$) (Table 5).

Of the 45 patients, 16 underwent both preoperative and postoperative MMSE testing. The remaining 29 patients were lost to follow-up due to death, difficulties in transporting bedridden patients, and limited education. Among the 16 patients, significant MMSE improvement was observed in five patients, along with concurrent improvements in urinary incontinence and gait disturbance. However, Evans index values exhibited variability, increasing in some patients and decreasing in others. A statistically significant negative correlation was observed between patient age and preoperative MMSE scores ($r=-0.593$; $p<0.001$), while no significant correlation was found between preoperative MMSE scores and complaint duration ($r=0.085$; $p=0.581$).

Although complete independence was not achieved in all cases, 40 patients experienced substantial benefits following shunting implantation. Of the five patients who did not benefit, one had Parkinson's disease and dementia, one had hypertension, diabetes, and bipolar disorder, one had anxiety disorder, one had cerebrovascular disease and hypertension, and one had diabetes and coronary artery disease.

The comorbidities of patients, duration of symptoms, preoperative MMSE scores, and mortality rates were analyzed statistically. A significant correlation was observed between preoperative MMSE scores and both Alzheimer's disease and cerebrovascular disease. Additionally, the association between hypertension and mortality cases was statistically significant (Table 6 and Figures 1 and 2).

Table 4. Preoperative and postoperative Evans index and MMSE values of the patients

Variable	Preoperative	Postoperative	p-value
Evans index	0.34 (0.20-0.72)	0.34 (0.21-0.65)	0.821
MMSE	19.00 (5-26)	15.50 (7-26)	0.506

Data are presented as median (minimum-maximum) values
MMSE: Mini-Mental State Examination

DISCUSSION

The mechanism underlying NPH primarily involves CSF malabsorption at arachnoid granulations (5,6). Cases of iNPH have also been linked to periventricular ischemic events, weakening and expansion of the ventricular wall, and comorbid conditions such as hypertension, ischemic heart disease, diabetes, and high-density lipoprotein cholesterol (5). In our cohort, hypertension was the most common comorbidity, followed by diabetes, cerebrovascular disease, and coronary artery disease.

INPH predominantly affects individuals aged 50-70 years (1). Previous studies reported prevalence rates of 3.3 per 100,000 among individuals aged 50-59 years, 49.3 per 100,000 among those aged 60-69 years, and 181.7 per 100,000 among those aged 70-79 years (7). The mean age of our patients was 70.04±7.15 years, with the youngest being 46 years old and the oldest 85 years old.

The classic symptom triad of iNPH includes gait disturbance, progressive dementia, and urinary incontinence. Gait disturbances were typically characterized by wide strides, shuffling, and magnetic movements, often accompanied by imbalance. Urinary incontinence, seen in 95% of cases, results from detrusor hyperactivity. Dementia symptoms manifest as psychomotor slowing, impaired attention, and

Table 5. Comparison of Evans index percentage change with postoperative improvements

Variable		Descriptive statistics	p-value
Improvement in walking	Yes	0.01 (-0.48-0.13)	0.280
	No	0.07 (-0.48-0.13)	
Improvement in urinary incontinence	Yes	0.01 (-0.48-0.13)	0.768
	No	0.00 (-0.46-0.27)	
Increase in the postoperative ventricular size	Yes	0.08 (0.01-0.27)	<0.001
	No	0.04 (-0.48-0.10)	
Enlargement of subarachnoid space (preoperative)	Yes	0.01 (-0.48-0.27)	0.866
	No+partially	0.01 (-0.14-0.13)	
Shunt complication	Yes	0.03 (-0.10-0.13)	0.732
	No	0.01 (-0.48-0.27)	

Data are presented as median (minimum-maximum) values

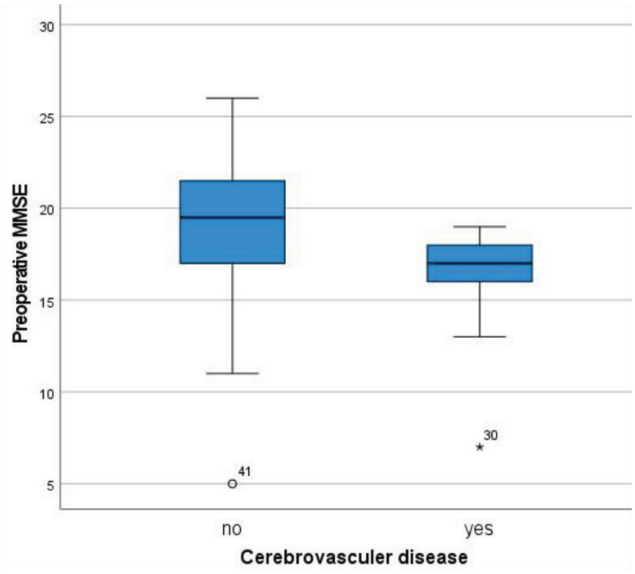

Figure 1. Comparison of preoperative MMSE and cerebrovascular disease

(Box plot of MMSE values for patients with and without CVD. Bold lines indicate medians, box plots show the 25th to 75th percentiles, bars indicate the 1.5-fold interquartile range, and circles represent values between the 1.5-fold and threefold interquartile range. Outliers are marked by asterisks)

MMSE: Mini-Mental State Examination, CVD: Cerebrovascular disease

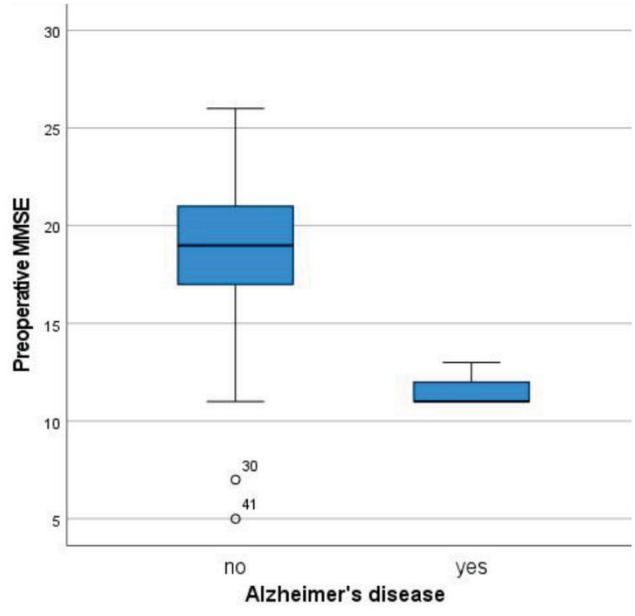

Figure 2. Comparison of preoperative MMSE and Alzheimer's disease

(Box plot of MMSE values for patients with and without AD. Bold lines indicate medians, box plots show the 25th to 75th percentiles, bars indicate the 1.5-fold interquartile range, and circles represent values between the 1.5-fold and threefold interquartile range. Outliers are marked by asterisks)

MMSE: Mini-Mental State Examination, AD: Alzheimer's disease

executive and visuospatial dysfunction, even in patients with MMSE scores >25 (7). In our study, 80% of patients presented with the full triad, while others exhibited isolated or combined symptoms, including gait disturbance, imbalance, headache, and speech disturbance.

Differentiating iNPH from other causes of progressive dementia, such as atherosclerotic encephalopathy, is critical. Diagnostic approaches include radiological imaging, CSF flow dynamics analysis, neuropsychological assessments, and metabolic studies. Preoperative lumbar puncture (LP) to drain 50 cc of CSF is commonly used to evaluate symptom improvement before deciding on shunt surgery (5). In all our patients, CSF flow magnetic resonance imaging revealed hyperdynamic flow, and LP was performed to assess improvement in urinary incontinence and gait. MMSE and walking tests, conducted by neurology, confirmed the diagnosis, after which shunt surgery was performed.

It is hypothesized that in iNPH, problems in CSF circulation and absorption lead to decreased ventricular wall tensile strength and ventricular dilatation. These changes result in symptoms caused by periventricular tissue ischemia as well as tension and compression in neuronal connections (8). Normal values of the Evans index are reported as 0.20-0.25, with early or suspicious dilation classified as 0.25-0.30, and significant dilation defined as >0.30 (9). In cases of iNPH, the Evans index should be greater than 0.3, with no lesions obstructing CSF flow (5). Moreover, the Evans index has been shown to vary with age and gender, and postoperative changes in the Evans index are not associated with cognitive outcomes (9).

In our study, the preoperative Evans index was 0.34 (range: 0.20-0.72), while the postoperative Evans index remained at 0.34 (range: 0.21-0.65). No significant differences were observed in the preoperative and postoperative statistical evaluations (p=0.821). A decrease in the Evans index was observed in 20 of the 45 patients, whereas an increase was noted in 25 patients. Among the 25 patients with an increased Evans index, 21 showed improved walking, and 13 exhibited improved urinary incontinence. These findings suggest that an increased Evans index may not correlate with clinical benefits, as reported in previous studies. Notably, when comparing postoperative Evans indices with other parameters, a significant association was observed only with increased postoperative ventricular dimensions (p<0.001) (Table 6).

The most commonly used shunt types in iNPH treatment include VP, LP, and ventriculoatrial (VA) shunts. A study comparing VP and VA shunts found no significant difference in complication rates between the two groups in a cohort of 128

Table 6. Comorbidities of patients

Comorbidity	Variable	Yes	No	p-value
Parkinson's disease	Complaint period*	12 (12-12)	12 (6-48)	0.724
	Preop MMSE*	17 (11-19)	19 (5-26)	0.155
	Exitus†	2 (13.3)	13 (86.7)	0.591
Dementia	Complaint period*	12 (8-24)	12 (6-48)	0.781
	Preop MMSE*	17 (5-24)	19 (7-26)	0.214
	Exitus†	2 (13.3)	13 (86.7)	1.000
Epilepsy	Complaint period*	12 (12-24)	12 (6-48)	0.562
	Preop MMSE*	17 (7-21)	19 (5-26)	0.360
	Exitus†	1 (6.7)	14 (93.3)	1.000
Cognitive disorders	Complaint period*	—	12 (6-48)	—
	Preop MMSE*	—	19 (5-26)	—
	Exitus†	—	15 (100)	0.545
Cerebrovascular disease	Complaint period*	12 (6-24)	12 (6-48)	0.582
	Preop MMSE*	17 (7-19)	19.5 (5-26)	0.019
	Exitus†	2 (13.3)	13 (86.7)	0.695
Hypertension	Complaint period*	12 (6-48)	12 (6-36)	0.205
	Preop MMSE*	19 (5-24)	18 (7-26)	0.837
	Exitus†	8 (53.3)	7 (46.7)	0.044
Diabetes	Complaint period*	12 (6-24)	12 (6-48)	0.522
	Preop MMSE*	19 (5-24)	19 (7-26)	0.887
	Exitus†	7 (46.7)	8 (53.3)	0.070
Bipolar disorder	Complaint period*	—	12 (6-48)	—
	Preop MMSE*	—	19 (5-26)	—
	Exitus†	1 (6.7)	14 (93.3)	1.000
Anxiety disorder	Complaint period*	12 (8-12)	12 (6-48)	0.338
	Preop MMSE*	24 (17-24)	19 (5-26)	0.143
	Exitus†	2 (13.3)	13 (86.7)	0.254
Coronary artery disorder	Complaint period*	9 (6-48)	12 (6-36)	0.048
	Preop MMSE*	18 (13-23)	19 (5-26)	0.654
	Exitus†	4 (26.7)	11 (73.3)	0.410
Depression	Complaint period*	12 (12-24)	12 (6-48)	0.562
	Preop MMSE*	13 (7-18)	19 (5-26)	0.061
	Exitus†	—	15 (100)	0.540
Alzheimer's disease	Complaint period*	12 (6-24)	12 (6-48)	0.782
	Preop MMSE*	11 (11-13)	19 (5-26)	0.014
	Exitus†	1 (6.7)	14 (93.3)	1.000

*: Median (minimum-maximum), †: n (%) values, MMSE: Mini-Mental State Examination

patients (10,11). Programmable valves are frequently preferred in iNPH patients due to their ability to allow intraventricular pressure adjustments, which reduce low drainage-related complications. Shunt pressure adjustments are reported to be necessary in 40% of cases (12). In our study, we used programmable VP shunts in all patients. Postoperative complications were observed in six (13.3%) patients, with four (66.7%) requiring shunt revision due to subdural hemorrhage and two due to shunt dysfunction. The initial shunt pressure for patients who developed subdural hemorrhage was set at 110 mmH_2O. To mitigate this risk, we increased the initial shunt pressure to 130 mmH_2O in subsequent patients (n=5). Following this adjustment, no further cases of subdural hemorrhage were reported.

A review of the literature suggests that the use of valves designed to prevent excessive drainage is advisable to reduce complications such as subdural hemorrhage, headaches, and valve revisions (13). However, no consensus exists regarding the optimal shunt pressure. In our clinic, we employ a differential shunt system, and recommend an initial pressure of 130 mmH_2O, although larger studies are needed to confirm this approach.

In a previous study, improvement rates among 179 NPH patients assessed at 3, 6, and 24 months post-shunt surgery were 33%, 60%, and 75%, respectively. Walking improved in 93% of patients, whereas improvements in dementia and incontinence were approximately half as frequent (6). In our cohort, 40 out of 45 (88.9%) patients experienced significant clinical benefits, predominantly in walking function. Specifically, 40 (88.9%) patients demonstrated improved gait, and 22 (48.9%) patients exhibited improvements in urinary incontinence. Patients also reported enhanced communication with relatives. Among the five patients who did not benefit from shunting, comorbidities such as Parkinson's disease, dementia, hypertension, diabetes, bipolar disorder, anxiety disorders, cerebrovascular disease, and coronary artery disease were identified as contributing factors.

In this study, MMSE was conducted preoperatively and at 3 months, 1 year, and 2 years postoperatively. The mean MMSE score increased from 22.4±5.4 preoperatively to 23.8±5.0 ($p=0.0002$) at 3 months and 23.7±4.8 ($p=0.004$) at 1 year postoperatively, before declining to 22.6±5.3 at 2 years. In our cohort, all 45 patients underwent preoperative MMSE testing; however, only 16 completed both preoperative and postoperative evaluations. The remaining 29 patients were lost to follow-up due to the challenges of transporting bedridden patients, mortality, or low educational levels. Among the 16 patients with complete MMSE data, no significant difference was observed between preoperative (median: 19.00; range: 5-26) and postoperative scores (median: 15.50; range: 7-26). However, five patients with significant increases in MMSE scores also showed improvements in urinary incontinence and gait disturbances. Low MMSE scores in our cohort may be attributable to delayed postoperative assessments, low educational levels, and high rates of comorbidities. A negative correlation was found between patient age and preoperative MMSE scores ($r=-0.593$; $p<0.001$), while no significant correlation was observed between preoperative MMSE scores and symptom duration ($r=0.085$; $p=0.581$).

Given the advanced age and high comorbidity burden in NPH patients, mortality is often unrelated to the disease itself. In the literature, mortality rates of 37% and 13% have been reported (14,15). In our study, 15 (33.3%) out of 45 patients died during follow-up, with none of these deaths attributed to shunt-related complications. Mortality was due to underlying comorbidities.

Study Limitations

This study has some limitations. Because the study was retrospective and single-center, it may not be representative of the broader patient population. We believe that multicenter studies with a larger number of patients would be necessary to reach more detailed results.

CONCLUSION

The diagnosis and management of iNPH are complex processes requiring multidisciplinary collaboration between neurology and neurosurgery teams. The advanced age and comorbidities of these patients increase both surgical and postoperative risks. Our findings emphasize the importance of clinical evaluation in diagnosing iNPH, the limited utility of the Evans index in postoperative follow-up, and the significance of MMSE scores in both diagnosis and long-term monitoring. Despite the challenges, accurate diagnosis and appropriate treatment can significantly improve patients' quality of life.

ETHICS

Ethics Committee Approval: The study was approved by the Ethics Committee of University of Health Sciences Türkiye, Bursa High Specialization Training and Research Hospital (approval no: 2024-TBEK 2024/06-01, date: 12.06.2024).

Informed Consent: Written informed consent was obtained from all participants or their legal guardians.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: E.B.G., Consept: E.B.G., A.A., Design: E.B.G., A.A., Data Collection or Processing: E.B.G., Analysis or Interpretation: E.B.G., A.A., Literature Search: E.B.G., A.A., Writing: E.B.G., A.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Hakim S, Adams RD. The special clinical problem of symptomatic hydrocephalus with normal cerebrospinal fluid pressure: observations on cerebrospinal fluid hydrodynamics. J Neurol Sci. 1965;2:307-27.

2. Wallenstein MB, McKhann GM 2nd. Salomón Hakim and the discovery of normal-pressure hydrocephalus. Neurosurgery. 2010;67:155-9.
3. Jaraj D, Rabiei K, Marlow T, Jensen C, Skoog I, Wikkelsø C. Prevalence of idiopathic normal-pressure hydrocephalus. Neurology. 2014;82:1449-54.
4. Nakajima M, Yamada S, Miyajima M, Ishii K, Kuriyama N, Kazui H, et al. Guidelines for management of idiopathic normal pressure hydrocephalus (third edition): endorsed by the Japanese society of normal pressure hydrocephalus. Neurol Med Chir (Tokyo). 2021;61:63-97.
5. Taşkın MM. Normal basınçlı hidrosefali: yeni kavramlar [Internet]. Düşünen Adam; 2008;21:45-58.
6. McGirl MJ, Woodworth G, Coon AL, Thomas G, Williams MA, Rigamonti D. Diagnosis, treatment, and analysis of long-term outcomes in idiopathic normal-pressure hydrocephalus. Neurosurgery. 2005;57:699-705.
7. Shprecher D, Schwalb J, Kurlan R. Normal pressure hydrocephalus: diagnosis and treatment. Curr Neurol Neurosci Rep. 2008;8:371.
8. Yılmaz MB. İdiopatik normal basınçlı hidrosefali hastalarında kraniyal MR bulguları. Akd Med J. 2019;5:194-200.
9. Zhou X, Xia J. Application of the Evans index in normal pressure hydrocephalus patients: a mini-review. Front Aging Neurosci. 2022;13:783092.
10. Lam CH, Villemure JG. Comparison between ventriculoatrial and ventriculoperitoneal shunting in the adult population. Br J Neurosurg. 1997;11:43-8.
11. Özdöl Ç, Belen D. Idiopathic normal pressure hydrocephalus. Türk Nöroşirürji Derg. 2009;19:97-104.
12. Grasso G, Torregrossa F, Leone L, Frisella A, Landi A. Long-term efficacy of shunt therapy in idiopathic normal pressure hydrocephalus. World Neurosurg. 2019;129:458-63.
13. Zipfel J, Kohlmann-Dell'Acqua C, Noell S, Trakolis L. 17 years of experience with shunt systems in normal pressure hydrocephalus—from differential pressure to gravitational valves. World Neurosurg. 2024;22:100293.
14. Kambara A, Kajimoto Y, Yagi R, Ikeda N, Furuse M, Nonoguchi N, et al. Long-term prognosis of cognitive function in patients with ıdiopathic normal pressure hydrocephalus after shunt surgery. Front Aging Neurosci. 2021;12:617150.
15. Kahlon B, Sjunnesson J, Rehncrona S. Long-term outcome in patients with suspected normal pressure hydrocephalus. Neurosurgery. 2007;60:327-32.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):33-41
DOI: 10.4274/BMJ.galenos.2025.2024.8-16

Research

Combined Use of Intraoperative Neuromonitoring and Neuronavigation Techniques in Surgery for Vestibular Schwannoma in the Cerebellopontine Angle

Serebellopontin Açı Yerleşimli Vestibüler Schwannoma Cerrahisinde İntraoperatif Nöromonitörizasyon ve Nöronavigasyon Tekniklerinin Kombine Kullanımı

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ABSTRACT

Objective: Surgery for vestibular schwannoma (VS), located in the cerebellopontine angle, presents a significant neurosurgical challenge due to the tumor's proximity to cranial nerves and critical neural and vascular structures. This study aimed to evaluate the efficacy and safety of combining intraoperative neuronavigation (NN) and neuromonitoring (NM) in the resection of VS tumors.

Methods: We retrospectively reviewed the medical records of patients who underwent VS tumor resection at our center between 2018 and 2023. Patients were divided into two groups: those who underwent surgery with NN and NM guidance (nVS group) and those who underwent surgery without these techniques (pVS group). The groups were compared with respect to cranial nerve identification, preservation of facial nerve function, advantages and limitations of NN and NM systems, and extent of tumor resection.

Results: In the pVS group, intraoperative visualization of the facial nerve was not achieved in seven patients (46.7%). Conversely, all patients in the nVS group had their facial nerves successfully identified intraoperatively ($p<0.001$). Postoperative evaluation revealed worsening facial nerve function, as measured by the House-Brackmann scale, in seven (46.7%) patients in the pVS group compared with two (16.7%) patients in the nVS group ($p<0.001$). The median time from anesthesia induction to surgery commencement was significantly shorter in the pVS group ($p<0.001$).

Conclusion: The combined use of NN and NM enhances tumor margin identification and adjacent structure visualization during surgery. Additionally, it facilitates real-time monitoring of neurological functions, contributing to improved surgical outcomes and reduced risk of postoperative complications.

Keywords: Vestibular schwannoma, neuromonitoring, neuronavigation, image guided surgery

ÖZ

Amaç: Vestibüler schwannoma (VS) tümörlerinin cerrahisi, tümörlerin kraniyal sinirlere ve önemli nöral ve vasküler yapılara yakınlığı nedeniyle nöroşirürjikal bir zorluk olmaya devam etmektedir. Çalışmamızda, VS tümörlerinin rezeksiyonunda birlikte kullanılan intraoperatif nöronavigasyon (NN) ve nöromonitörizasyonun (NM) etkinliğini ve güvenilirliğini araştırdık.

Gereç ve Yöntem: 2018-2023 yılları arasında merkezimizde VS tümörü nedeniyle ameliyat edilen hastalar retrospektif olarak analiz edildi. Çalışmaya NN ve NM kılavuzluğunda ameliyat edilen grup (nVS) ve kontrol grubu (pVS) dahil edildi. Gruplar, kraniyal sinirlerin tanımlanması, fasiyal sinirin fonksiyonel olarak korunması, kullanılan NN ve NM sistemlerinin avantaj ve dezavantajları ve rezeksiyon derecesine göre karşılaştırıldı.

Bulgular: pVS grubunda 7 (%46,7) hastada fasiyal sinir intraoperatif olarak görüntülenemedi. Ancak, nVS grubunda NN ve NM kullanımı ile tüm hastalarda fasiyal sinir lokalize edildi ($p<0,001$). Ameliyat sonrasında, pVS grubunda 7 hasta (%46,7) ve nVS grubunda 2 hasta (%16,7) House-Brackmann ölçeğinde ameliyat öncesi değerlendirmelere kıyasla kötüleşme gösterdi ($p<0,001$). Anestezi indüksiyonu ile ameliyatın başlaması arasında geçen ortanca süre pVS grubundaki hastalarda anlamlı derecede kısaydı ($p<0,001$).

Sonuç: NN ve NM'nin birlikte kullanımı, cerrahi sırasında tümör sınırlarının ve komşu yapıların belirlenmesine ve hastaların nörolojik fonksiyonlarının gerçek zamanlı olarak izlenmesine olanak sağlar.

Anahtar Kelimeler: Vestibüler schwannoma, nöromonitörizasyon, nöronavigasyon, görüntü kılavuzluğunda cerrahi

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Cite as: Türkkan A, Bekar A. Combined use of intraoperative neuromonitoring and neuronavigation techniques in surgery for vestibular schwannoma in the cerebellopontine angle. Med J Bakirkoy. 2026;22(1):33-41

Received: 09.09.2024
Accepted: 13.05.2025
Publication Date: 12.03.2026

INTRODUCTION

The cerebellopontine angle (CPA) is a complex anatomical region that houses numerous critical neural and vascular structures (1-3). Vestibular schwannoma (VS) is the most common benign tumor in this region (4,5). Surgical treatment of VS poses significant challenges for neurosurgeons, as they must navigate narrow surgical corridors while avoiding damage to vital neurovascular structures. Such damage can result in severe neurological deficits or even mortality (6-9).

Image-guided neuronavigation (NN) systems, which are computer-assisted tools, enable neurosurgeons to plan surgical approaches by accurately visualizing anatomical details and localizing lesions. These systems also provide intraoperative orientation, facilitating precise identification of tumor margins (10,11). The application of NN to the surgical treatment of VS enables the precise intraoperative identification of lesions (2,5,11).

However, NN alone does not provide critical information about the functional integrity of neural tissues and cranial nerves. To achieve optimal surgical outcomes, methods that deliver continuous, real-time functional feedback to the surgical team are essential (2,5,12). Neuromonitoring (NM) systems fulfill this need by offering constant intraoperative assessment of the functional status of cranial nerves and neural tissues, thereby facilitating the early detection of hazardous conditions and critical neurophysiological changes (3,12-14). Such real-time monitoring allows for the timely modification of the surgical plan, reducing the risk of irreversible neurological damage.

This study aims to share our clinical experience with the combined use of NN and NM in the surgical management of VS located within the CPA. We specifically evaluated the effectiveness and safety of integrating these techniques to improve surgical precision and outcomes.

METHODS

This retrospective study was conducted following approval from the Medicana Bursa Hospital Ethics Committee (approval no: 2023/05-2, date: 27.12.2023). All procedures adhered to the ethical standards set forth by the institutional and national research committees and the principles of the 1964 Declaration of Helsinki and its subsequent amendments. Written informed consent was obtained from all participants.

Patients

Patient data were retrieved from the hospital's electronic database, which included outpatient follow-up records, operative notes, NM and NN data, histopathological reports, neuroimaging studies, and surgical videos.

Patients were included if they had VSs exceeding 20-mm in diameter and had undergone surgical resection between 2018 and 2023. These patients were categorized into two groups. Patients who underwent surgery before the implementation of NN and NM systems (2018-2021) were classified as the pVS. Those who underwent surgery using NN and NM guidance (2021-2023) were designated as the nVS group. Patients with tumors whose histopathological diagnoses were other than VS, patients undergoing surgical interventions for non-tumor-related conditions, patients undergoing biopsy procedures, and patients with contraindications to magnetic resonance imaging (MRI) were excluded from the study.

Use of NN

In the nVS group, NN was facilitated by the Medtronic Stealth Station (Medtronic, Minnesota, USA). Axial T2-weighted and contrast-enhanced T1-weighted MRI scans, with a 1-mm slice interval, were acquired preoperatively and tailored for integration with the NN system. These images were transferred to the surgical NN workstation.

Patient positioning was achieved with a dynamic reference frame affixed to a Mayfield head holder. The NN system was registered using surface marking techniques and a freehand stereotactic navigation device. Image-patient registration (fusion) was performed to achieve precise alignment with three-dimensional imaging. Once the required accuracy level was verified, surgical procedures commenced (Figure 1).

Use of NM

In the nVS group, NM protocols were established using the nerve integrity monitor-eclipse system (Medtronic, Inc., Minneapolis, Minnesota). The NM protocol included transcranial motor-evoked potentials (MEPs) elicited in the median and tibial nerves, as well as in corticobulbar-innervated muscles of the head and face. Additionally, free-running muscle electromyography recordings were obtained from the orbicularis oculi, orbicularis oris, masseter, and genioglossus muscles.

Baseline MEP values were recorded preoperatively for each patient. An experienced neurophysiologist continuously monitored the intraoperative NM parameters (Figure 2). Significant NM events were defined as either a reduction of >50% in MEP amplitude or an increase of >20 mA in the current required to elicit MEP responses. If a significant change in MEP parameters was detected, the surgical procedure was suspended until normalization occurred.

At the surgeon's discretion, cranial nerve localization and functional status were assessed intermittently using a monopolar probe at the lowest amperage (0.05-0.5 mA).

Surgical Procedure

All surgeries were performed with patients positioned in a Mayfield three-pin head-holder in the park-bench position. In the pVS group, standard anesthesia protocols were implemented, whereas the nVS group received intravenous remifentanil and propofol as the general anesthetic regimen, with neuromuscular blocking agents used only during induction.

Standard microsurgical techniques were employed in both groups, using a Leica OH6 surgical microscope (Leica Microsystems, Wetzlar, Germany). Following a dural incision, the cerebellum was retracted using a narrow brain retractor. The cerebellomedullary cistern was then opened, and cerebrospinal fluid (CSF) was drained to relax the cerebellum, fully exposing the CPA. In the nVS group, the NN and NM systems guided localization of cranial nerves. In the pVS group, cranial nerve localization was based on the surgeon's preoperative MRI evaluation and intraoperative microscopic visualization of the surgical field. Tumor tissue was removed incrementally using an ultrasonic surgical aspirator (CUSA Clarity Console, Integra LifeSciences, France).

All patients underwent evaluations of facial nerve function and detailed neurological examinations at three time

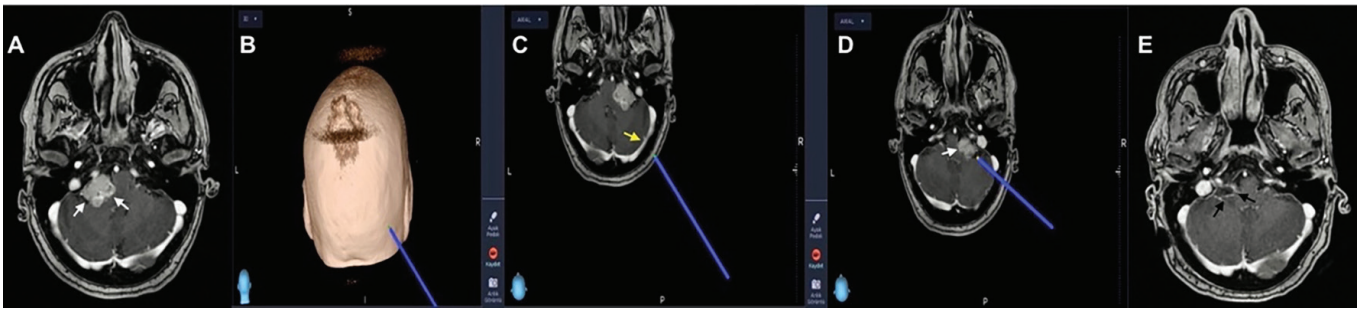

Figure 1. Intraoperative NN application in a patient undergoing surgery for vestibular schwannoma located in the right CPA. **A.** Preoperative contrast-enhanced MRI image showing the tumor in the right CPA (white arrow), **B.** determination of the skin incision site using intraoperative NN (blue arrow: NN probe image), **C.** intraoperative localization of the transverse sinus with intraoperative NN (yellow arrow: transverse sinus; blue arrow: NN probe image), **D.** intraoperative identification of tumor localization and surrounding structures with intraoperative NN (white arrow: tumor; blue arrow: NN probe image). **E.** Postoperative contrast-enhanced MRI image showing the excised tumor area (black arrow)
NN: Neuronavigation, CPA: Cerebellopontine angle, MRI: Magnetic resonance imaging

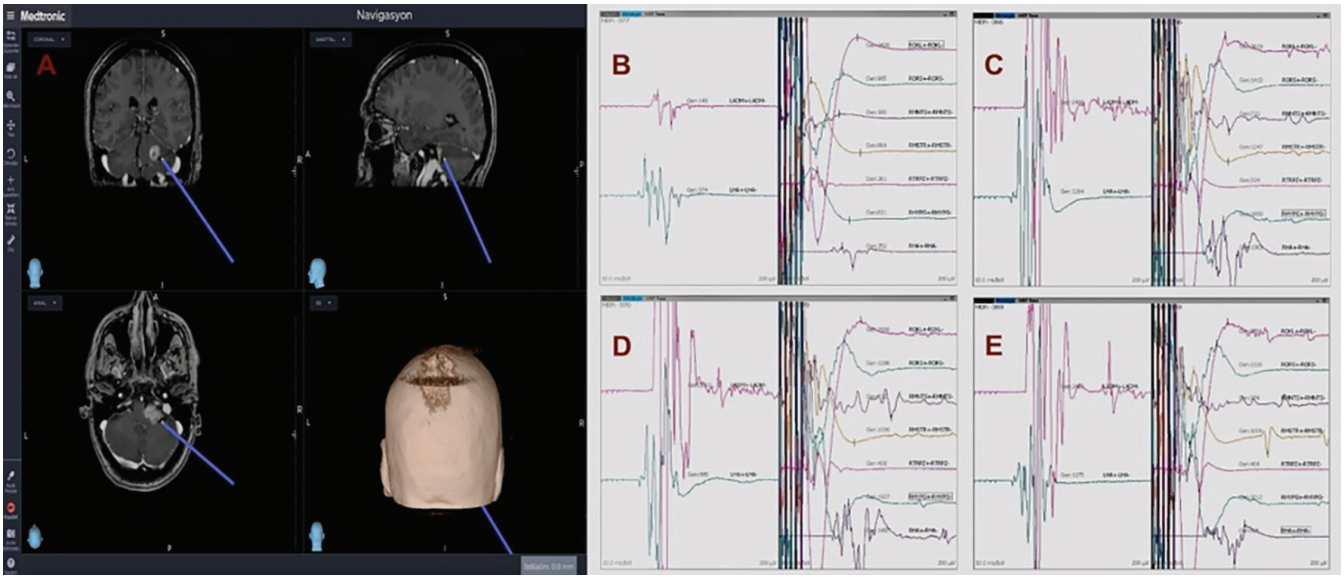

Figure 2. Combined intraoperative NN and NM application in a patient undergoing surgery for vestibular schwannoma located in the right CPA. For NM, MEP traces were recorded from the orbicularis oculi, orbicularis oris, masseter, mentalis, hypoglossus, trapezius, abductor digiti minimi, and tibialis muscles using cortical magnetic stimulation, corresponding to cranial nerves V, VII, X, XI, and XII. **A.** Intraoperative NN used for determining tumor localization and surrounding structures. **B.** Baseline MEP traces recorded before the operation. **C.** MEP traces recorded during tumor resection. **D.** MEP traces recorded after tumor resection. **E.** Final MEP traces recorded after the operation
NN: Neuronavigation, NM: Neuromonitoring, CPA: Cerebellopontine angle, MEP: Motor-evoked potential

points: before discharge, 1-month postoperatively, and 6 months postoperatively. Facial nerve function was assessed using the House-Brackmann (HB) scale (15), with an increase in the HB score compared with preoperative values regarded as indicating a new neurological deficit.

All patients underwent preoperative brain MRI enhanced with 1-mm gadolinium, as well as early postoperative cranial computed tomography (within 24 hours) and follow-up MRI scans. Independent neuroradiologists and the study authors reviewed all neuroimaging scans for residual contrast-enhancing tumor tissue. Gross total resection (GTR) was defined as the absence of significant tumor tissue on postoperative MRI, whereas subtotal resection was defined as residual tumor volume exceeding 5% of the total tumor volume.

The groups were compared with respect to age, gender, anatomical structures, facial nerve identification, preservation of facial nerve function, operative time, the advantages and disadvantages of the NN and NM systems, and the extent of tumor resection.

Statistical Analysis

Descriptive statistics, including numbers, percentages, means, and standard deviations, were used to analyze clinical characteristics. The Mann-Whitney U test was used to compare the following variables between the nVS and pVS groups: age, time from anesthesia induction to surgery initiation, mean operation time, and preoperative and postoperative facial nerve HB scale scores. Changes in facial nerve function based on the HB scale were analyzed using the Friedman test, while the chi-square test was used to compare gender distributions. Analysis of covariance was used to assess the variables influencing postoperative 6-month facial nerve HB scores. Statistical significance was set at $p<0.05$, and IBM SPSS 26.0 software was used for all statistical analyses.

RESULTS

Twenty-seven patients who underwent VS surgery in the CPA and met the inclusion criteria were enrolled in the study. The pVS group comprised 15 patients (6 males and 9 females), while the nVS group included 12 patients (5 males and 7 females; p=0.930). The mean age was 55.9±11.4 yr (range, 37-74 yr) in the pVS group and 51.7±11.1 yr (range, 30-72 yr) in the nVS group (p=0.300). Table 1 presents the demographic and clinical characteristics of the study population.

In the pVS group, dural sinus damage and mastoid air-cell openings were observed during craniotomy in three patients (20%) and four patients (26.7%), respectively. Additionally, facial nerves were not visualized intraoperatively in seven patients (46.7%). In the nVS group, no damage to the dural sinuses or mastoid bone was observed. An NM probe was used to stimulate the tumor capsule and surrounding tissues, facilitating localization of the facial nerve in all cases. The difference in facial nerve identification between the groups was statistically significant (p=0.006; Table 1).

GTR was achieved in 53.3% (8/15) of the pVS group and 58.3% (7/12) of the nVS group; the difference was not statistically significant (p=0.795; Table 1). The median operative times did not differ significantly between groups (p=0.139). However, the median time from anesthesia induction to surgery initiation was significantly shorter in the pVS group than in the nVS group (p<0.001). Setting up the NN system and placing NM electrodes required an additional 28.6±6.6 min (Table 1).

Postoperatively, seven patients (46.7%) in the pVS group exhibited deterioration in facial nerve function based on HB scale scores. At the 6-month follow-up, two patients returned to their preoperative neurological status, and two patients showed partial improvement. In the nVS group, deterioration was observed in 2 (16.7%) patients, with one showing partial improvement at follow-up. Preoperative, first-month postoperative, and six-month postoperative HB scores did not differ significantly between groups (p=0.648, p=0.373, and p=0.792; respectively). However, intra-group analysis revealed significant differences in the pVS group's HB scores over time (p=0.003), whereas no significant differences were noted in the nVS group (p=0.156) (Table 2).

When considering the effects of group, gender, GTR rates, and preoperative HB scores on 6-month postoperative HB scores, membership in the pVS group was a statistically significant factor associated with worsened outcomes (p=0.030). Preoperative HB scores also significantly influenced postoperative deterioration (p=0.003; Table 3, Figure 3). No complications related to NN or NM occurred, and there was no surgical mortality in the series.

Table 1. Demographic and clinical characteristics of the patients included in the study

Med (n)		nVS group		pVS group		p
		Q1-Q3 (%)	Med (n)	Q1-Q3 (%)		
Age, yr		50.50	45.50-59.50	54.00	47.00-65.00	0.300[a]
Mean start of surgery time, min		57.50	52.50-65.00	20.00	20.00-30.00	<0.001[a,*]
Mean operation time, min		190.00	180.00-210.00	180.00	150.00-200.00	0.139[a]
Gender	Male	5	41.7	6	40.0	0.930[b]
	Female	7	58.3	9	60.0	
Signs and symptoms	Headache	5	41.7	7	46.7	
	Hearing loss	6	50.0	8	53.3	
	Ataxia	4	33.3	3	20.0	
	Facial pain	1	8.3	1	6.7	
	Dysphagia disorders	3	25.0	1	6.7	
	Facial paralysis	2	16.7	1	6.7	
Extent of the surgery	STR	5	41.7	7	46.7	0.795[b]
	GTR	7	58.3	8	53.3	
Intraoperative FN determination facial nerve localization	Yes	12	100.0	8	53.3	0.006[b,*]
	No	0	0.0	7	46.7	
Dural venous sinus injury	Yes	12	100.0	12	80.0	0.100[b]
	No	0	0.0	3	20.0	
Opening of the mastoid air cells	Yes	12	100.0	11	73.3	0.053[b]
	No	0	0.0	4	26.7	

FN: Facial nerve, GTR: Gross total resection, Med: Median, STR: Subtotal resection, Min: Minute, *: Statistically significant, [a]: Mann-Whitney U test, [b]: Chi-square test

Table 2. Evaluation of facial nerve function in the postoperative follow-up of patients based on the HB scale

FN-HB grade	nVS group			pVS group			p[a]
	Med	Q1	Q3	Med	Q1	Q3	
Preoperative period	1.00	1.00	1.00	1.00	1.00	1.00	0.648
1-month follow-up	1.00	1.00	2.00	1.00	1.00	3.00	0.373
6-month follow-up	1.00	1.00	2.00	1.00	1.00	3.00	0.792
	0.156[b]			0.003[b,*]			

FN: Facial nerve, HB: House-Brackmann, Med: Median, *: Statistically significant, [a]: Mann-Whitney U test, [b]: Friedman test

DISCUSSION

In the present study, combined use of NN and NM techniques in VS surgery significantly improved the identification and preservation of anatomical and vascular structures.

One of the primary challenges in VS involving CPA tumors is intraoperative localization of displaced neurovascular structures and cranial nerves (2,3,14). Achieving anatomical orientation can facilitate tumor resection while minimizing patient harm. In conventional cranial surgery, surgeons use preoperative computed tomography or MRI imaging to construct a three-dimensional mental representation of lesions and surrounding anatomy to guide the procedure. This task is considerably more complex for CPA lesions (16-19).

NN systems offer a significant advantage in preoperative planning and intraoperative anatomical orientation (5,11,20). In a study involving 436 patients undergoing VS surgery via the retrosigmoid approach, Chen et al. (5) demonstrated that NN effectively identified sinus structures and the tumor's anatomical relationships with adjacent structures. Similarly, in our study, NN facilitated accurate localization of the sigmoid sinus, transverse sinus, brainstem, and tumor. In the nVS group, skin incisions were planned using NN to identify the sinuses, thereby avoiding sinus damage during craniotomy. Furthermore, the air cells in the petrosal and mastoid bones were identified using the NN system, enabling the planning of a personalized craniotomy. In the pVS group, the identification of anatomical

and neurovascular structures relied solely on the surgeon's expertise. Complications such as sinus rupture and opening of the mastoid air cells were noted, but their incidence did not differ significantly from that in the nVS group ($p<0.1$), which was likely due to the small cohort size. Nevertheless, the NN system provided surgeons with greater ease and confidence when identifying anatomical structures. One of the key factors influencing surgical success in VS is the accurate determination of the anatomical relationship between the tumor and the facial nerve. The NN system offers a substantial advantage by enhancing intraoperative anatomical orientation.

Despite their potential, NN systems are infrequently employed during VS surgery, likely due to concerns about their accuracy. One major challenge is brain shift, which can disrupt surgical orientation (21,22). Addressing this issue is a critical area of ongoing research, as maintaining procedural accuracy is vital (20-22). However, existing literature indicates that brain shift is less common in infratentorial tumors, even with CSF drainage (20,23,24). The infratentorial space is characterized by a smaller volume, and despite CSF drainage and dislocation of surrounding tissues, displacement of the brainstem from the midline rarely occurs (20). This stability is attributed to the cranial nerves and major blood vessels, which are firmly positioned in this anatomical region. As a

Table 3. Variables affecting the postoperative 6-month facial nerve HB scores via ANCOVA analysis

	Type III sum of squares	df	Mean square	F	p	R^2
Corrected model	16.029	8	2.004	3.438	0.014	0.604
Intercept	0.019	1	0.019	0.033	0.857	0.002
Preoperative FN-HB grade	6.711	1	6.711	11.516	0.003*	0.390
pVS group	3.235	1	3.235	5.552	0.030*	0.236
Gender	1.147	1	1.147	1.968	0.178	0.099
GTR	0.100	1	0.100	0.172	0.683	0.009
pVS group and gender	0.737	1	0.737	1.265	0.275	0.066
pVS group and GTR	0.012	1	0.012	0.020	0.889	0.001
Gender and GTR	0.247	1	0.247	0.423	0.524	0.023
pVS group, gender, and GTR	0.496	1	0.496	0.851	0.369	0.045
Error	10.489	18	0.583			
Total	95.000	27				
Corrected total	26.519	26				

R^2=0.556 (adjusted R^2=0.463). *: Statistically significant, ANCOVA: Analysis of covariance, FN: Facial nerve, GTR: Gross total resection, HB: House-Brackmann

Figure 3. ANCOVA results associated with postoperative 6-month facial nerve function HB scores. ANCOVA analysis, which controlled for the effects of the pVS group, gender, GTR, and preoperative facial nerve HB scores, revealed that the pVS group exhibited significantly higher postoperative HB scores compared with the nVS group 6 months after surgery. The pVS group was identified as a highly significant factor in the worsening of facial nerve scores (χ^2=0.1236, p=0.03)

ANCOVA: Analysis of covariance, HB: House-Brackmann, GTR: Gross total resection

result, brain shift in these cases is minimal and does not pose significant challenges (23,24). Consequently, NN data maintains its accuracy during surgical procedures. Sure et al. (24) reported that NN significantly improves the efficiency and safety of skull-base tumor surgery and that no notable intraoperative shift was observed. Similarly, Zhang et al. (20) reported that NN is a reliable tool for infratentorial tumor surgeries because spatial shifts in the brainstem are negligible.

Data from the patient records in our study corroborate these findings, showing no significant deviations in NN data for the nVS group and successful intraoperative identification of dural sinuses, tumor localization, adjacent brainstem structures, and vascular anatomy. However, NN alone was insufficient for the precise localization of cranial nerves, including the facial nerve, near tumor tissue. These structures were effectively identified by stimulation with the NM probe. The combined use of NN and NM facilitated accurate localization of tumor tissue, neurovascular structures, and displaced cranial nerves, including the facial nerve, in all patients in the nVS group.

Identification of anatomical structures is only one aspect of achieving surgical success during VS resection. Equally critical is the intraoperative monitoring of neuronal functions to prevent new neurological deficits. NM enables real-time monitoring of brainstem and cranial nerve functions during surgery. Della Pepa et al. (13) demonstrated, in a series of 83 patients, that NM reliably predicted early and late postoperative facial nerve function following CPA tumor resection. Furthermore, a meta-analysis by Starnoni et al. (14), conducted on behalf of the European Association for Neurosurgical Societies Skull Base Committee, recommended the routine use of NM to preserve facial and cochlear nerve function during VS surgery.

In our study, intraoperative facial nerve monitoring was successful in all patients in the nVS group, indicating a statistically significant advantage over the pVS group ($p<0.01$). Postoperative facial nerve outcomes aligned with intraoperative findings, with better results observed in the nVS group compared to the pVS group.

Brainstem auditory evoked potential (BAEP) measurements are another commonly used intraoperative NM technique in VS surgery (2,25), particularly for monitoring cochlear nerve function (25,26). BAEP has been shown to influence resection strategies to preserve hearing during VS surgery (25,27) and to predict postoperative hearing loss. In a meta-analysis, Gu et al. (26) found that changes in BAEP during VS surgery have a high sensitivity (0.95) in predicting postoperative hearing loss. Thus, intraoperative BAEP monitoring may provide valuable insight into hearing function during surgery, allowing the neurosurgeon to decide whether to continue or halt tumor resection. However, the retrospective design of our study limits our ability to track BAEP values for every patient because the data are incomplete. The presence of different types of BAEP changes in some patients also hindered further analysis, which is a key limitation of this study. We believe that future research should prioritize the integration of advanced NM techniques that have improved sensitivity and specificity, particularly in larger patient populations, to address one of the most significant challenges in VS surgery: loss of cranial nerve function.

However, NM data can be influenced by factors such as the depth of anesthesia and cold-water irrigation during surgery (2,14,28,29). Additionally, the complex and redundant nature of cranial nerve pathways, including multiple corticobulbar branches that innervate cranial nerve nuclei, complicates the relationship between changes in MEP amplitude and clinical outcomes (28-30). Recent literature has examined various electrophysiological methods used in VS surgery (2,12,28-30). In our review, we found few studies combining NM with navigation (2,5). Our study aimed to evaluate the advantages and disadvantages of using NN alongside NM during intraoperative oncologic neurosurgical procedures targeting VS. We found that combining NN and NM significantly improved the identification of anatomical structures and the localization of the facial nerve during surgery. Furthermore, among patients who experienced worsening facial nerve HB scores at 6 months post-surgery, failure to use the NN-NM combination was a highly significant factor (Table 3, Figure 3). The use of NN and NM allows for real-time intraoperative monitoring, which aids in identifying the tumor mass, critical neurovascular structures, and safe entry points. Continuous monitoring of the facial nerve enables functional tracking, which significantly contributes to achieving maximal surgical safety. These findings highlight the two main advantages of combining NN and NM during surgery.

Nevertheless, there are some disadvantages. First, this method is costly and requires additional equipment that is not typically available in standard surgical centers. Preoperative data must be loaded onto the navigation workstation and registered to the patient's reference frame during surgery. Similarly, for NM, proper electrode placement and baseline recordings of the patient's functional status are necessary and can delay the initiation of surgery. In our study, the interval from anesthesia induction to surgical incision was significantly longer in the nVS group than in the other groups. Furthermore, the accuracy of these techniques depends on staff training, and the techniques

require a learning curve. To ensure success, experienced neurophysiologists must closely monitor and interpret the data during surgery.

Study Limitations

Our study has several limitations. First, it is a single-center retrospective study with a small sample size. Increasing the sample size may increase confidence in estimates or reduce the margin of error. Second, we did not assess the individual anesthetic doses (e.g., analgesics and muscle relaxants) or body temperatures, which may have influenced the measurements. However, all patients underwent surgery in a highly standardized surgical and anesthetic environment, as described in previous studies. Finally, although all tumors were large VS causing facial nerve compression, preoperative facial nerve involvement varied among patients and should be considered when interpreting clinical outcomes, particularly regarding facial nerve function. Moreover, BAEP data were incomplete for some patients, limiting our analysis. Therefore, larger, randomized trials with more objective criteria are needed to provide definitive answers.

CONCLUSION

Our study demonstrates that real-time intraoperative information is a significant advantage in the surgical management of VS. NM provides real-time monitoring of neurological function, while NN enables precise identification of anatomical and neurovascular structures adjacent to the tumor. When used together, these methods complement each other, enhancing patient safety and enabling safer resection. This synergy has the potential to significantly improve outcomes in VS surgery.

ETHICS

Ethics Committee Approval: This retrospective study was conducted following approval from the Medicana Bursa Hospital Ethics Committee (approval no: 2023/05-2, date: 27.12.2023).

Informed Consent: Written informed consent was obtained from all participants.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: A.T., A.B., Concept: A.T., A.B., Design: A.T., A.B., Data Collection or Processing: A.T., A.B., Analysis or Interpretation: A.T., A.B., Literature Search: A.T., Writing: A.T.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Grunwald I, Papanagiotou P, Nabhan A, Politi M, Reith W. Anatomie des kleinhirnbrückenwinkels [Anatomy of the cerebellopontine angle]. Radiologe. 2006;46:192-6.
2. Izzo A, Stifano V, Della Pepa GM, Di Domenico M, D'Alessandris QG, Menna G, et al. Tailored approach and multimodal intraoperative neuromonitoring in cerebellopontine angle surgery. Brain Sci. 2022;12:1167.
3. D'Alessandris QG, Menna G, Stifano V, Della Pepa GM, Burattini B, Di Domenico M, et al. A study on the role of intraoperative corticobulbar motor evoked potentials for improving safety of cerebellopontine angle surgery in elderly patients. Diagnostics (Basel). 2023;13:710.
4. You YP, Zhang JX, Lu AL, Liu N. Vestibular schwannoma surgical treatment. CNS Neurosci Ther. 2013;19:289-93.
5. Chen LH, Zhang HT, Sun K, Chen WJ, Xu RX. Microsurgery for vestibular schwannoma via retrosigmoid transmeatal approach with intraoperative monitoring techniques. Balkan Med J. 2021;38:212-21.
6. Haq IBI, Permana AT, Susilo RI, Wahyuhadi J. Deadly complication of sacrificing superior petrosal vein during cerebellopontine angle tumor resection: a case report and literature review. Surg Neurol Int. 2021;12:306.
7. Rayan T, Helal A, Graffeo CS, Perry A, Carlstrom LP, Driscoll CLW, et al. Cerebrovascular complications of vestibular schwannoma surgery. J Neurol Surg B Skull Base. 2021;83(Suppl 2):e443-8.
8. Kunert P, Smolarek B, Marchel A. Facial nerve damage following surgery for cerebellopontine angle tumours. Prevention and comprehensive treatment. Neurol Neurochir Pol. 2011;45:480-8.
9. Gurgel RK, Dogru S, Amdur RL, Monfared A. Facial nerve outcomes after surgery for large vestibular schwannomas: do surgical approach and extent of resection matter? Neurosurg Focus. 2012;33:E16.
10. Barone DG, Lawrie TA, Hart MG. Image guided surgery for the resection of brain tumours. Cochrane Database Syst Rev. 2014;2014:CD009685.
11. da Silva EB Jr, Leal AG, Milano JB, da Silva LF Jr, Clemente RS, Ramina R. Image-guided surgical planning using anatomical landmarks in the retrosigmoid approach. Acta Neurochir (Wien). 2010;152:905-10.
12. Acioly MA, Liebsch M, de Aguiar PH, Tatagiba M. Facial nerve monitoring during cerebellopontine angle and skull base tumor surgery: a systematic review from description to current success on function prediction. World Neurosurg. 2013;80:e271-300.
13. Della Pepa GM, Stifano V, D'Alessandris QG, Menna G, Burattini B, Di Domenico M, et al. Intraoperative corticobulbar motor evoked potential in cerebellopontine angle surgery: a clinically meaningful tool to predict early and late facial nerve recovery. Neurosurgery. 2022;91:406-13.
14. Starnoni D, Giammattei L, Cossu G, Link MJ, Roche PH, Chacko AG, et al. Surgical management for large vestibular schwannomas: a systematic review, meta-analysis, and consensus statement on behalf of the EANS skull base section. Acta Neurochir (Wien). 2020;162:2595-617.
15. House JW, Brackmann DE. Facial nerve grading system. Otolaryngol Head Neck Surg. 1985;93:146-7.
16. Ciric I, Zhao JC, Rosenblatt S, Wiet R, O'Shaughnessy B. Suboccipital retrosigmoid approach for removal of vestibular schwannomas: facial nerve function and hearing preservation. Neurosurgery. 2005;56:560-70.

17. Boublata L, Belahreche M, Ouchtati R, Shabhay Z, Boutiah L, Kabache M, et al. Facial nerve function and quality of resection in large and giant vestibular schwannomas surgery operated by retrosigmoid transmeatal approach in semi-sitting position with intraoperative facial nerve monitoring. World Neurosurg. 2017;103:231-40.
18. Jian ZH, Sheng MF, Li JY, An DZ, Weng ZJ, Chen G. Developing a method to precisely locate the keypoint during craniotomy using the retrosigmoid keyhole approach: surgical anatomy and technical nuances. Front Surg. 2021;8:700777.
19. Raheja A, Bowers CA, MacDonald JD, Shelton C, Gurgel RK, Brimley C, et al. Middle fossa approach for vestibular schwannoma: good hearing and facial nerve outcomes with low morbidity. World Neurosurg. 2016;92:37-46.
20. Zhang M, Xiao X, Gu G, Zhang P, Wu W, Wang Y, et al. Role of neuronavigation in the surgical management of brainstem gliomas. Front Oncol. 2023;13:1159230.
21. Gerard IJ, Kersten-Oertel M, Petrecca K, Sirhan D, Hall JA, Collins DL. Brain shift in neuronavigation of brain tumors: a review. Med Image Anal. 2017;35:403-20.
22. Gerard IJ, Kersten-Oertel M, Hall JA, Sirhan D, Collins DL. Brain shift in neuronavigation of brain tumors: an updated review of intra-operative ultrasound applications. Front Oncol. 2021;10:618837.
23. Dolati P, Gokoglu A, Eichberg D, Zamani A, Golby A, Al-Mefty O. Multimodal navigated skull base tumor resection using image-based vascular and cranial nerve segmentation: a prospective pilot study. Surg Neurol Int. 2015;6:172.
24. Sure U, Alberti O, Petermeyer M, Becker R, Bertalanffy H. Advanced image-guided skull base surgery. Surg Neurol. 2000;53:563-72.
25. Vivas EX, Carlson ML, Neff BA, Shepard NT, McCracken DJ, Sweeney AD, et al. Congress of Neurological Surgeons systematic review and evidence-based guidelines on intraoperative cranial nerve monitoring in vestibular schwannoma surgery. Neurosurgery. 2018;82:E44-6
26. Gu F, Yang X, Wang Z, Tan X, Xue T, Chen Z, et al. Diagnostic accuracy of intraoperative brainstem auditory evoked potential for predicting hearing loss after vestibular schwannoma surgery. Front Neurol. 2022;13:1018324.
27. Gugel I, Grimm F, Hartjen P, Breun M, Zipfel J, Liebsch M, et al. Risk stratification for immediate postoperative hearing loss by preoperative BAER (brainstem auditory evoked response) and audiometry in NF2-associated vestibular schwannomas. Cancers (Basel). 2021;13:1384.
28. Prell J, Strauss C, Rachinger J, Alfieri A, Scheller C, Herfurth K, et al. Facial nerve palsy after vestibular schwannoma surgery: dynamic risk-stratification based on continuous EMG-monitoring. Clin Neurophysiol. 2014;125:415-21.
29. Bovo N, Momjian S, Gondar R, Bijlenga P, Schaller K, Boëx C. Sensitivity and negative predictive value of motor evoked potentials of the facial nerve. J Neurol Surg A Cent Eur Neurosurg. 2021;82:317-24.
30. Greve T, Wang L, Thon N, Schichor C, Tonn JC, Szelényi A. Prognostic value of a bilateral motor threshold criterion for facial corticobulbar MEP monitoring during cerebellopontine angle tumor resection. J Clin Monit Comput. 2020;34:1331-41.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):42-48
DOI: 10.4274/BMJ.galenos.2026.2025.11-17

Research

Clinical and Sociodemographic Characteristics and Treatment Approaches of Patients with Psychotic Spectrum Disorders Followed in A Community Mental Health Center

Toplum Ruh Sağlığı Merkezinde Takip Edilen Psikotik Spektrum Bozuklukları Olan Hastaların Klinik ve Sosyodemografik Özellikleri ve Tedavi Yaklaşımları

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ABSTRACT

Objective: To examine the clinical and sociodemographic characteristics and treatment approaches of patients with psychotic spectrum disorders receiving services from a community mental health center.

Methods: This cross-sectional study included 203 patients diagnosed with psychotic spectrum disorders who were registered at a community mental health center and consented to participate. Data were collected through face-to-face interviews conducted by the clinician. Patients diagnosed by a clinician according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition diagnostic criteria provided written and verbal informed consent. The sociodemographic data form and the Positive and Negative Syndrome Scale were administered to all participants. Prior to the commencement of the study, ethical approval was obtained from the Yalova University Ethics Committee and institutional permission was granted by the Provincial Directorate of Health (approval no: 2025/330, date: 25.06.2025).

Results: In our study, the majority of patients were male (66.5%). Mental disorders were more frequently observed among first- and second-born children within households. A psychiatric disorder was present in the first-degree relatives of 88 patients (43.3%). Additionally, a history of legal issues was identified in 55 (27.1%) patients, and tobacco use was reported by 114 (56.2%) patients. Regarding treatment, 45 patients (22.2%) were receiving long-acting injectable paliperidone palmitate (3-month formulation), and 28 patients (13.8%) were receiving long-acting injectable aripiprazole.

Conclusion: This study is one of the few investigations in Türkiye examining the clinical and treatment characteristics of patients with psychotic spectrum disorders who receive services from a community mental health center. Therefore, we believe that our study makes a significant contribution to the existing literature.

Keywords: Psychotic disorder, treatment, community mental health services

ÖZ

Amaç: Bu çalışmanın amacı, toplum ruh sağlığı merkezinden hizmet alan psikotik spektrum bozukluğu tanılı hastaların klinik ve sosyodemografik özellikleri ile tedavi yaklaşımlarını incelemektir.

Gereç ve Yöntem: Kesitsel tipte planlanan bu çalışma, bir toplum ruh sağlığı merkezine kayıtlı ve çalışmaya katılmaya gönüllü olan, psikotik spektrum bozukluğu tanılı 203 hasta ile yürütülmüştür. Veriler, klinisyen tarafından yüz yüze görüşme yöntemiyle toplanmıştır. Zihinsel Bozuklukların Tanısal ve İstatistiksel El Kitabı, Beşinci Baskı tanı ölçütlerine göre klinisyen tarafından tanı konulan hastalardan yazılı ve sözlü bilgilendirilmiş onam alınmıştır. Tüm katılımcılara sosyodemografik veri formu ve Pozitif ve Negatif Sendrom Ölçeği uygulanmıştır. Çalışmanın yürütülmesinden önce Yalova Üniversitesi Etik Kurulu'ndan onay ve İl Sağlık Müdürlüğü'nden kurumsal izin alınmıştır (onay no: 2025/330, tarih: 25.06.2025).

Bulgular: Çalışmamızda hastaların çoğunluğunu erkekler oluşturmaktaydı (%66,5). Ruhsal bozuklukların, ailede birinci ve ikinci sırada doğan çocuklarda daha sık görüldüğü saptandı. Hastaların 88'inin (%43,3) birinci derece yakınlarında psikiyatrik hastalık öyküsü bulunduğu belirlendi.

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Received: 24.11.2025
Accepted: 26.01.2026
Publication Date: 12.03.2026

Cite as: Şahpolat M, Adıgüzel V, Yıldırım S. Clinical and sociodemographic characteristics and treatment approaches of patients with psychotic spectrum disorders followed in a community mental health center. Med J Bakirkoy. 2026;22(1):42-48

ÖZ

Ayrıca 55 hastada (%27,1) adli öykü olduğu, 114 hastanın (%56,2) ise tütün kullandığı saptandı. Tedaviye ilişkin olarak 45 hastanın (%22,2) uzun etkili enjektabl paliperidon palmitat (3 aylık form) ve 28 hastanın (%13,8) uzun etkili enjektabl aripiprazol tedavisi aldığı belirlendi.

Sonuç: Bu çalışma, Türkiye'de toplum ruh sağlığı merkezinden hizmet alan psikotik spektrum bozukluğu tanılı hastaların klinik ve tedavi özelliklerini inceleyen nadir araştırmalardan biridir. Bu nedenle, mevcut literatüre yapacağı katkı açısından önemli olduğuna inanılmaktadır.

Anahtar Kelimeler: Psikotik bozukluk, tedavi, toplum ruh sağlığı hizmetleri

INTRODUCTION

Psychosis is a syndrome characterized by impaired reality testing, delusions, hallucinations, disorganized thoughts and speech, marked behavioral disturbances, including catatonia, and negative symptoms (such as affective flattening, alogia, and avolition). The category of "psychotic disorders" includes schizophrenia, schizophreniform disorder, schizoaffective disorder, substance/medication-induced psychotic disorder, psychotic disorder due to a general medical condition, among others (1). Psychotic spectrum disorder (PSD) is a severe mental illness characterized by early onset, recurrent episodes, and a chronic course. Psychotic disorders, which significantly impair cognitive and social functioning, place a considerable burden on both families and society. Schizophrenia, the most common psychotic disorder, affects approximately 24 million people worldwide and has a lifetime prevalence of approximately 1% (2). Psychotic disorders are significant because of the negative impacts they have on individuals, families, and society throughout the course of the illness. The lifetime prevalence of encountering any legal issues for individuals with PSD has been reported as 21% (3). The main contributing factors to legal problems or violent behavior include psychotic episodes, positive symptoms, nonadherence to treatment, history of violence, and alcohol or substance abuse (4,5). For these reasons, regular follow-up and treatment of patients with PSD are critically important.

Mental health services can be categorized as community-based and hospital-based service-delivery models. Since the 1960s, because of inadequacies in prevention and follow-up care and serious violations of human rights, nearly all developed countries have shifted from a hospital-based model to community-based services (6). In Türkiye, the foundation for the transition to a community-based model was established by the National Mental Health Policy Directive prepared in 2006. In line with this, the Ministry of Health of Türkiye decided to establish Community Mental Health Centers (CMHCs) in April 2009 and began implementing related projects (7,8). Prior to the adaptation studies initiated at the CMHC in Bolu, mental health services for individuals with mental disorders in Türkiye were limited to psychiatric outpatient clinics located in hospitals or day hospitals (9). CMHCs have broad and significant responsibilities. These include informing patients with severe mental illness and their families who live within the geographic area of the CMHC, providing outpatient treatment and follow-up, enhancing patients' psychosocial skills through therapy-based interventions, facilitating their participation in occupational therapy according to their interests, offering psychoeducation and rehabilitation services, collaborating with psychiatric clinics, and conducting home visits through mobile teams (7).

The aim of this study is to examine the clinical and sociodemographic characteristics and treatment approaches of patients diagnosed with PSD who receive services from a CMHC.

METHODS

Study Design

This study had a cross-sectional design.

Population and Sample

The study population consisted of all registered patients diagnosed with PSD who were followed and treated at a CMHC. A total of 203 patients diagnosed with PSD who voluntarily agreed to participate in the study were included.

Study Site and Duration

The study was conducted between August 15 and September 30, 2025, at a CMHC affiliated with the Provincial Health Directorate in a city in the Marmara Region.

Data Collection Tool

Sociodemographic Data Form

A semi-structured questionnaire developed for the purpose of this study to collect data on patients' age, gender, marital status, educational level, employment status, family history of mental illness, alcohol and tobacco use, and current treatment modalities.

The Positive and Negative Syndrome Scale (PANSS) is a semi-structured interview comprising 30 items designed to assess seven positive symptoms, seven negative symptoms, and 16 general psychopathology symptoms, each rated on

a seven-point severity scale (9). The 7-point scale in each item reflects increasing levels of psychopathology severity: 1=absent, 2=very mild, 3=mild, 4=moderate, 5=moderate/severe, 6=severe, 7=extreme. The validity and reliability of the Turkish version of the scale were assessed by Kostakoğlu et al. (10).

Ethics

The study was designed in accordance with the principles of the Declaration of Helsinki, the Patient Rights Regulation, and ethical standards. Ethical approval was obtained from the Yalova University Ethics Committee and institutional permission was granted by the Provincial Directorate of Health (approval no: 2025/330, date: 25.06.2025). Written informed consent was obtained from all participants in the study.

Implementation

Interviews were conducted in a private consultation room, ensuring that no third party was present with the patient. The purpose of the study and the confidentiality of personal information were explained in detail to the patients. Patients were asked whether they wished to participate, and those who volunteered were included in the study. The sociodemographic data form was completed by the clinician through face-to-face interviews with the patients. The PANSS was administered by the clinician to patients included in the study who were diagnosed with a PSD, and the patients' treatment protocols and illness characteristics were assessed. The sociodemographic and clinical characteristics of the patients were examined in two sections. The first section focused on sociodemographic characteristics such as gender, educational status, marital status, employment status, family history of psychotic disorders, and age at onset of illness. The second section examined clinical features related to the illness, including tobacco use, alcohol use, and substance misuse; history of legal issues after illness onset; and treatment protocol.

Data Collection

The data obtained in the study were analyzed using SPSS for Windows, version 21.0 (Statistical Package for the Social Sciences). Descriptive statistical methods (mean, standard deviation, frequency, and percentage) were employed to evaluate the data.

RESULTS

A total of 203 patients participated in the study. Among them, 8.8% (n=18) were diagnosed with schizoaffective disorder and 91.2% (n=185) with schizophrenia. Of the participants, 66.5% (n=135) were male and 33.5% (n=68) were female. In terms of marital status, 81.8% (n=166) were single and 18.2% (n=37) were married. A family history of psychotic disorders was reported in 43.3% (n=88) of participants, while 56.2% (n=114) had tobacco use disorder. Comorbid physical illnesses were observed in 42.9% (n=87) of the participants. When examining the age distribution, the majority of participants were between 50 and 59 years of age (n=66; 30.0% of the sample). Additionally, age at illness onset was most frequently reported as 21-29 years, accounting for 37.9% (n=77) of cases (Table 1).

Table 1. Patient characteristics

Characteristics	Number (n)	%
Gender		
Female	68	33.5
Male	135	66.5
Age		
20-29 years	10	4.9
30-39 years	29	14.3
40-49 years	56	27.6
50-59 years	61	30.0
60-69 years	40	19.7
70 years and over	7	3.4
Marital status		
Single	166	81.8
Married	37	18.2
Birth order		
1st child	53	26.1
2nd child	61	30.0
3rd child	31	15.3
4th child	20	9.9
5th or later	38	18.7
Educational status		
Illiterate	4	2.0
Literate	13	6.4
Primary school	59	29.1
Secondary school	46	22.7
High School	61	30.0
University	20	9.9
Family history of psychotic disorder		
Yes	88	43.3
No	115	56.7
Tobacco use disorder		
Yes	114	56.2
No	89	43.8
Comorbid physical illness		
Yes	87	42.9
No	116	57.1

Table 1. Continued

Characteristics	Number (n)	%
Age of illness onset		
8-15 years	24	11.8
16-20 years	50	24.6
21-29 years	77	37.9
30-39 years	34	16.7
40 years and above	18	8.9
Number of psychiatric hospitalizations		
None	25	12.3
1-5 times	149	73.4
6-10 times	16	7.9
11 years and above	13	6.4
Employment status before illness onset		
Yes	97	47.8
No	106	52.2
Employment status after illness onset		
Yes	59	29.1
No	144	70.9
History of legal issues		
Yes	55	27.1
No	148	72.9
Electroconvulsive therapy (ECT) history		
Yes	63	31.0
No	140	69.0
Clozapine use		
Yes	69	34.0
No	134	66.0
Use of long-acting intramuscular (IM) antipsychotic medication		
None	78	38.4
Risperidone long-acting IM formulation	2	1.0
Paliperidone palmitate long-acting IM (monthly formulation)	39	19.2
Paliperidone palmitate long-acting IM (3-month formulation)	45	22.2
Haloperidol long-acting IM	8	3.9
Zuclopenthixol depot IM	3	1.5
Aripiprazole Maintena IM	28	13.8
Diagnosis		
Schizophrenia	185	91.2
Schizoaffective disorder	18	8.8
Mean PANSS Score	72.4±13.2	

PANSS: Positive and Negative Syndrome Scale

With respect to birth order, 26.1% (n=53) were first-born children, 30.0% (n=61) were second-born, 15.3% (n=31) were third-born, 9.9% (n=20) were fourth-born, and 18.7% (n=38) were fifth-born or later. Educational status was as follows: illiterate, 2.0% (n=4); literate, 6.4% (n=13); primary school, 29.1% (n=59); secondary school, 22.7% (n=46); high school, 30.0% (n=61); university, 9.9% (n=20). The number of psychiatric hospitalizations was reported as follows: none: 12.3% (n=25); 1-5 times: 73.4% (n=149); 6-10 times: 7.9% (n=16); 11 times or more: 6.4% (n=13) (Table 1).

Employment Status

Employment prior to illness onset: employed: 47.8% (n=97), unemployed: 52.2% (n=106); employment after illness onset: employed: 29.1% (n=59), unemployed: 70.9% (n=144). History of legal issues was reported in 27.1% (n=55) of the participants. Electroconvulsive therapy (ECT) had been administered to 31.0% (n=63), while 69.0% (n=140) had not undergone ECT. Clozapine use was observed in 34.0% (n=69) of the patients, whereas 66.0% (n=134) were not using clozapine (Table 1).

Use of long-acting antipsychotics (LAIs) was distributed as follows: no LAI medication: 38.4% (n=78), risperidone LAI: 1.0% (n=2), paliperidone palmitate LAI (monthly formulation): 19.2% (n=39), paliperidone palmitate LAI (3-month formulation): 22.2% (n=45), haloperidol LAI: 3.9% (n=8), zuclopenthixol depot: 1.5% (n=3), aripiprazole maintena: 13.8% (n=28) The mean total PANSS score was found to be 72.4±13.2 (Table 1).

DISCUSSION

In this study, the clinical and sociodemographic characteristics and treatment approaches of patients with PSD receiving services from a CMHC were examined.

In our study, 66.5% (n=135) of the patients were male. The overall prevalence of psychosis is higher in males than in females, and males are more likely to seek treatment (11). A study conducted in Türkiye reported that the proportion of early psychosis cases in CMHCs was 60.7% (12), and another study by Yıldız and Yıldırım (13) indicated that the proportion of male patients was 66.5%.

In our study, 81.8% of PSD patients were single, consistent evidence that marriage or partnership rates are significantly lower among individuals with severe mental disorders than in the general population. This finding is also supported by national CMHC data. In a large-scale registry study from a CMHC in the Black Sea Region (n=640), the proportions of single and married individuals were 61.3% and 35.5%, respectively; among the schizophrenia subgroup, the rate of single individuals was 65.2% (14). Similarly, at another comparative study conducted at a CMHC, the marriage rate among patients with schizophrenia was 22.9%, while the proportion of single patients was 54.3%, further

demonstrating the relatively low prevalence of marriage among patients with psychosis receiving community-based services (15). In contrast to our findings, Şahpolat (16), in a comparative study conducted at a CMHC, reported that 52.2% of patients were married. This discrepancy may stem from the inclusion of different patient populations and regional cultural differences.

43.3% of participants had a first-degree relative diagnosed with another psychiatric disorder. In a study conducted by Belli et al. (17) involving patients with schizophrenia (n=463), the rate of psychotic disorder among relatives of these patients (regardless of degree of kinship) was 26%. Tang et al. (18) reported rates of psychotic disorders among relatives of patients with schizophrenia: 11% in males and 14% in females (n=542).

In our study, comorbid physical illnesses were observed in 42.9% of patients. In a Turkish adaptation study of the health improvement profile, physical health problems were detected in 57.1% of participants (19), which is higher than that observed in our study. This difference may be attributed to factors such as age/gender composition, measurement methods (diagnostic records vs. symptom screening), and healthcare access.

In terms of age distribution, 30% of the participants were in the 50-59 age range. In Turkish CMHC cohorts, the mean age is generally reported to be in the mid-40s, indicating that community-based follow-up often clusters around middle-to-older-age groups (20). Murat and Kutlu (19) also reported that the mean age of patients was in the 40s. In our sample, The high concentration of chronic cases in the 50-59 age group may reflect a shift toward an older age distribution.

Legal histories were present in 27.1% of patients, suggesting that individuals with serious mental illness have a higher frequency of contact with the criminal justice system than the general population (21). Indeed, large-sample studies report that 20-40% of individuals with PSD experience at least one arrest or detention over the long term; for schizophrenia alone approaches 39% (22). Yıldız et al. (23) reported that 11% of psychotic patients had a forensic history. A separate study of hospitalized patients in Türkiye reported a rate of 18% (24). Wallace et al. (3) reported a 21% prevalence of legal history and associated it with substance use. Our findings appear consistent with the literature.

Examination of the treatments received by patients in our study showed that rates of LAI use were as follows: no medication, 38.4% (n=78); risperidone, 1.0% (n=2); monthly paliperidone, 19.2% (n=39); 3-month paliperidone, 22.2% (n=45); haloperidol, 3.9% (n=8); zuclopenthixol, 1.5% (n=3); and aripiprazole, 13.8% (n=28). Non-adherence to antipsychotic treatment is a major issue among patients. Depot antipsychotics, developed in the 1960s to improve adherence, have been shown to reduce rates of relapse and hospitalization significantly (25,26). Some studies suggest that atypical antipsychotics are more effective than conventional ones in improving adherence and preventing relapse (27,28). Despite the advantages of long-acting depot antipsychotic injections for many patients with chronic psychotic disorders, the proportion of patients treated with these formulations worldwide—varying across national, regional, and local contexts—has been reported to be as low as 15% (16,29,30). In our study, the utilization rate of long-acting injectable antipsychotics was 25.1%. This relatively higher rate may reflect a more severe clinical profile among patients with psychotic disorders who seek services from CMHCs than among the broader population of individuals with psychotic disorders.

Study Limitations

There are several limitations to our study. First, the study was conducted at a single center. Secondly, the province where the study was conducted has a relatively small population, which may cause its demographics to differ from those of other regions. Moreover, the findings of this study should be interpreted with caution, taking into account the limitations inherent in its cross-sectional design.

CONCLUSION

In conclusion, among patients with PSD receiving services from a CMHC, the male predominance, the high proportion of single individuals, the frequent presence of psychiatric disorders among first-degree relatives, and the considerable burden of comorbid physical illness are notable. The age distribution, concentrated in the 50-59 age, suggests a chronic and progressive course of illness, while the presence of a legal history in one in four patients highlights the persistence of associated social risks. The rate of LAI use suggests a level supportive of treatment adherence but also indicates room for improvement relative to international benchmarks. From the perspective of mental health services, strengthening gender-sensitive psychoeducational programs, family- and community-based interventions, and routine physical health monitoring at the CMHC level is recommended. In terms of pharmacotherapy, enhancing access to and acceptance of LAIs antipsychotics is encouraged. Initiatives aimed at improving the quality and standards of care provided within the scope of CMHC services should be prioritized. To this end, particular emphasis

should be placed on enhancing the scope and quality of in-service training in CMHCs, especially for specialist psychiatric nurses, in collaboration with psychiatrists and clinical psychologists. further studies are recommended to assess the effectiveness of care and services provided to patients.

ETHICS

Ethics Committee Approval: Prior to the commencement of the study, ethical approval was obtained from the Yalova University Ethics Committee and institutional permission was granted by the Provincial Directorate of Health (approval no: 2025/330, date: 25.06.2025).

Informed Consent: Written informed consent was obtained from all participants in the study.

FOOTNOTES

Authorship Contributions

Surgical and Medical PrActices: M.Ş., V.A., Concept: M.Ş., V.A., Design: M.Ş., V.A., Data Collection or Processing: M.Ş., V.A., S.Y., Analysis or Interpretation: M.Ş., V.A., S.Y., Literature Search: M.Ş., V.A., Writing: M.Ş., V.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. American Psychiatric Association. DSM-5-TR: Schizophrenia spectrum and other psychotic disorders. Washington (DC): American Psychiatric Association; 2022. Available from: https://www.psychiatry.org/getmedia/2f985d86-684c-485f-b03d-b599180e3124/APA-DSM5TR-OtherSpecifiedSchizophrenia.pdf
2. World Health Organization. Schizophrenia: fact sheet [Internet]. 2022 [cited 2025 Nov 22]. Available from: https://www.who.int/news-room/fact-sheets/detail/schizophrenia
3. Wallace C, Mullen PE, Burgess P. Criminal offending in schizophrenia over a 25-year period marked by deinstitutionalization and increasing prevalence of comorbid substance use disorders. Am J Psychiatry. 2004;161:716-27.
4. Bobes J, Fillat O, Arango C. Violence among schizophrenia out-patients compliant with medication: prevalence and associated factors. Acta Psychiatr Scand. 2009;119:218-25.
5. Swanson JW, Swartz MS, Van Dorn RA, Elbogen EB, Wagner HR, Rosenheck RA, et al. A national study of violent behavior in persons with schizophrenia. Arch Gen Psychiatry. 2006;63:490-9.
6. World Health Organization. Regional Office for Europe. Mental health declaration for Europe: facing the challenges, building solutions. WHO European Ministerial Conference on Mental Health; 12-15 January 2005; Helsinki, Finland. Copenhagen: World Health Organization Regional Office for Europe; 2005. Available from: https://iris.who.int/handle/10665/107625
7. Alataş G, Karaoğan A, Arslan M, Yanık M. Community-based mental health model and Community Mental Health Centers project in Turkey. Arch Neuropsychiatry. 2009;46(Suppl 1):25-9.
8. Ensari H, Gültekin BK, Karaman D, Koç A, Beşkardeş AF. The effects of the service of community mental health center on the schizophrenia patients -evaluation of quality of life, disabilities, general and social functioning- a summary of one year follow-up. Anadolu Psikiyatri Derg. 2013;14:108-14.
9. Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr Bull. 1987;13:261-76.
10. Kostakoğlu AE, Batur S, Tiryaki A, Goğuş A. Reliability and validity of the Turkish version of the positive and negative syndrome scale (PANSS). Türk Psikoloji Derg. 1999;14:23-34.
11. Moniem I, Kafetzopoulos V. Sex differences in schizophrenia: symptomatology, treatment efficacy and adverse effects. Front Psychiatry. 2025;16:1594334.
12. Aydin M, Altınbaş K, Nal Ş, Ercan SK, Ayhan MG, Usta A, Özbek S. The comparison of patients with schizophrenia in Community Mental Health Centers according to living conditions in nursing home or home. Anadolu Psikiyatri Derg. 2020;21:14-22.
13. Yıldız E, Yıldırım Ö. The mediating role of psychological flexibility in the relationship between psychotic symptom severity and depression in individuals diagnosed with schizophrenia. J Psychiatr Ment Health Nurs. 2024;31:869-82.
14. Bayrak NG, Geniş B, Gürhan N. Investigation of profiles of patients with schizophrenia and bipolar affective diagnosis in a community mental health center. Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Dergisi. 2022;15:289-97.
15. Ayhan MG, Kose A, Ercan SK, Bozdogan SY, Ozayhan HY, Eren İ. Care burden in the relatives of patients with schizophrenia taking services of community mental health center: a comparative study. Cukurova Med J. 2019;44:92-9.
16. Şahpolat M. Bir toplum ruh sağlığı merkezinde izlenen hastaların klinik ve sosyodemografik özellikleri ile tedavi yaklaşımlarının incelenmesi. MKU Tip Fak Derg. 2019;10:70-6.
17. Belli H, Özçetin A, Ertem Ü, Alpay E, Bahçebaşi T, Kiran ÜK, et al. Some sociodemographic features and factors associated with treatment in patients with schizophrenia. Anadolu Psikiyatri Derg. 2007;8:102-12.
18. Tang YL, Gillespie CF, Epstein MP, Mao PX, Jiang F, Chen Q, et al. Gender differences in 542 Chinese inpatients with schizophrenia. Schizophr Res. 2007;97:88-96.
19. Murat M, Kutlu FY. Turkish adaptation of the health improvement profile for the evaluation of physical well-being of individuals with severe mental illness. Florence Nightingale J Nurs. 2024;32:168-83.
20. Durmaz O, Akkişi Kumsar N. Toplum ruh sağlığı merkezi uygulamalarının şizofreni hastalığının sürecine klinik değişkenler temelinde etkisi. Kıbrıs Türk Psikiyatri ve Psikoloji Dergisi. 2020;2:82-8.
21. Morgan VA, Morgan F, Valuri G, Ferrante A, Castle D, Jablensky A. A whole-of-population study of the prevalence and patterns of criminal offending in people with schizophrenia and other mental illness. Psychol Med. 2013;43:1869-80. Erratum in: Psychol Med. 2013;43:1881.
22. Compton MT, Graves J, Zern A, Pauselli L, Anderson S, Ashekun O, et al. Characterizing arrests and charges among individuals with serious mental illnesses in public-sector treatment settings. Psychiatr Serv. 2022;73:1102-8.
23. Yıldız M, Yazıcı A, Böke O. Şizofrenide nüfus ve klinik özellikler: çok merkezli kesitsel bir olgu kayıt çalışması [Demographic and clinical characteristics in schizophrenia: a multi center cross-sectional case record study]. Turk Psikiyatri Derg. 2010;21:213-24.
24. Karşıdağ Ç, Alpay N, Kocabıyık A. Schizophrenia and cigarette dependence. Dusunen Adam J Psychiatry Neurol Sci. 2005;18:13-20.
25. Davis JM, Matalon L, Watanabe MD, Blake L, Metalon L [corrected to Matalon L]. Depot antipsychotic drugs. Place in therapy. Drugs. 1994;47:741-73. Erratum in: Drugs 1994;48:616.

26. Tuglu C. Antipsychotics for the treatment of bipolar disorder. Bull Clin Psychopharmacol. 2008:18(Suppl 2):S50-6.
27. Çetin M, Turgay A. Antipsychotic treatment in the fiftieth year of modern psychopharmacology: an update. Bull Clin Psychopharmacol. 2002;12:211-26.
28. Leucht S, Barnes TR, Kissling W, Engel RR, Correll C, Kane JM. Relapse prevention in schizophrenia with new-generation antipsychotics: a systematic review and exploratory meta-analysis of randomized, controlled trials. Am J Psychiatry. 2003;160:1209-22.
29. Akkaya C, Altin M, Kora K, Karamustafalioglu N, Yasan A, Tomruk N, Kurt E. Sociodemographic and clinical features of patients with bipolar I disorder in Türkiye - HOME study. Bull Clin Psychopharmacol. 2012;22:31-42.
30. Rothbard AB, Kuno E, Foley K. Trends in the rate and type of antipsychotic medications prescribed to persons with schizophrenia. Schizophr Bull. 2003;29:531-40.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):49-59
DOI: 10.4274/BMJ.galenos.2025.2024.10-2

Research

Evaluation of Anxiety Status of Patients with "Low Grade Smear" as A Result of Cervical Smear

Servikal Smear Sonucu "Düşük Dereceli Smear" Olan Hastaların Anksiyete Durumlarının Değerlendirilmesi

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ABSTRACT

Objective: To evaluate anxiety levels in patients with abnormal Pap smear results. Upon identifying a significant increase in anxiety levels, the researchers seek to adopt a holistic approach to women's health by proposing strategies to mitigate psychosocial impacts and outlining potential preventive measures.

Methods: The study protocol complied with the ethical standards outlined in the 1964 Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital (approval no: KAEK/2018.6.16, date: 30.07.2018). After obtaining ethics committee approval, patients who met the predefined inclusion and exclusion criteria and provided informed consent were consecutively enrolled in the study groups until the target sample size was reached. This prospective study included 94 outpatients in the research group with atypical squamous cells of undetermined significance (ASC-US) or low-grade squamous intraepithelial lesion (LSIL) Pap smear results. The control group consisted of 94 outpatients who were seen at the gynecology clinic of our hospital and had negative Pap smear results. After their physicians informed them of their test results, patients were provided with information about the study and asked to give informed consent. They were then asked to complete a semi-structured interview form, the state-trait anxiety inventory, and the health anxiety inventory.

Results: Family history of cancer, current medical conditions, single or divorced marital status, and higher educational level were identified as factors associated with increased anxiety levels. Anxiety levels were significantly higher among patients with ASC-US and LSIL results than those in the control group.

Conclusion: Although the probability of cervical cancer among patients with low-grade smear results is extremely low (approximately 1-2 per 1,000), this group exhibited a significant increase in anxiety levels. This appears to be related to patients misinterpreting their results and lacking adequate knowledge of cervical cancer. However, anxiety levels can be reduced if healthcare professionals provide patients with clearer, more detailed, and more comprehensible information. While the primary goal of screening tests is the early detection and prevention of cervical cancer, it is equally important to preserve patients' mental well-being and to adopt a more holistic approach to healthcare.

Keywords: Pap smear test, anxiety, cervical cancer

ÖZ

Amaç: Çalışmamızın amacı, smear testi sonucu düşük dereceli smear gelen hastaların anksiyete düzeylerini değerlendirmektir. Anksiyete düzeylerinde anlamlı bir artış saptandığında, kadın sağlığına bütüncül bir yaklaşımla bu durumun olası psiko-sosyal etkilerini önlemeye yönelik çözümler üretmeyi ve alınabilecek önlemleri ortaya koymayı amaçlamaktayız.

Gereç ve Yöntem: Çalışma protokolü, 1964 Helsinki Bildirgesi'nde belirtilen etik ilkelerle uyumludur ve Sağlık Bilimleri Üniversitesi, İstanbul Kanuni Sultan Süleyman Eğitim ve Araştırma Hastanesi Klinik Araştırmalar Etik Kurulu tarafından onaylanmıştır (karar no: KAEK/2018.6.16, tarih: 30.07.2018). Etik kurul onayı alındıktan sonra, önceden tanımlanmış dahil etme ve dışlama kriterlerini karşılayan ve bilgilendirilmiş onam veren hastalar, hedeflenen örneklem büyüklüğüne ulaşılana kadar ardışık olarak çalışmaya dahil edilmiştir. Bu prospektif olarak tasarlanmış çalışmanın

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Cite as: Yaman İ, Ceylan Y, Akkaya S, Akbayır Ö, Temel Yüksel İ. Evaluation of anxiety status of patients with "low grade smear" as a result of cervical smear. Med J Bakirkoy. 2026;22(1):49-59

Received: 20.11.2024
Accepted: 08.07.2025
Publication Date: 12.03.2026

araştırma grubuna, Pap smear testi sonucu önemi belirsiz atipik skuamöz hücreler (ASC-US) ve düşük dereceli skuamöz intraepitelyal lezyon (LGSIL) gelen 94 ayaktan hasta dahil edilmiştir. Kontrol grubunu ise, hastanemiz kadın hastalıkları polikliniğine başvuran ve Pap smear sonucu negatif olan 94 ayaktan hasta oluşturmuştur. Hekimler hastalara Pap smear sonuçlarını açıkladıktan sonra çalışmanın amacı hakkında bilgi vermiş ve bilgilendirilmiş onam almıştır. Tüm hastalardan yan yapılandırılmış görüşme formu, durumluk-sürekli kaygı envanteri ve sağlık anksiyetesi envanterini doldurmaları istenmiştir.

Bulgular: Ailede kanser öyküsü olması, mevcut bir hastalığın bulunması, medeni durumun bekar ya da boşanmış olması ve yüksek eğitim düzeyi gibi faktörler, anksiyete düzeyini artıran risk faktörleri olarak belirlenmiştir. ASC-US ve LGSIL grubundaki hastaların anksiyete düzeyleri anlamlı derecede daha yüksek bulunmuştur.

Sonuç: Düşük dereceli smear sonucu saptanan hastalarda serviks kanseri görülme olasılığı binde 1-2 gibi oldukça düşük oranlarda olmasına rağmen, bu hasta grubunda anksiyete düzeylerinde anlamlı bir artış gözlemlenmiştir. Bu durumun, hastaların sonuçları yanlış algılaması ve servikal kanser hakkında yeterli bilgiye sahip olmamasıyla ilişkili olduğu düşünülmektedir. Ancak, hastaların hekim tarafından daha açık, anlaşılır ve detaylı bir şekilde bilgilendirilmesi durumunda bu anksiyete düzeylerinin azaltılabileceği açıktır. Serviks kanserinin erken teşhisi için tarama testlerinin yaygınlaştırılması hedeflenirken, hastaların ruh sağlığının olumsuz etkilenmemesi de göz önünde bulundurulmalı ve insan sağlığına bütüncül bir yaklaşım benimsenmelidir.

Anahtar Kelimeler: Pap smear testi, anksiyete, serviks kanseri

INTRODUCTION

Cervical cancer ranks fourth in both incidence and mortality among cancers affecting women, following breast, lung, and colorectal cancers. Globally, approximately 500,000 new cases are diagnosed each year, and more than 250,000 women die from cervical cancer annually (1).

Anxiety is a state of fear, distress, tension, and uneasiness experienced in response to a perceived threat. Anxiety disorders are twice as common in women as in men, and their prevalence in the general population is estimated at 4-6% (2,3).

Several studies have reported that patients diagnosed with epithelial cell abnormalities during cervical cancer screening experience significantly increased anxiety levels, along with negative impacts on their quality of life and social functioning (4-6).

In this study, we evaluated the anxiety levels of patients with low-grade dyskaryotic cervical smear results [atypical squamous cells of undetermined significance (ASC-US) and low-grade squamous intraepithelial lesion (LSIL)] using validated anxiety-assessment tools after they were informed of the results by their physician. The aim was to compare anxiety levels between patients with abnormal cervical cytology results and those with normal cytology findings.

METHODS

The study protocol complied with the ethical standards outlined in the 1964 Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital (approval no: KAEK/2018.6.16, date: 30.07.2018). After obtaining approval from the ethics committee, patients who met the inclusion and exclusion criteria and provided informed consent were consecutively enrolled in the study groups until the target sample size was reached.

Patients who presented to our clinic and whose Pap smears showed ASC-US or LSIL were assigned to the patient group (n=94), while those with normal Pap smear results constituted the control group (n=94). Informed consent was obtained from all participants.

Patients were excluded from the study if they had a history of abnormal smear test results, isolated human papillomavirus (HPV) positivity, atypical squamous cells-cannot exclude high-grade squamous intraepithelial lesion, atypical glandular cells, or high-grade squamous intraepithelial lesions smear results, were informed about their results by someone other than a physician (e.g., a nurse, other healthcare personnel, or via phone), or had a history of any malignancy.

Three tools were used for data collection: a semi-structured interview form, the State-Trait Anxiety Inventory (STAI), and the health anxiety inventory.

The semi-structured interview form was used to assess the patients' anamnesis, sociodemographic and cultural characteristics, other background information, and factors that might influence their anxiety levels.

The STAI consists of two distinct subscales, each containing 20 items, for a total of 40 items. The state anxiety scale assesses how individuals feel "at a particular moment and under specific conditions," requiring them to respond based on their current emotions and experiences. In contrast, the trait anxiety scale evaluates how individuals generally feel in daily life.

In the state anxiety scale, items are rated according to the intensity of emotional experience, with the following options: 1. not at all; 2. somewhat; 3. moderately so; 4. very much so. In the trait anxiety scale, items are rated according to frequency as follows: 1. almost never; 2. sometimes; 3. often; 4. almost always. These two types of anxiety, state and trait, are conceptually distinct; this distinction forms the basis of the two-factor theory of anxiety developed. The

STAI was designed to measure both transient (state) and enduring (trait) levels of anxiety in individuals from both normal and clinical populations (7-9).

When both scales are administered together, it is recommended that the state anxiety scale be completed first, followed by the trait anxiety scale. This order is advised because the state anxiety scale is particularly sensitive to immediate emotional, physiological, and cognitive responses—such as apprehension, worry, or excitement—triggered by evaluative conditions. Administering it first allows participants to express their initial emotional state, resulting in a more accurate assessment of transient anxiety (10).

Spielberger et al. (9) assessed the reliability of the STAI at three levels. The Turkish adaptation and standardization of the inventory were conducted by Öner and Le Compte (8), and it has since been widely used in studies involving both Turkish adolescent and adult populations (9).

Both the original and Turkish versions of the STAI underwent test-retest reliability assessments and Kuder-Richardson reliability analyses. The construct validity of both scales was experimentally tested in non-clinical and clinical populations within the framework of the two-factor theory. The observed pattern in which state anxiety increases before significant or stressful events and decreases afterward, while trait anxiety remains relatively stable, supports the theoretical assumptions and provides evidence of construct validity. In this study, the STAI was administered to assess the anxiety status of patients with low-grade cervical smear results, in accordance with the procedures and psychometric standards described above.

Health anxiety is condition in which individuals excessively misinterpret normal bodily sensations negatively despite the absence of any underlying medical condition. It consists of two core components: the belief that one has a serious illness and the perception that this illness will result in harmful consequences (11).

The primary psychiatric disorder associated with health anxiety is hypochondriasis, and the two conditions are often considered to exist on a continuum. Elevated levels of health anxiety are also thought to be present in other somatoform disorders (12).

The health anxiety inventory is a self-report questionnaire developed by Salkovskis et al. (13). It consists of 18 items. The first 14 items offer four-option, sequential responses designed to assess the respondent's emotional and cognitive states. The remaining four items evaluate how the individual might feel if they assumed they had a serious illness. Each item is scored on a scale from 0 to 3, with higher scores indicating greater levels of health anxiety. The Turkish adaptation and validation of the inventory were conducted by Aydemir et al. (14).

After data collection, the state, trait, and health anxiety scores were calculated and recorded for each patient.

Statisical Analysis

Continuous variables were expressed as mean±standard deviation, and categorical variables as frequencies and percentages. The normality of the distribution of continuous variables was assessed using the Kolmogorov-Smirnov test.

The chi-square test or Fisher's exact test was used to compare categorical variables between groups. An independent samples t-test was used to compare continuous variables between two groups. One-way analysis of variance (ANOVA) followed by appropriate post-hoc tests was used to compare three groups.

Two-way ANOVA was performed to assess the interaction between smear test results and demographic variables on STAI-State version (STAI-S) scores.

A simple logistic regression analysis was used to evaluate the association between each sociodemographic variable and increased levels of state anxiety. Variables found to be significant in univariate analyses were further analyzed using multiple logistic regression to identify independent predictors.

All statistical analyses were conducted using IBM SPSS Statistics, version 21.0. (IBM Corp., Armonk, NY, USA).

RESULTS

Patients were categorized into two groups based on their Pap smear results: those with normal results (normal group) and those with ASC-US or LSIL results (abnormal group). The demographic characteristics of the two groups are presented in Table 1. The rate of abnormal smear results was significantly higher in older patients (67%) than younger patients (4.3%) (p=0.036). Additionally, while the proportion of patients with normal smear results was significantly higher in the 21-24 age group (n=14), the frequency of abnormal results was significantly greater among patients aged 35 and above (n=63).

There was no statistically significant difference in the distribution of smear results among education levels (p=0.472).

Similarly, no statistically significant differences were observed in the distribution of smear results based on patients' marital status (p=0.275) or number of children (p=0.241).

Table 1. Comparison of the distribution of demographic characteristics according to the smear results

		Smear result		x^2; p
		Negative=94	Positive=94	
Age	**≤24**	14 (14.9%)	4 (4.3%)	6.626; 0.036*
	25-34	28 (29.8%)	27 (28.7%)	
	≥35	52 (55.3%)	63 (67.0%)	
Education	**None**	6 (6.4%)	2 (2.1%)	2.545; 0.472**
	Primary education	55 (58.5%)	53 (56.4%)	
	High school	24 (25.5%)	28 (29.8%)	
	University	9 (9.6%)	11 (11.7%)	
Marital status	**Single**	19 (20.2%)	11 (11.7%)	2.580; 0.275*
	Married	65 (69.1%)	71 (75.5%)	
	Widow	10 (10.6%)	12 (12.8%)	
Child (grouped)	**0**	23 (24.7%)	15 (16.0%)	2.849; 0.241*
	1-3	52 (55.9%)	63 (67.0%)	
	≥4	18 (19.4%)	16 (17.0%)	
Employment	**No**	48 (51.1%)	63 (67.0%)	6.740; 0.034*
	Yes	42 (44.7%)	25 (26.6%)	
	Retired	4 (4.3%)	6 (6.4%)	
Smoking history	**No**	74 (78.7%)	64 (68.1%)	2.725; 0.099*
	Yes	20 (21.3%)	30 (31.9%)	
Alcohol history	**No**	90 (95.7%)	89 (94.7%)	1.000***
	Yes	4 (4.3%)	5 (5.3%)	
Previous smear history	**No**	48 (51.1%)	50 (53.2%)	0.085; 0.884**
	Yes	46 (48.9%)	44 (46.8%)	
Presence of disease history	**No**	84 (89.4%)	81 (86.2%)	0.198; 0.656****
	Yes	10 (10.6%)	13 (13.8%)	
Family history of cancer	**No**	66 (70.2%)	57 (60.6%)	1.905; 0.168*
	Yes	28 (29.8%)	37 (39.4%)	
Have you ever received psychiatric treatment before?	**No**	80 (85.1%)	74 (78.7%)	0.898; 0.343****
	Yes	14 (14.9%)	20 (21.3%)	
Presence of significant problems in the last year	**No**	74 (78.7%)	72 (76.6%)	0.031; 0.861****
	Yes	20 (21.3%)	22 (23.4%)	
Do you know about CxCa before?	**No**	50 (53.2%)	69 (73.4%)	8.265; 0.004*
	Yes	44 (46.8%)	25 (26.6%)	
Result acknowledgment status	**Good**	92 (97.9%)	17 (18.1%)	123.221; <0.001*
	Bad	0 (0.0%)	53 (56.4%)	
	Uncertain	2 (2.1%)	24 (25.5%)	

*: Pearson chi-square test, **: Pearson exact chi-square test, ***: Fisher's exact chi-square test, ****: Yates chi-square test, CxCa: Cervical cancer

A statistically significant difference was observed in the distribution of smear results according to employment status (p=0.034). The rate of abnormal smear results was significantly higher among non-working individuals (housewives) (67%) and retired individuals (6.4%) compared with employed patients (26.6%). When employment subgroups (working, retired, and non-working) were evaluated separately, the proportion of abnormal results was significantly higher among retired and non-working women. In contrast, the frequency of normal smear results was significantly higher among employed patients.

The relationships between smear results and several patient-related factors were examined individually, including history of smoking (p=0.099), alcohol use (p=1.000), previous Pap

smear testing (p=0.884), presence of a significant medical condition (p=0.656), family history of cancer (p=0.168), history of psychiatric treatment (p=0.343), and major life events in the past year (p=0.861). No statistically significant associations were found for any of these variables.

The rate of abnormal smear test results was significantly higher among patients who lacked prior knowledge of cervical cancer (p=0.04). Furthermore, among patients with abnormal smear results (n=94), a substantial proportion (73.4%) reported no prior knowledge of cervical cancer, which was statistically significant (p=0.04).

A statistically significant difference in the distribution of smear results was observed according to how patients received their results (p<0.001). Among patients with abnormal smear results, the proportion of negative emotional responses was significantly higher than among patients with normal smear results.

Smear results and state anxiety scores from the STAI of all patients in the abnormal (n=94) and normal (n=94) groups were compared across patients' demographic characteristics using two-way analysis of variance (Table 2).

According to the smear test results, there was a statistically significant difference in STAI-S scores between age groups within both the normal and abnormal groups. Among women aged 21-24, the mean STAI-S score in the normal group was significantly lower than that in the abnormal group (p<0.001). Similar findings were observed in the 25-34 age group and in patients aged 35 years and older (p<0.001; for both). In each age group, patients with normal smear results had significantly lower mean STAI-S scores compared to those with abnormal results.

Across multiple comparisons, no statistically significant difference in mean STAI-S score was found between patients aged 21-24 and those over 35 years, all with abnormal smear results (p=0.21).

Within each educational subgroup (primary school, high school, university or higher), mean STAI-S scores were significantly higher in those with abnormal smear results than in those with normal results (p<0.001).

In multiple comparisons, the mean STAI-S score was significantly higher among patients with abnormal smear results who had university-level education or higher than among those with only a high school education (p=0.01).

Table 2. Comparison of smear results and STAI test state anxiety scores according to the demographic characteristics of the patients

			Smear result				
			Normal		Abnormal		p*
			Mean	±SD	Mean	±SD	
Age		**≤24 (1)**	38.93	2.24	57.25	4.19	<0.001
		25-34 (2)	38.00	1.58	52.70	1.61	<0.001
		≥35 (3)	37.29	1.16	51.81	1.06	<0.001
	Multiple comparison	1-2:	0.74		0.31		
		1-3:	0.52		0.21		
		2-3:	0.72		0.64		
Education		**None (0)**	36.67	3.39	47.50	5.86	0.11
		Primary education (1)	38.64	1.12	52.26	1.14	<0.001
		High school (2)	36.46	1.69	50.54	1.57	<0.001
		University (3)	36.44	2.76	57.82	2.50	<0.001
	Multiple comparison	0-1:	0.58		0.43		
		0-2:	0.96		0.62		
		0-3:	0.96		0.11		
		1-2:	0.28		0.37		
		1-3:	0.46		0.04		
		2-3:	1.00		0.01		
Marital status		**Single (0)**	40.26	1.89	56.64	2.48	<0.001
		Married (1)	36.40	1.02	51.76	0.98	<0.001
		Widow (2)	41.70	2.60	51.50	2.38	0.01
	Multiple comparison	0-1:	0.07		0.07		
		0-2:	0.66		0.14		
		1-2:	0.06		0.92		

Table 2. Continued

			Smear result				
			Normal		Abnormal		p*
			Mean	±SD	Mean	±SD	
Child (grouped)		0 (0)	40.43	1.71	54.93	2.12	<0.001
		1-3 (1)	36.21	1.14	51.25	1.03	<0.001
		>3 (2)	39.56	1.93	53.94	2.05	<0.001
	Multiple comparison	0-1:	0.04		0.12		
		0-2:	0.73		0.74		
		1-2:	0.14		0.24		
Employment		No(1)	37.38	1.19	53.56	1.04	<0.001
		Yes (2)	38.52	1.27	51.12	1.65	<0.001
		Retired (3)	34.00	4.11	44.00	3.36	0.06
	Multiple comparison	1-2:	0.51		0.21		
		1-3:	0.43		0.01		
		2-3:	0.29		0.06		
Smoking history		No (0)	37.23	0.97	51.63	1.04	<0.001
		Yes (1)	39.65	1.86	53.73	1.52	<0.001
	Multiple comparison		0.25		0.25		
Alcohol history		No (0)	37.73	0.86	51.69	0.87	<0.001
		Yes (1)	38.00	4.09	63.20	3.66	<0.001
	Multiple comparison		0.95		<0.001		
Previous smear history		No (0)	36.90	1.19	53.92	1.17	<0.001
		Yes (1)	38.63	1.22	50.45	1.25	<0.001
	Multiple comparison		0.31		0.04		
Presence of disease history		No (0)	38.04	0.90	52.94	0.92	<0.001
		Yes (1)	35.30	2.62	48.31	2.30	<0.001
	Multiple comparison		0.33		0.06		
Family history of cancer		No (0)	37.91	1.03	51.96	1.11	<0.001
		Yes (1)	37.36	1.58	52.81	1.38	<0.001
	Multiple comparison		0.77		0.63		
Have you ever received psychiatric treatment before?		No (0)	36.85	0.92	51.62	0.95	<0.001
		Yes (1)	42.86	2.19	54.80	1.83	<0.001
	Multiple comparison		0.01		0.13		
Presence of significant problems in the last year		No (0)	37.22	0.97	52.35	0.99	<0.001
		Yes (1)	39.70	1.87	52.14	1.78	<0.001
	Multiple comparison		0.24		0.92		
Do you know about CxCa before?		No (0)	35.98	1.14	53.80	0.97	<0.001
		Yes (1)	39.75	1.22	48.16	1.62	<0.001
	Multiple comparison		0.03		<0.001		
Result acknowledgment status		Good (0)	37.63	0.81	45.12	1.88	<0.001
		Bad (1)	-		56.02	1.07	-
		Uncertain (2)	43.00	5.49	49.17	1.59	0.28
	Multiple comparison	0-1:	-		<0.001		
		0-2:	0.34		0.10		
		1-2:	-		<0.001		

*: Two-way analysis of variance, CxCa: Cervical cancer, SD: Standard deviation

Similarly, patients with abnormal smear results and with university-level education had significantly higher STAI-S scores than those with primary school education (p=0.04).

In subgroup analyses based on variables such as marital status (single, married, widowed), number of children (none, 1-3, ≥3), employment status (employed, unemployed, retired), smoking status and alcohol use, history of previous smear testing, presence of serious illness or cancer, psychiatric treatment history, major life events in the past year, and prior knowledge of cervical cancer, each category was evaluated separately. In all subgroups except for illiterate individuals, retired patients, and those who responded "uncertain" to the question about how they reacted to their smear result, patients with abnormal smear results had significantly higher STAI-S scores compared to those with normal results. No statistically significant differences were found among these three subgroups.

In multiple comparisons, patients with abnormal smear results who lacked prior knowledge about cervical cancer (mean STAI-S=53.80) had significantly higher anxiety levels than those who had prior knowledge (mean STAI-S=48.16) (p<0.001). Conversely, among patients with normal smear results, those without prior knowledge of cervical cancer had significantly lower STAI-S scores (mean=35.98) than those who were informed (mean=39.75) (p=0.03).

Simple logistic regression analysis was conducted to identify the sociodemographic factors associated with increased state anxiety levels and to determine whether each variable, individually, constituted a risk factor. In the final step, all sociodemographic variables were analyzed simultaneously using multiple logistic regression analysis to identify statistically significant categories and independent risk factors contributing to elevated state anxiety levels (Table 3).

Table 3. Single and multiple logistic regression analysis

	Single model		Multiple model (final step)	
	p	Odds ratio* (95% CI)	p	Odds ratio* (95% CI)
Age (≤24)	0.418			
25-34	0.384	2.296 (0.354-14.896)		
≥35	0.196	4.26 (0.474-38.267)		
Education (none)	0.760			
Primary education	0.378	2.447 (0.334-17.912)		
High school	0.675	1.598 (0.179-14.297)		
University	0.540	2.285 (0.163-32.078)		
Marital status (single)	0.005		0.001	
Married	0.302	0.261 (0.02-3.336)	0.059	0.349 (0.117-1.042)
Widow	0.091	8.416 (0.713-99.409)	0.029	5.795 (1.195-28.106)
Child (0)	0.597			
1	0.696	0.614 (0.053-7.09)		
2	0.856	0.791 (0.063-9.911)		
3	0.178	0.173 (0.013-2.218)		
4	0.448	0.367 (0.028-4.89)		
5	0.648	0.334 (0.003-36.864)		
6	0.811	0.264 (0-14500.028)		
Employment (no)	NA		NA	
Smoking history (yes)	0.895	0.92 (0.265-3.194)		
Alcohol history (yes)	0.520	2.336 (0.176-30.965)		
Previous smear history (yes)	0.600	1.35 (0.441-4.134)		
Presence of disease history (yes)	0.027	0.154 (0.03-0.806)		
Family history of cancer (yes)	0.010	4.478 (1.434-13.98)	0.021	2.928 (1.176-7.29)
Have you ever received psychiatric treatment before? (yes)	0.806	0.853 (0.241-3.017)		
Presence of significant problems in the last year (yes)	0.509	1.48 (0.462-4.743)		

Table 3. Continued

	Single model		Multiple model (final step)	
	p	**Odds ratio* (95% CI)**	**p**	**Odds ratio* (95% CI)**
Do you know about CxCa before? (yes)	0.365	1.648 (0.559-4.861)		
Result acknowledgment status (good)	<0.001		<0.001	
Bad	<0.001	191.365 (24.647-1485.77)	<0.001	94.863 (17.022-528.661)
Uncertain	<0.001	52.709 (9.477-293.138)	<0.001	31.589 (7.163-139.313)

*: An odds ratio (OR) is a measure of association between an exposure and an outcome, NA: Non-applicable, CxCa: Cervical cancer, CI: Confidence interval

Being single, having a history of illness, having a family history of cancer, and having an unclear or negative response to the smear result were identified as individual risk factors for elevated state anxiety levels.

When all sociodemographic characteristics were evaluated simultaneously, marital status, family history of cancer, and patients' emotional responses to their smear test results (such as reacting negatively or with uncertainty) were identified as the primary factors contributing to elevated state anxiety scores.

The state anxiety scores in patients with abnormal smear results (n=94) were significantly higher than in patients with normal smear results (n=94) (p<0.001) (Table 4). However, no statistically significant differences were found between the groups for trait anxiety scores (p=0.117) or health anxiety inventory scores (p=0.168).

In Table 5, unlike Table 4, smear results were analyzed in three groups rather than two and multiple comparisons were conducted. Accordingly, the state anxiety scores of patients with normal smear results were significantly lower than those of patients with ASC-US and LGSIL smear results (p<0.001; for both comparisons). However, no statistically significant difference in state anxiety scores was observed between patients with ASC-US (n=52) and those with LGSIL (n=42) smear results (p=0.465).

Table 4. Comparison of anxiety scores between patients with normal and abnormal smear results

	Group	**n**	**Mean**	**±SD**	**Minimum**	**Maximum**	**p**
STAI test status anxiety score	0	94	37.74	7.936	17	58	<0.001
	1	94	52.3	8.734	22	71	
STAI test trait anxiety score	0	94	45.89	8.645	30	67	0.177
	1	94	47.56	8.257	30	69	
Health anxiety inventory	0	94	18.36	7.931	3	39	0.168
	1	94	19.95	7.773	6	38	

SD: Standard deviation, STAI: State-Trait Anxiety Inventory, 0: Patients with normal smear test results (control group), 1: Patients with abnormal smear test results (low-grade squamous intraepithelial lesion, atypical squamous cells of undetermined significance) (research group)

Table 5. Comparison of anxiety scores among patients with normal, ASCUS, and LGSIL smear results

	Group	**n**	**Mean**	**±SD**	**Minimum**	**Maximum**	**p**	**Multiple comparison**
STAI test status anxiety score	0	94	37.74	7.936	17	58	<0.001	0-1: <0.001 0-2: <0.001 1-2: 0.465
	1	52	51.73	8.31	39	71		
	2	42	53	9.284	22	71		
STAI test trait anxiety score	0	94	45.89	8.645	30	67	0.394	-
	1	52	47.73	8.727	30	67		
	2	42	47.36	7.736	32	69		
Health anxiety inventory	0	94	18.36	7.931	3	39	0.361	-
	1	52	19.67	8.556	6	38		
	2	42	20.29	6.765	7	37		

SD: Standard deviation, ASCUS: Atypical squamous cells of undetermined significance, LGSIL: Low-grade squamous intraepithelial lesion, STAI: State-Trait Anxiety Inventory, 0: Patients with normal smear results (n=94), 1: Patients with ASCUS smear result (n=52), 2: Patients with LGSIL smear result (n=42)

DISCUSSION

In the present study, following the disclosure of cervical smear test results, we evaluated patients' anxiety levels using standardized assessment tools. Patients with ASC-US or LSIL smear results had significantly higher state anxiety levels than those with normal smear results. Furthermore, being single or divorced, having a family history of cancer, and responding negatively or uncertainly to smear-test results were identified as significant risk factors for elevated levels of state anxiety.

In two separate studies, Crombie et al. (15) and Gray et al. (16) concluded that patients experienced a significant increase in fear, pain, and discomfort following routine cervical screening tests.

In their study, Maissi et al. (17) investigated the psychosocial effects of HPV testing by assessing four patient groups: those with normal smear test results; those with borderline smear results who were HPV-positive; those with borderline smear results who were HPV-negative; and those with borderline smear results whose HPV status was not checked. They reported that anxiety was significantly lower in patients with normal smear results, whereas both anxiety and sadness were significantly higher in patients with borderline smear results who tested HPV-positive. In the long term, patients with borderline smear results were followed, and their levels of persistent anxiety, general distress, and concern about the outcome—especially during the first month after receiving their smear results—were significantly higher compared with those of patients with normal smear results.

In our study, abnormal smear test results were significantly less common among patients who had prior knowledge about cervical cancer. This may be attributed to preventive health behaviors adopted by these individuals, such as practicing monogamy, delaying the onset of sexual activity, avoiding smoking, and maintaining a healthy diet.

In a comprehensive study conducted by Drolet et al. (18), the authors investigated the psychosocial impacts of abnormal cervical smear results. Anxiety was assessed at three time points: shortly after the smear result, at four weeks, and at twelve weeks. The main findings of their study and the comparisons with our results are outlined below:

• Drolet et al. (18) found that the rate of abnormal smear results was significantly higher among patients with low income and those who were single. Similarly, in our study, the rate of abnormal smear results was significantly higher among women with lower educational attainment and those who were not employed.

• When asked about the likelihood of an abnormal smear result progressing to cervical cancer within 10 years, regardless of their actual result, a majority of patients in Drolet et al. (18) study either reported having no information or assumed a high risk. This suggests a widespread misunderstanding of what a smear result indicates. Interestingly, in our study, among patients with normal smear results, those with prior knowledge of cervical cancer had significantly higher anxiety levels than those without knowledge. This could be attributed to their awareness not only of cervical cancer screening but also of the disease's prognosis, thereby increasing anticipatory anxiety. It may also suggest that even a normal screening result may not reduce anxiety in patients who are well-informed but already fearful of the disease. Conversely, in patients with abnormal results, a lack of prior knowledge was associated with significantly higher anxiety levels. These findings indicate that appropriate patient education about cervical cancer and screening results may help reduce anxiety, thereby promoting both physical and psychological well-being.

• In Drolet et al. (18) study, 35% of patients with abnormal smear results continued to experience elevated anxiety even 12 weeks after receiving their results. Risk factors for persistent anxiety included low income and misinterpretation of the smear result as indicative of a high cancer risk. In our study, patients with abnormal smear results who had never undergone a smear test reported significantly higher anxiety levels than those who had previously undergone a smear test. This may be due to concerns about delayed diagnosis or fear that the abnormality had been present for a long time. Patients who had previously participated in screening may have experienced lower anxiety, possibly due to confidence in early detection and adherence to screening protocols.

• In Drolet et al. (18) study, smear results were communicated to patients by physicians or health personnel, by telephone, or by mail. Notably, patients who received their results via letter or telephone experienced significantly lower anxiety levels than those who were informed directly by a physician or health worker. Additionally, higher educational level, living alone, low income, and an increased number of recent stressful life events were identified as risk factors for increased anxiety. In our study, anxiety levels were found to be significantly higher among patients with a university-level education compared with those with primary or high school education. One possible explanation is that higher education may be associated with greater personal and family responsibilities, leading to anxiety about potential future impairment in their ability to fulfill these roles.

In our study, anxiety levels were also higher among patients with abnormal smear results who reported alcohol use than among non-users. This may be attributed to the negative effects of alcohol on the psychophysiological system.

In our study, we observed a statistically significant increase in STAI-S scores among patients with abnormal smear results, whereas STAI-Trait version (STAI-T) and health anxiety scores did not differ significantly between the groups. This finding suggests that the anxiety experienced by these patients is most likely a transient and reactive emotional response to the unexpected and often misunderstood nature of abnormal smear results, rather than a chronic psychological trait or a general tendency toward health-related anxiety.

This result is consistent with previous literature, as it is well established that state anxiety is sensitive to acute stressors and contextual triggers, while STAI-T reflects a more stable personality disposition. Indeed, in their reliability and standardization studies of the STAI, Öner and Le Compte (19) demonstrated that, despite fluctuations in state anxiety scores under varying conditions over time intervals ranging from 10 days to one year, STAI-T scores in the same individuals remained relatively stable.

Furthermore, the absence of significant differences in health anxiety scores indicates that participants were not affected by somatoform disorders or generalized health-related fears, but rather exhibited situation-specific emotional reactions. These findings emphasize the importance of timely and effective physician-patient communication when disclosing abnormal screening results.

In our study, patients with ASC-US or LSIL smear results exhibited significantly higher anxiety levels than those with normal results. From the patients' perspective, both diagnoses appeared to induce a similar level of anxiety. When adequate time is devoted to patient communication and detailed information is provided regarding the procedures and their outcomes, the resulting anxiety may be reduced, thereby preventing negative effects on daily functioning and preserving both physical and mental well-being.

CONCLUSION

In our study, we observed a significant increase in anxiety levels among patients with ASC-US and LSIL smear results, consistent with previous findings in the literature. Factors such as personal history of illness, family history of cancer, and single or divorced marital status were identified as significant contributors to elevated anxiety. Additionally, higher levels of anxiety were noted among women with higher educational attainment, those who used alcohol, and those who had never undergone a smear test.

Although the incidence of carcinoma among patients with low-grade smear results (ASC-US and LSIL) is extremely low (approximately 0.1-0.2%), patients often perceive their results as "bad" or alarming. This highlights the importance of providing patients with clear, descriptive, and empathetic explanations when delivering abnormal smear results. Physician-patient communication plays a crucial role in alleviating emotional distress in these cases.

For patients with abnormal cervical cytology, it is essential to implement not only appropriate clinical follow-up and treatment protocols but also holistic support strategies that protect mental well-being. Further comprehensive studies are needed to identify and develop effective communication and counseling approaches to minimize anxiety and promote psychological resilience in this patient population.

ETHICS

Ethics Committee Approval: The study protocol complied with the ethical standards outlined in the 1964 Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Kanuni Sultan Süleyman Training and Research Hospital (approval no: KAEK/2018.6.16, date: 30.07.2018).

Informed Consent: Informed consent was obtained from all participants.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: İ.Y., İ.T.Y., Concept: Y.C., Ö.A., Design: Y.C., Ö.A., İ.T.Y., Data Collection or Processing: İ.Y., S.A., Analysis or Interpretation: İ.Y., İ.T.Y., Literature Search: Y.C., S.A., Writing: İ.Y., S.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer. 2015;136:E359-86.
2. Stanley MA, Beck JG. Anxiety disorders. Clin Psychol Rev. 2000;20:731-54.
3. Yetkin S, Aslan S, Akdemir A, Örsel S. Anksiyete bozuklukları. In: Sadock BJ, Sadock BA, editors. Kaplan & Sadock's Concise Textbook of Clinical Psychiatry. 2nd ed. İstanbul: Öncü Kitabevi; 2005. p. 211-2.

4. Marteau TM, Kidd J, Cuddeford L, Walker P. Reducing anxiety in women referred for colposcopy using an information booklet. Br J Health Psychol. 1996;1:181-9.
5. Cullen J, Schwartz MD, Lawrence WF, Selby JV, Mandelblatt JS. Short-term impact of cancer prevention and screening activities on quality of life. J Clin Oncol. 2004;22:943-52.
6. Bell S, Porter M, Kitchener H, Fraser C, Fisher P, Mann E. Psychological response to cervical screening. Prev Med. 1995;24:610-6.
7. Marteau TM, Bekker H. The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). Br J Clin Psychol. 1992;31:301-6. Erratum in: Br J Clin Psychol. 2020;59:276.
8. Öner N, Le Compte WA. Durumluk-sürekli kaygı envanteri el kitabı. Boğaziçi Üniversitesi Yayınları; 1985.
9. Spielberger CD, Gonzalez-Reigosa F, Martinez-Urrutia A, Natalicio LF, Natalicio DS. The State-Trait Anxiety Inventory. Interam J Psychol. 1971;5.
10. Öner N. Türkiye'de kullanılan psikolojik testler: bir başvuru kaynağı. Boğaziçi Üniversitesi; 1997.
11. Abramowitz JS, Olatunji BO, Deacon BJ. Health anxiety, hypochondriasis, and the anxiety disorders. Behav Ther. 2007;38:86-94.
12. Noyes R Jr, Stuart SP, Langbehn DR, Happel RL, Longley SL, Muller BA, et al. Test of an interpersonal model of hypochondriasis. Psychosom Med. 2003;65:292-300.
13. Salkovskis PM, Rimes KA, Warwick HM, Clark DM. The health anxiety inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. Psychol Med. 2002;32:843-53.
14. Aydemir Ö, Kirpinar İ, Sati T, Uykur B, Cengisiz C. Reliability and validity of the Turkish version of the health anxiety inventory. Noro Psikiyatr Ars. 2013;50:325-31.
15. Crombie IK, Orbell S, Johnston G, Robertson AJ, Kenicer M. Women's experiences at cervical screening. Scott Med J. 1995;40:81-2.
16. Gray NM, Sharp L, Cotton SC, Masson LF, Little J, Walker LG, et al.; TOMBOLA group. Psychological effects of a low-grade abnormal cervical smear test result: anxiety and associated factors. Br J Cancer. 2006;94:1253-62.
17. Maissi E, Marteau TM, Hankins M, Moss S, Legood R, Gray A. Psychological impact of human papillomavirus testing in women with borderline or mildly dyskaryotic cervical smear test results: cross sectional questionnaire study. BMJ. 2004;328:1293.
18. Drolet M, Brisson M, Maunsell E, Franco EL, Coutlée F, Ferenczy A, et al. The psychosocial impact of an abnormal cervical smear result. Psychooncology. 2012;21:1071-81.
19. Öner N, Le Compte A. Süreksiz durumluk/sürekli anksiyete envanteri el kitabı. Boğaziçi Üniversitesi Yayınları.; 1983. p. 1-26.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):60-66
DOI: 10.4274/BMJ.galenos.2025.2025.4-9

Research

The Impact of Nicotine Dependence on Cough Capacity and Respiratory Symptoms in Young Adults

Genç Yetişkinlerde Nikotin Bağımlılığının Öksürük Kapasitesi ve Solunum Semptomları Üzerindeki Etkisi

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ABSTRACT

Objective: The aim of this study was to investigate the effect of nicotine dependence on cough capacity, respiratory symptoms, and cough-related quality of life in young adults.

Methods: A total of 101 university students, both smokers and non-smokers, who met the inclusion criteria were included in the study. Nicotine dependence status of smokers, cough capacity of both groups, and cough-related quality of life were evaluated in the study.

Results: When peak cough flow values were analysed, a statistically significant difference was found between the groups (p=0.045). When the Leicester Cough Questionnaire physical, psychological, social sub-dimensions, and total score were analysed, no statistically significant difference was found between the groups (p=0.599, p=0.333, p=0.077, p=0.154; respectively). A weak negative correlation was found between nicotine dependence level and peak cough flow in smokers (r=-0.297, p=0.02).

Conclusion: According to the results of the study, smoking has harmful effects on lung function, which causes a significant decrease in peak cough flow rate. In addition, as the nicotine dependence level of smokers increased, peak cough flow decreased. The deterioration of lung function and more respiratory symptoms reported by smokers may affect quality of life.

Keywords: Cigarette smoking, cough, peak expiratory flow rate, pulmonary functions, quality of life

ÖZ

Amaç: Bu çalışmanın amacı genç erişkinlerde nikotin bağımlılığının öksürük kapasitesi, solunum semptomları ve öksürükle ilişkili yaşam kalitesi üzerine etkisini araştırmaktır.

Gereç ve Yöntem: Çalışmaya dahil edilme kriterlerini karşılayan sigara içen ve içmeyen toplam 101 üniversite öğrencisi dahil edildi. Çalışmada sigara içenlerin nikotin bağımlılık durumu, her iki grubun öksürük kapasitesi ve öksürükle ilişkili yaşam kalitesi değerlendirildi.

Bulgular: Tepe öksürük akım değerleri incelendiğinde gruplar arasında istatistiksel olarak anlamlı fark bulundu (p=0,045). Leicester Öksürük Anketi fiziksel, psikolojik, sosyal alt boyutları ve toplam puanı incelendiğinde gruplar arasında istatistiksel olarak anlamlı bir fark bulunmadı (sırasıyla p=0,599, p=0,333, p=0,077, p=0,154). Sigara içenlerde nikotin bağımlılık düzeyi ile tepe öksürük akımı arasında negatif yönde zayıf bir korelasyon bulundu (r=-0,297, p=0,02).

Sonuç: Çalışma sonuçlarına göre, sigara içmenin akciğer fonksiyonları üzerinde zararlı etkileri vardır ve sigara içmek tepe öksürük akım hızında anlamlı bir azalmaya neden olmaktadır. Ayrıca sigara içenlerin nikotin bağımlılık düzeyi arttıkça tepe öksürük akımı azalmıştır. Akciğer fonksiyonlarının bozulması ve sigara içenlerin daha fazla solunum semptomu bildirmesi yaşam kalitesini etkileyebilir.

Anahtar Kelimeler: Sigara içmek, öksürük, tepe ekspiratuvar akış hızı, solunum fonksiyonları, yaşam kalitesi

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Cite as: Dikmen Hoşbaş B, Arduç Ş, Mustafaoğlu R. The impact of nicotine dependence on cough capacity and respiratory symptoms in young adults. Med J Bakirkoy. 2026;22(1):60-66

Received: 16.04.2025
Accepted: 08.07.2025
Publication Date: 12.03.2026

INTRODUCTION

Nicotine, the primary psychoactive substance in tobacco leaves, has resulted in the widespread use of tobacco and more than one billion smokers worldwide (1). While smoking rates have decreased in numerous high-income nations, tobacco consumption remains prevalent in many low- and middle-income countries. According to the global burden of disease study, the global smoker population was projected to reach around 1.14 billion by 2019, an increase from just under 1 billion in 1990 (1). In Türkiye, this global trend shows similar patterns. In a study conducted in 2022 with 286 high school students in Türkiye, the prevalence of any tobacco product use among young people was found to be 32.2%. This study shows that 3 out of 10 young people are on their way to becoming addicted (2). Most smokers develop a dependency on the nicotine delivered by cigarettes (3). Due to neuroadaptive changes and psychological processes resulting from regular nicotine intake through cigarettes, quitting tobacco can trigger a well-known withdrawal syndrome. This typically presents as irritability, anxiety, a depressed mood, concentration difficulties, increased hunger, sleep disturbances, and restlessness, all of which make cessation challenging (4). Smoking poses serious health risks, primarily affecting the respiratory and cardiovascular systems. It can lead to lung damage by harming the airways and alveoli. Smoking-related lung conditions include emphysema and chronic obstructive pulmonary disease (5). Smoking can affect the respiratory function of young people (6). Smoking has been shown to cause acute changes in the lungs, such as increased airflow resistance, coughing, and airway irritation. The airways become irritated, mucus production increases, and lung tissue is damaged. Cough capacity is a person's maximum expiratory flow rate, measured by the peak cough flow rate. When the airways are narrowed, cough capacity is reduced. Reduced cough capacity is a major cause of pulmonary complications leading to morbidity and mortality (7). Few studies have examined the effects of smoking on respiratory function in young people (8). Providing smokers with information about their lung function may help increase their motivation to quit smoking (9). Consequently, this study aimed to objectively assess the impact of smoking on cough capacity among university students who smoke. Our hypothesis is that smokers will have a lower cough capacity than non-smokers and that peak cough flow will decrease as the degree of smoking dependence increases. To the best of the authors' knowledge, no research has yet examined the impact of tobacco dependence on cough capacity in young adults in Türkiye. This study is distinct in this context and aims to add valuable insights to the existing literature.

METHODS

This cross-sectional observational study was conducted at the Physiotherapy and Rehabilitation Application and Research Centre of Üsküdar University from July 2024 to January 2025. The study was approved by the Ethics Committee for Non-Interventional Clinical Research of Üsküdar University (approval no: 2024-55, date: 29.06.2024) and was conducted in accordance with the Declaration of Helsinki. Participants were recruited through face-to-face interviews and were divided into two groups: smokers (study group, n=61) and non-smokers (control group, n=41). All participants were given both verbal and written information about the study, and written informed consent was obtained from each participant.

Participants and Procedure

Sample size was determined by an a priori power analysis using G*Power 3 (Heinrich Heine University, Düsseldorf, Germany) (10). The required sample size to achieve a power of 0.90 with an alpha of 0.05 is at least n=34 per group when using Cohen's d=0.80 (11). Based on this, the study sample was composed of 61 smokers (study group) and 40 non-smokers (control group). Participants in the study group were university students of both genders, aged 18-24 years, who had been smoking for more than 1 year. Subjects who refused to sign the written informed consent, those with unstable cardiopulmonary, neuromuscular or musculoskeletal disorders that may affect the accuracy of the study results, those with systemic acute infective diseases such as anemia, heart diseases, pulmonary infective pathology, any recent upper respiratory or lower respiratory tract infection, lung cancer, human immunodeficiency virus, pneumonia, tuberculosis, among others, and those who participated in regular exercise training in the last six weeks, were excluded. The control group consisted of subjects of both genders, aged between 18-24 years, who did not use any tobacco product, cooperated with the measurements and volunteered to participate in the study.

Measures

Sociodemographic and clinical information of the participants was recorded. In the study, nicotine dependence status of the smoker group and peak cough flow rate, determining the cough capacity of both groups, were evaluated with a digital peak flow meter, and cough-related quality of life was evaluated with the Leicester Cough Questionnaire (LCQ).

Data Collection Tools

Sociodemographic and Clinical Information Form: Gender, age, education, body weight, height, and body mass index (BMI), presence of cough (present/absent),

type (productive/non-productive), duration (number/day), sputum complaints, dyspnea, age at initiation of smoking, and daily amount of cigarettes smoked were questioned and recorded.

Fagerstrom Nicotine Dependence Test: Nicotine dependence status of the subjects was determined with the Fagerstrom Nicotine Dependence Test. The Fagerstrom Nicotine Dependence Test is a self-assessment scale consisting of 6 questions providing a dichotomous and quadruple Likert-type measurement between 0-1 and 0-3. It is used to assess the risk, level of severity, and change in terms of physical dependence on nicotine in individuals. (12). The reliability coefficient of the test is 0.56. According to the scores obtained from the scale; 8-10 points are "very high level nicotine addict;" 6-7 points are "high level nicotine addict;" 5 points are "medium level nicotine addict;" 3-4 points are "low level nicotine addict" and 0-2 points are "very low level nicotine addict" (12).

Cough Capacity: The procedure for using the ExpiRite Peak Flow Meter® (Clement Clarke International Ltd., Harlow, UK) was thoroughly explained to all participants. They were instructed to inhale as deeply as possible and then exhale forcefully and quickly into the device. Participants were instructed to seal their lips around the peak flow meter while seated, ensuring that they exhaled in a single breath without placing their tongue on the tip of the device. Measurements were taken three times and the highest reading was recorded (13).

Leicester Cough Questionnaire: The LCQ is a questionnaire designed to assess the quality of life in individuals with chronic cough, developed in the United Kingdom. It consists of 19 items across three domains: physical, psychological, and social. The topics included in the LCQ were chosen using the clinical impact factor approach, which prioritizes issues identified by patients as problematic and ranks them based on their perceived significance. These issues are then categorized into domains using clinical reasoning (14). The questionnaire is completed using a seven-point Likert scale, where higher scores reflect better health. The overall score is the sum of the three domains, namely: physical, psychological, and social. The Turkish reliability and validity of the LCQ in chronic cough patients (15) has been conducted.

Statistical Analysis

All statistical analyses were performed using Statistical Package for Social Science (SPSS) version 20.0 for Windows (SPSS, Inc., Chicago, IL, USA). Descriptive statistics, including frequencies and percentages for categorical variables, and means and standard deviations for continuous variables, were computed. The normality of the data distribution was tested using the Kolmogorov-Smirnov test. Parametric tests (independent sample t-test) were used to compare normally distributed variables between groups, while non-parametric tests (Mann-Whitney U test) were applied for non-normally distributed variables. Categorical variables were analyzed using the chi-square test. The relationship between smoking addiction levels and peak cough flow was assessed with the Spearman's correlation test. Spearman's correlation coefficients were interpreted as follows: no association (0-0.19), weak (0.20-0.39), moderate (0.40-0.69), strong (0.70-0.89), and very strong (0.90-1). The significance level was accepted as $p<0.05$.

RESULTS

A comparison of the sociodemographic and clinical characteristics of the participants is presented in Table 1. The average age of participants in the study group was 21.16±1.81 years, while the control group had an average age of 21.25±1.64 years. Significant differences were observed between the study and control groups in terms of weight, height, and BMI values ($p<0.05$). When analyzing self-reported respiratory symptoms, including cough, dyspnea, and sputum, statistically significant differences were found between the study and control groups ($p<0.05$, $p=0.001$, $p=0.002$, $p=0.001$; respectively).

The distribution of self-reported respiratory symptoms including cough, dyspnea, and sputum according to the groups is shown in Figure 1.

The percentage distribution of respiratory symptoms of the individuals in the study group is shown in Figure 2. Cough was found in 47.5% of the individuals in the study group, dyspnea in 37.7%, and sputum in 34.4%.

When the peak cough flow values were analysed, a statistically significant difference was found between individuals in the study group and individuals in the control group ($p<0.05$; $p=0.045$) (Table 2). When the LCQ physical, psychological, social sub-dimensions, and total score were analyzed, no statistically significant difference was found between the individuals in the study group and the individuals in the control group ($p>0.05$; $p=0.599$, $p=0.333$, $p=0.077$, $p=0.154$; respectively).

A weak negative correlation was found between nicotine dependence level and peak cough flow in smokers ($r=-0.297$, $p<0.05$; $p=0.02$) (Table 3).

Table 1. Comparison of sociodemographic and clinical characteristics of individuals

		Study group (n=61) Mean±SD	Control group (n=40) Mean±SD	p-value*
Age (years)		21.16±1.81	21.25±1.64	0.95**
Weight (kg)		77.81±13.26	67.85±15.44	**0.001***
Height (cm)		175.46±7.54	168.70±8.65	**<0.001***
BMI (kg/m²)		25.19±3.37	23.60±3.82	**0.03***
Age at initiation of smoking (years)		17.22±2.48	-	
Duration of smoking (years)		3.97±2.76	-	
Amount of cigarette use (pcs/day)		18.14±10.14	-	
Gender	**Female** **Male**	15 (24.6) 46 (75.4)	17 (42.5) 23 (57.5)	0.058***
Degree of smoking dependence	**Very low** **Low** **Medium** **High** **Very high**	19 (31.1) 10 (16.4) 7 (11.5) 15 (24.6) 10 (16.4)	- - - - -	
Respiratory symptoms				
Cough	**Yes** **No**	29 (47.5) 32 (52.5)	3 (7.5) 37 (92.5)	**<0.001****
Dyspnea	**Yes** **No**	23 (37.7) 38 (62.3)	4 (1) 36 (90)	**0.002****
Sputum	**Yes** **No**	21 (34.4) 40 (65.6)	2 (5) 38 (95)	**0.001****

*: Independent sample t-test, **: Mann-Whitney U test, ***: Chi-square test, p<0.05 statistical significance, n: Number of people, SD: Standard deviation, kg: Kilogram, m: Metre, Study group: Individual smokers, Control group: Non-smokers

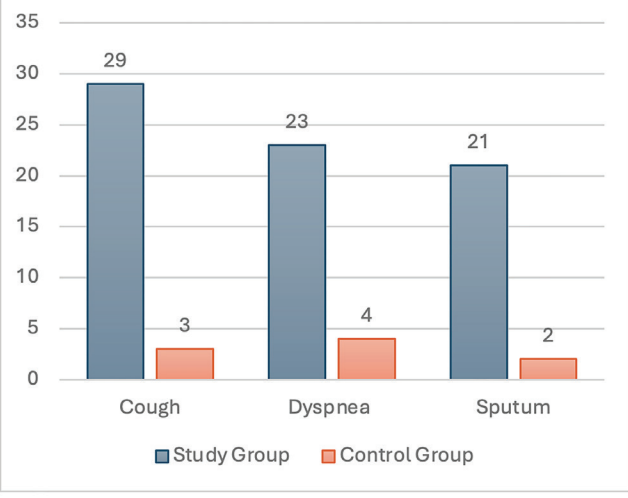

Figure 1. Distribution of respiratory symptoms of individuals according to groups

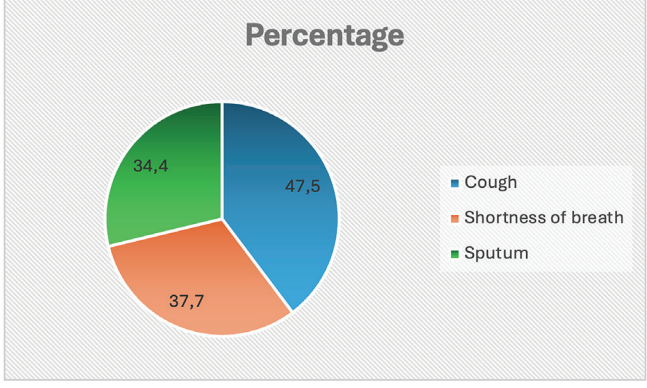

Figure 2. Percentage distribution of respiratory symptoms in the study group

DISCUSSION

The objective of this study was to assess lung function in healthy young smokers and non-smokers through the measurement of peak expiratory flow rate. The results revealed that smokers exhibited significantly lower cough capacity compared to non-smokers. While no significant difference was observed in the overall cough-related quality of life questionnaire score, the smoking group scored lower on both the sub-parameters and the total score of the questionnaire compared to the non-smoking group. Additionally, the study found that peak cough flow was negatively correlated with increasing nicotine dependence among smokers. This may indicate that increasing nicotine exposure progressively weakens expiratory muscle function. When self-reported respiratory symptoms were analysed, smokers reported more cough, dyspnoea, and sputum symptoms.

Table 2. Comparison of respiratory muscle strength and peak cough flow values of individuals

	Study group (n=61) Mean±SD	Control group (n=40) Mean±SD	p-value*
Peak cough flow (L/min)	445.00±135.90	455.50±138.74	0.045*
Leicester Cough Questionnaire subscales			
Physical	5.89±1.05	6.04±0.86	0.599**
Psychological	5.96±1.11	6.17±0.90	0.333**
Social	6.25±1.14	8.02±9.60	0.077**
Total	18.12±2.93	18.84±2.41	0.154**

*: Independent sample t-test, **: Mann-Whitney U test, p<0.05 statistical significance. n: Number of people, SD: Standard deviation, l: Liter, min: Minute, Study group: Individual smokers, Control group: Non-smokers, Study group: Individuals who smoke p<0.05 statistical significance

Table 3. The relationship between nicotine dependence level and cough capacity in smokers

	Degree of smoking dependence
Study group	**rho (p)**
Peak cough flow (L/min)	-0.297 (0.02)

L: Liter, min: Minute, rho: Spearman's correlation coeffidient

Smoking has become increasingly common among university students (16). In addition, smoking prevalence is higher in men than in women (1). In the literature, smoking prevalence was found to be higher in men than in women (17). In our study, the prevalence of smoking was found to be higher in male individuals, at 75.4%. Many studies have shown conflicting results regarding the relationship between smoking and BMI, with differences observed according to gender and/or race (18). In a study involving young men, daily smokers were found to have a higher average BMI compared to non-smokers (18). In our study, the BMI of smokers was found to be significantly higher than that of non-smokers. It is suggested that this may be due to less physically active lifestyles and poor dietary habits.

It is a serious problem that the increasing tendency to smoke tobacco, especially in young people, affects lung function (19). The early stages of airflow obstruction caused by tobacco smoking are reversible; however, if left untreated, they may progress to irreversible obstructive lung disease (20). Tobacco smoking is associated with cough, wheezing, sputum production, and dyspnoea. Respiratory symptoms (chronic cough, wheezing, asthma, dyspnea) have been reported among young adults (19). Research on tobacco use has demonstrated a link between smoking during adolescence and the development of asthma, as well as respiratory symptoms such as coughing, phlegm, wheezing, and shortness of breath (5). A cross-sectional study conducted on adolescents found a link between e-cigarette use and a higher risk of experiencing cough and sputum (21). Similarly, when self-reported respiratory symptoms were analysed in our study, it was found that smokers reported significantly more cough, dyspnea, and sputum-related symptoms. In the studies conducted, when the peak cough flow rate value was compared smokers and non-smokers, it was concluded that it decreased in smokers (22,23). It was also observed that mean peak cough flow velocity values decreased as smoking duration increased (23). One study found that smokers had lower peak cough flow velocity values than nonsmokers, even if they were asymptomatic (24).

In our study, we concluded that young adult smokers had significantly lower cough capacity compared to non-smokers, and that there was a negative relationship between peak cough flow rate and nicotine dependence. Recurrent inflammation is a frequent and persistent pathological finding that destroys alveolar walls in smokers, and this may be cause of the decrease in peak cough flow rate. This could also be attributed to the cumulative harmful effects of tobacco smoke on the airways over time. It is well-established that exposure to cigarette smoke leads to airway inflammation. The combined impact of the direct harmful effects of cigarette smoke and the indirect damage caused by the inflammatory response results in several epithelial alterations, including squamous metaplasia, increased mucous gland activity, changes in mucociliary clearance, and fibrotic transformations (25). All these changes lead to thickening of the bronchial wall, resulting in narrowing of the airway and restriction of flow (26). These mechanisms may explain the reduced peak cough flow observed in our sample of young smokers.

Cough has been significantly associated with deterioration in health-related quality of life in several general population studies (27,28). Cough is frequently comorbid in smokers and may affect quality of life (29). In a study, a significant long-term deterioration in quality of life was observed in smokers compared to never smokers (29). In our study, it was found that there was no significant difference in the cough-related quality of life questionnaire score in the smoker group compared to the non-smoker group; however, the sub-parameters and total score of the questionnaire were lower in the smoker group. In this respect, our study is consistent with previous studies in terms of the negative effect of cough on quality of life in smokers. It can be inferred that the deterioration of lung function and reporting more respiratory symptoms in smokers may prevent participation in daily activities and consequently affect general well-being and quality of life.

Study Limitations

The current study has some limitations, such as the small sample size and the fact that the study population consisted of young adults from only one university. There are also limitations such as sample inhomogeneity in height and weight data, reliance on self-reported data, and gender imbalance with a predominance of males in both groups. Future large-scale studies with more objective assessments are needed to analyze subgroups based on age, gender, or level of nicotine dependence.

CONCLUSION

Early detection of airflow obstruction and smoking cessation can result in significant health gains. Understanding the harmful effects of smoking is crucial for effective smoking control. Smoking accelerates the natural decline in pulmonary function with age, which is why adult and adolescent smokers typically exhibit lower lung function compared to non-smokers. Our study results indicate that smoking significantly impairs lung function, particularly decreasing the peak cough flow rate. Furthermore, as nicotine dependence increases, peak cough flow tends to decrease. Cigarette smoking remains the leading cause of preventable death worldwide. The use of all tobacco products should be strongly discouraged, especially among university students where smoking is prevalent and efforts should be made to specifically raise awareness among young adults. Coordinated approaches to tobacco prevention, cessation, and control are vital for creating a smoke-free environment. If smoking is halted at an early stage, the initial signs of airway obstruction can be reversed, allowing for normal lung function. Awareness and motivational programs are essential to discourage healthy young individuals from smoking. Moreover, to encourage young adult smokers to quit, it is important to provide accurate data on the health risks associated with smoking and its impact on pulmonary function. Despite the fact that smoking is a major health issue, there is limited research assessing pulmonary function in youth smokers and university students who smoke. Increasing awareness of the health effects of smoking through effective interventions that provide information about the harms of smoking may increase the intention to quit smoking among university students who smoke. To the best of our knowledge, there is no study evaluating the effect of tobacco addiction on cough capacity in young adults, including university students in our country. Our study is unique in this respect and will contribute to the literature. We think that there is a need for future studies with a larger sample size that represents the whole population, in which lung functions are evaluated in more detail.

ETHICS

Ethics Committee Approval: The study was approved by the Ethics Committee for Non-Interventional Clinical Research of Üsküdar University (approval no: 2024-55, date: 29.06.2024) and was conducted in accordance with the Declaration of Helsinki.

Informed Consent: All participants were given both verbal and written information about the study, and written informed consent was obtained from each participant.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: B.D.H., Ş.A., Consept: B.D.H., Ş.A., Design: B.D.H., Ş.A., R.M., Data Collection or Processing: Ş.A., Analysis or Interpretation: R.M., Literature Search: B.D.H., Ş.A., R.M., Writing: B.D.H.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: This study was conducted within the scope of the TÜBİTAK 2209-A Research Project Support Program for Undergraduate Students (project no: 2209-A/1919B012322504).

REFERENCES

1. Collaborators GT. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. Lancet. 2021;397:2337-60. Erratum in: Lancet. 2021;397:2336.
2. Kurtuluş Ş, Can R. Use of e-cigarettes and tobacco products among youth in Turkey. Eurasian J Med. 2022;54:127-132.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-5. 5th ed. Washington (DC): American Psychiatric Association; 2013.
4. West R. Tobacco smoking: health impact, prevalence, correlates and interventions. Psychol Health. 2017;32:1018-36.
5. National Center for Chronic Disease Prevention and Health Promotion (US), Office on Smoking and Health. The health consequences of smoking-50 years of progress: a report of the Surgeon General. Atlanta (GA): Centers for Disease Control and Prevention (US); 2014.
6. Kenfield SA, Wei EK, Rosner BA, Glynn RJ, Stampfer MJ, Colditz GA. Burden of smoking on cause-specific mortality: application to the nurses' health study. Tob Control. 2010;19:248-54.
7. Park JH, Kang S-W, Lee SC, Choi WA, Kim DH. How respiratory muscle strength correlates with cough capacity in patients with respiratory muscle weakness. Yonsei Med J. 2010;51:392-7.
8. Patankar LH, More M, Sonawane DR, Kanabar A. Clinical study of Shaman Dhoompan in cigarette smokers with peak expiratory flow rate. World J Pharm Res. 2021;10:1359-74.
9. Trofor A, Miron R, Buculei I, Puiu L, Man MA. "Lung age" - a motivational smoking cessation tool in smokers with chronic obstructive pulmonary disease. Tob Induc Dis. 2018;16(Suppl 1):A309.

10. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39:175-91.
11. Beck TW. The importance of a priori sample size estimation in strength and conditioning research. J Strength Cond Res. 2013;27:2323-37.
12. Uysal MA, Kadakal F, Karşidağ C, Bayram NG, Uysal O, Yilmaz V. Fagerstrom test for nicotine dependence: reliability in a Turkish sample and factor analysis. Tuberk Toraks. 2004;52:115-21.
13. Uysal A. Solunum fonksiyon testleri: spirometri, PEF ölçümü, DLCO endikasyonlari ve uygulama teknik bilgileri. Thorac Res Pract. 2011;12:1.
14. Birring S, Prudon B, Carr A, Singh S, Morgan M, Pavord I. Development of a symptom specific health status measure for patients with chronic cough: Leicester Cough Questionnaire (LCQ). Thorax. 2003;58:339-43.
15. Akış Gönan N, Havlucu Y, Yorgancıoğlu A, Göktaş T, Akış Gönan N. Reliability and validity of a Turkish version of Leicester Cough Questionnaire. Eur Respir J. 2015;46(Suppl 59):PA3949.
16. Abdelaal AAM, Mousa GSM. Impact of cigarettes smoking on undergraduates' lung health and functional performance: observational cross-sectional study. Int J Prev Med. 2022;13:59.
17. Wali SO. Smoking habits among medical students in Western Saudi Arabia. Saudi Med J. 2011;32:843-8.
18. Hamari A, Toljamo T, Nieminen P, Kinnula VL. High frequency of chronic cough and sputum production with lowered exercise capacity in young smokers. Ann Med. 2010;42:512-20.
19. Chaffee BW, Barrington-Trimis J, Liu F, Wu R, McConnell R, Krishnan-Sarin S, et al. E-cigarette use and adverse respiratory symptoms among adolescents and young adults in the United States. Prev Med. 2021;153:106766.
20. Nighute S, Buge K, Kumar S. Effect of cigarette smoking on peak expiratory flow rate: a short review. Int J Curr Res Physiol Pharmacol. 2017;3:3-5.
21. McConnell R, Barrington-Trimis JL, Wang K, Urman R, Hong H, Unger J, et al. Electronic cigarette use and respiratory symptoms in adolescents. Am J Respir Crit Care Med. 2017;195:1043-9.
22. Sawant GV, Kubde SR, Kokiwar PR. Effect of smoking on PEFR: a comparative study among smokers and non-smokers in an urban slum community of Hyderabad, India. Int J Community Med Public Health. 2016;3:246-50.
23. Naznin R, Nessa A, Nazrina S. Effect of cigarette smoking on peak expiratory flow rate. J Armed Forces Med Coll Bangladesh. 2019;15:165-7.
24. Meena S, Manikandan R. Peak expiratory flow rates in age matched smokers and non-smokers in a tertiary care hospital. Int Arch Integr Med. 2018;5:23-8.
25. Bohadana A, Teculescu D, Martinet Y. Mechanisms of chronic airway obstruction in smokers. Respir Med. 2004;98:139-51.
26. Medabala T, Rao B, MI GM, Kumar P. Effect of cigarette and cigar smoking on peak expiratory flow rate. J Clin Diagn Res. 2013;7:1886-9.
27. Voll-Aanerud M, Eagan TM, Plana E, Omenaas ER, Bakke PS, Svanes C, et al. Respiratory symptoms in adults are related to impaired quality of life, regardless of asthma and COPD: results from the European community respiratory health survey. Health Qual Life Outcomes. 2010;8:107.
28. Ternesten-Hasséus E, Larsson S, Millqvist E. Symptoms induced by environmental irritants and health-related quality of life in patients with chronic cough-A cross-sectional study. Cough. 2011;7:1-8.
29. Krishna G, Jose AM, Rahali W, Alyamani W, Mohammed M, Alghamdi B, et al. Long-term cardiopulmonary outcomes and quality of life: a comparative study among cigarette, electronic cigarette and dual use consumers. Research Square (Research Square). 2023;1-18.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):67-71
DOI: 10.4274/BMJ.galenos.2025.2025.1-23

Research

Evaluation of the Efficacy of the Biogold Strep A Rapid Antigen Test for the Detection of Group A Beta-Haemolytic *Streptococci* in Throat Swabs

Boğaz Sürüntü Örneklerinde A Grubu Beta-Hemolitik *Streptokokların* Tespitinde Biogold Strep A Hızlı Antijen Testinin Etkinliğinin Değerlendirilmesi

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ABSTRACT

Objective: Group A beta-haemolytic *Streptococcus* (GAS) cause 20-40% of childhood pharyngitis and 5-15% of adult pharyngitis. Without timely treatment, GAS can lead to severe complications, such as acute rheumatic fever and post-streptococcal glomerulonephritis. Early identification is crucial for preventing these outcomes. Rapid antigen tests (RAT) have opened a very useful diagnostic field in the diagnosis and treatment of acute tonsilopharyngitis. This study aimed to assess the effectiveness of the Biogold Strep A Card test compared with the gold-standard culture method.

Methods: This study included 6,188 throat swab samples submitted between January 2022 and May 2023. Samples were tested using both the Biogold Strep A Card (Bioriver, Türkiye) and culture methods.

Results: Among 6,188 patients, 2,717 (43.9%) were female and 3,471 (56.1%) male, with a mean age of 11.8±9.6 years. Among the patients examined, 17.2% (1,062) had positive cultures, while 18.7% (1,155) tested positive by the Biogold Strep A RAT. The Biogold Strep A Card test showed a sensitivity of 75.6%, specificity of 93.1%, positive predictive value of 69.4%, negative predictive value of 94.8%, and overall accuracy of 90.1%.

Conclusion: Initiating antibiotic therapy in patients with positive RAT results may reduce the risk of complications, particularly in children aged 5-15 years. For patients with negative RAT results, avoiding unnecessary antibiotics helps prevent resistance. Culturing RAT-negative cases further minimizes misdiagnosis and incomplete treatment.

Keywords: GAS, *Streptococcus pyogenes*, throat culture, rapid antigen test

ÖZ

Amaç: A grubu beta-hemolitik *Streptokoklar* (GAS) çocukluk çağı farenjitlerinin %20-40'ına ve yetişkin farenjitlerinin %5-15'ine neden olmaktadır. Zamanında tedavi edilmeyen GAS, akut romatizmal ateş ve post-streptokokal glomerülonefrit gibi ciddi komplikasyonlara yol açabilir. Bu sonuçların önlenmesi için erken teşhis çok önemlidir. Hızlı antijen testleri (RAT), akut tonsilofarenjitin tanı ve tedavisinde çok yararlı bir tanı alanı açmıştır. Bu çalışmada Biogold Strep A Card testinin altın standart olan kültür yöntemine kıyasla etkinliğinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Bu çalışmaya Ocak 2022 ve Mayıs 2023 tarihleri arasında gönderilen 6.188 boğaz sürüntü örneği dahil edilmiştir. Örnekler hem Biogold Strep A Card (Bioriver, Türkiye) hem de kültür yöntemleri kullanılarak test edilmiştir.

Bulgular: Toplam 6188 hastanın 2.717'si (%43,9) kadın ve 3.471'i (%56,1) erkek olup yaş ortalaması 11,8±9,6'dır. İncelenen toplam hasta sayısının %17,2'sinde (1.062) kültür testi pozitif çıkarken, %18,7'sinde (1.155) Biogold Strep A RAT testi pozitif çıkmıştır. Biogold Strep A Card testi %75,6 duyarlılık, %93,1 özgüllük, %69,4 pozitif öngörü değeri, %94,8 negatif öngörü değeri ve %90,1 genel doğruluk göstermiştir.

Sonuç: RAT sonuçları pozitif olan hastalarda antibiyotik tedavisinin başlatılması, özellikle 5-15 yaş grubunda komplikasyon riskini azaltabilir. RAT sonucu negatif olan hastalarda gereksiz antibiyotik kullanımından kaçınmak direnci önlemeye yardımcı olur. RAT-negatif olguların kültüre edilmesi yanlış tanı ve eksik tedaviyi en aza indirir.

Anahtar Kelimeler: GAS, *Streptococcus pyogenes*, boğaz kültürü, hızlı antijen testi

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Received: 31.01.2025
Accepted: 27.07.2025
Publication Date: 12.03.2026

Cite as: Bulut ME, Tekbaş U, Şahin SR, Tufan H, Pelit S, Aktaş E. Evaluation of the efficacy of the biogold strep A rapid antigen test for the detection of group A beta-haemolytic *Streptococci* in throat swabs. Med J Bakirkoy. 2026;22(1):67-71

INTRODUCTION

Approximately 16% of adults and 41% of children are diagnosed with pharyngitis annually (1). Group A beta-haemolytic *Streptococcus* (GAS) [*Streptococcus pyogenes* (*S. pyogenes*)] is the most prevalent bacterial cause of infectious pharyngitis. It is estimated that GAS is responsible for 20 to 40% of cases of pharyngitis in children and 5 to 15% in adults (2,3). The most common symptoms of the disease are sore throat, fever, tonsillar exudates, and swollen cervical lymph nodes. As the symptoms of bacterial pharyngitis are similar to those of viral pharyngitis, diagnosis based on clinical features alone (4). Although scores such as Centor and McIsaac have been developed to facilitate clinical decision-making in the diagnosis of GAS pharyngitis, the use of culture and rapid antigen tests (RAT) is necessary to obtain evidence-based results (1,5).

If GAS pharyngitis is not treated in a timely manner, it may result in an increase in the prevalence of suppurative and non-suppurative complications, including acute rheumatic fever (ARF), rheumatic heart disease, post-streptococcal glomerulonephritis, bacteremia, peritonsillar abscess, and retropharyngeal abscess, as well as increased mortality rates (6). It is therefore of utmost importance to rapidly detect the presence of GAS in order to prevent the adverse complications that may result (3).

The most reliable method for diagnosing GAS is the culture of a throat swab. However, the lengthy diagnostic period, which can take 24-48 hours, significantly limits the effective utilisation of the throat culture method (6,7). This presents a considerable challenge in low-income countries, where patients are less likely to return to the clinic for follow-up and treatment (8). RATs have been developed for this purpose, providing results within a short timeframe, thereby facilitating prompt administration of targeted treatment. The administration of targeted therapy is also advantageous in preventing the emergence of antibiotic resistance.

Currently, numerous RATs are available, each employing a distinct methodology to detect GAS antigens (7). The most commonly employed RATs in clinical practice are enzyme-based and use immunochromatographic (lateral flow) methodology. The tests are based on the detection of Lancefield group A carbohydrates, which are GAS-specific cell wall antigens (3,4). The diagnostic sensitivity of these tests ranges from 59% to 100%, while their specificity ranges from 54% to 100% (4). A negative test result does not definitively rule out the diagnosis of GAS and necessitates performing an additional throat culture (9).

The objective of this study was to assess the diagnostic accuracy of the Biogold Strep A Card test (Bioriver, Türkiye), a rapid assay to detect GAS in throat swab samples, compared with GAS culture results in patients with a preliminary diagnosis of acute tonsillopharyngitis.

METHODS

The present study encompasses 6,188 throat swab samples obtained from patients with a preliminary diagnosis of pharyngitis and sent to our laboratory between January 2022 and May 2023. As previously stated, the samples were cultured simultaneously with RAT. Sampling was conducted with two swabs (Microcult, Türkiye) to sample both tonsils and the posterior pharyngeal wall. One was used culture, and the other for RAT detection. The Biogold Strep A Card test (Bioriver, Türkiye), which is based on a lateral-flow immunoassay, was employed to detect the GAS antigen in throat swabs. The samples were inoculated on 5% sheep blood agar and incubated at 37 °C in a 5-10% CO_2 incubator for up to 48 hours. Identification was achieved by bacitracin sensitivity testing, latex agglutination, PYR testing, and matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry. A clinical isolate of *S. pyogenes*, previously identified by molecular methods, was employed for quality control purposes.

Ethics Approval

This study was approved University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee (approval no: 4503, date: 20.08.2024).

Statistical Analysis

Statistical calculations and data processing were performed in Python using the NumPy and Pandas libraries. Qualitative data were compared using the chi-square test and McNemar's test.

RESULTS

The study included 6,188 patients, of whom 2,717 (43.9%) were female and 3,471 (56.1%) were male. The age range of the patients was 1-87 years, with a mean age of 11.8±9.6 years. A total of 5,418 samples (87.6%) were derived from paediatric clinics, of which 4,177 were derived from paediatric emergency departments, and 770 samples (12.4%) were derived from adult clinics. A total of 6,188 patients with a preliminary diagnosis of pharyngitis underwent throat culture and RAT in our laboratory. Of the total number of patients examined, 17.2% (1,062) tested positive for culture, while 18.7% (1,155) tested positive for Biogold Strep A RAT. Table 1

presents a comparative analysis of the results obtained from culture and RAT testing across all age groups. The distribution of patients with positive culture results by age group is as follows: 29 patients were under 5 years of age, 998 patients were between 5 and 15 years of age, and 35 patients were over 15 years of age. Table 2 presents a comparative analysis of culture and RAT test results in the 5-15-year age group. By gender, the culture positivity rate was 16.8% among females and 17.3% among males. No significant difference was observed in the distribution of positive results ($p>0.05$). The statistical results of the Biogold Strep A Card test compared with culture are as follows: sensitivity, 75.6% and 76.0%; specificity, 93.1% and 92.0%; positive predictive value, 69.4% and 73.1%; negative predictive value, 94.8% and 93.4%; and test accuracy, 90.1% and 88.9% in the general population and in patients aged 5-15 years, respectively.

DISCUSSION

The Biogold test was found to be a valuable tool for patient treatment planning, with a sensitivity of 75.6% and a specificity of 93.1% when compared with culture, which is considered the gold standard.

Acute pharyngitis is frequently caused by viral infections. As the clinical manifestations of viral pharyngitis and GAS pharyngitis are similar, a decision based on clinical features alone is not always accurate (6). Given the absence of a vaccine against GAS, the disease can only be prevented and treated with antibiotics (10).

The prescription of antibiotics based solely on clinical findings, in the absence of appropriate diagnostic tests, results in avoidable medical costs and an increase in antibiotic resistance. While the average prevalence of GAS in patients with pharyngitis in developed countries is approximately 25%, reported antibiotic prescription rates are two to three times higher (6,11,12). Furthermore, the emergence of specific mutations in GAS has been demonstrated to reduce penicillin susceptibility (13-15). Therefore, employing sensitive, specific, and rapid microbiological diagnostic tests that provide reliable evidence to prevent the emergence of antibiotic resistance.

The majority of patients included in this study were children. GAS pharyngitis is a self-limiting infectious disease. Nevertheless, the primary objective of therapy is to prevent the development of suppurative and non-suppurative complications in paediatric patients. The administration of antibiotics is essential for reducing the duration and severity of symptoms, limiting the spread of the disease, and, most crucially, preventing non-suppurative complications such as ARF (16).

RAT was developed as an alternative to culture, which is currently regarded as the gold standard method for diagnosing the disease. It is a lateral-flow immunoassay that detects GAS antigen directly from throat swab samples within five minutes (4). RATs offer several advantages, including speed, ease of use, reduced risk of complications through earlier treatment initiation, and prevention of unnecessary antibiotic use (17).

In the meta-analysis conducted by Cohen et al. (3), 116 different RATs were analyzed across 98 publications. All participants underwent both a RAT and a throat culture, and the mean sensitivity and specificity of RATs were reported as 86% and 95%, respectively (3). In the study by Sølvik et al. (4), two distinct RATs were compared. A comparative methodology, utilising the culture of *S. pyogenes* as the reference standard, was employed. The diagnostic sensitivities of the QuickVue® Dipstick Strep A test and the DIAQUICK Strep A Blue Dipstick were 92% and 72%, respectively; the diagnostic specificities were 86% and 98%,

Table 1. Comparison of culture and rapid antigen test for all age groups

		Culture		
		Positive	**Negative**	**Total**
Rapid antigen test	**Positive**	802	353	1155
	Negative	260	4773	5033
	Total	1062	5126	**6188**

Table 2. Comparison of culture-rapid antigen test in 5-15 age group

		Culture		
		Positive	**Negative**	**Total**
Rapid antigen test	**Positive**	758	279	1037
	Negative	240	3396	3636
	Total	998	3675	**4673**

respectively. The findings indicated that both RATs exhibited satisfactory performance in this study (4).

In a further study published in 2019, the diagnostic accuracy of the QuickVue® Dipstick Strep A test was evaluated in children with acute tonsillopharyngitis. Two throat swabs were obtained RAT and culture. The culture method demonstrated that the sensitivity and specificity of the QuickVue® Dipstick Strep A test were 100% and 98%, respectively (18).

The sensitivity and specificity of the RAT included in the study were found to be 75.6% and 93.1%, respectively. Upon evaluation of the results, it was determined that the performance of the RAT test was adequate for the intended purpose. In the 5-15-year age group, the sensitivity and specificity of the RAT were 76.0% and 92.0%, respectively. These findings demonstrate that the selected RAT exhibits consistent performance in accurately detecting patients with a positive GAS result across all age groups.

A study revealed that 28% of antibiotic prescriptions for paediatric patients evaluated for pharyngitis were not in accordance with the guidelines, predominantly because antibiotics were prescribed despite negative GAS test results (19). In accordance with international recommendations, a positive RAT result can be considered a true positive, given the high specificity of the test. Conversely, in the event of a negative RAT result, it is recommended that a throat culture be conducted for confirmation, given that the sensitivity of certain RATs has been observed to decline by up to 70% (7,17,20,21).

In the present study, the specificity was 93.1% in the general population and 92.0% in the 5-15-year age group. This suggests that the test has a low probability of incorrectly classifying healthy individuals as positive (false positives). A false-positive RAT result may result from streptococcal species in the pharynx, including commensal *Streptococcus milleri* and *Streptococcus intermedius*—which express a carbohydrate antigen in common with group A streptococci—or from nutritional variants of group A streptococci or non-haemolytic group A streptococci, which are challenging to identify by culture on standard blood agar plates (17). Furthermore, research has demonstrated that the inhibition of *Staphylococcus aureus* using molecular techniques can prevent the proliferation of GAS on culture plates (22).

Although some parameters differed between the 5-15 age group and the general population when evaluated by age range, the overall performance of the test was satisfactory for both groups. The identification of streptococci has historically been regarded as the gold standard for the diagnosis of streptococcal infections. However, there is a risk of contamination with the natural flora of the upper respiratory tract when throat swab samples are collected for culture. Furthermore, optimal sampling of both the tonsils and the posterior pharyngeal wall can be challenging in young children, with culture sensitivity potentially reduced by up to 20% when sampling is suboptimal (23,24). This consequently results in false-negative culture results. Culture performance is influenced by the conditions used for cultivation and incubation (24). Moreover, culture results cannot distinguish active infection from the GAS carrier state (17). In the present study, serological confirmation was not employed to differentiate between active infection and carrier state. The present study was designed on the assumption that all patients with positive culture results were truly infected and that no false-positive results were obtained.

Study Limitations

A potential limitation of this study is the lack of clinical data on patients, including information on antibiotic use. The lack of documentation for patients from whom only a single swab was collected constitutes a limitation for the analysis of test results. In the study, true false-positive results could not be confirmed because a second confirmation test [polymerase chain reaction (PCR) or a different RAT] was not performed on samples that were RAT-positive but culture-negative. Additionally, since no second verification test (PCR or a different RAT) was applied to samples that were RAT-positive but culture-negative, true false-positive results could not be identified. The principal strength of this study is that it examines the relationship between culture and RAT using a large number of patient samples (n=6,188).

CONCLUSION

The data presented here support the conclusion that the risk of complications can be reduced by initiating antibiotic treatment early in patients with positive RAT results in clinical settings. In patients with negative results, unnecessary antibiotic use will be avoided, reducing the development of antibiotic resistance. Furthermore, given that a fully optimised RAT has yet to be developed, implementing a culture-based approach when RAT results are negative will help avoid misdiagnosis and incomplete treatment.

GAS infection can lead to numerous complications. The full extent of the healthcare burden and its effects on the global economy remain to be elucidated. Given the aforementioned considerations, further studies are necessary to elucidate the global impact and disease burden associated with GAS.

ETHICS

Ethics Committee Approval: This study was approved University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee (approval no: 4503, date: 20.08.2024).

Informed Consent: Retrospective study.

FOOTNOTES

Authorship Contributions

Consept: M.E.B., U.T., H.T., E.A., Design: M.E.B., H.T., S.P., E.A., Data Collection or Processing: M.E.B., U.T., S.R.Ş., H.T., S.P., E.A., Analysis or Interpretation: M.E.B., U.T., S.R.Ş., H.T., S.P., E.A., Literature Search: M.E.B., U.T., S.R.Ş., H.T., E.A., Writing: M.E.B., U.T., S.R.Ş., H.T., S.P., E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Kanagasabai A, Evans C, Jones HE, Hay AD, Dawson S, Savovi J, et al. Systematic review and meta-analysis of the accuracy of McIsaac and Centor score in patients presenting to secondary care with pharyngitis. Clin Microbiol Infect. 2024;30:445-52.
2. Wessels MR. Clinical practice. Streptococcal pharyngitis. N Engl J Med. 2011;364:648-55.
3. Cohen JF, Bertille N, Cohen R, Chalumeau M. Rapid antigen detection test for group A Streptococcus in children with pharyngitis. Cochrane Database Syst Rev. 2016;2016:CD010502.
4. Sølvik UØ, Boija EE, Ekvall S, Jabbour A, Breivik AC, Nordin G, et al. Performance and user-friendliness of the rapid antigen detection tests QuickVue dipstick strep A test and DIAQUICK Strep A Blue Dipstick for pharyngotonsillitis caused by Streptococcus pyogenes in primary health care. Eur J Clin Microbiol Infect Dis. 2021;40:549-58.
5. Muthanna A, Shamsuddin NH, Abdul Rashid A, Ghazali SS, Hamat RA, Mawardi M, et al. Diagnostic accuracy of centor score for diagnosis of group A streptococcal pharyngitis among adults in primary care clinics in Malaysia. Malays J Med Sci. 2022;29:88-97.
6. Kim HN, Kim J, Jang WS, Nam J, Lim CS. Performance evaluation of three rapid antigen tests for the diagnosis of group A Streptococci. BMJ Open. 2019;9:e025438.
7. Lean WL, Arnup S, Danchin M, Steer AC. Rapid diagnostic tests for group A streptococcal pharyngitis: a meta-analysis. Pediatrics. 2014;134:771-81.
8. Rimoin AW, Walker CL, Hamza HS, Elminawi N, Ghafar HA, Vince A, et al. The utility of rapid antigen detection testing for the diagnosis of streptococcal pharyngitis in low-resource settings. Int J Infect Dis. 2010;14:e1048-53.
9. Tanz RR, Gerber MA, Kabat W, Rippe J, Seshadri R, Shulman ST. Performance of a rapid antigen-detection test and throat culture in community pediatric offices: implications for management of pharyngitis. Pediatrics. 2009;123:437-44. Erratum in: Pediatrics. 2009;124:846.
10. Brouwer S, Rivera-Hernandez T, Curren BF, Harbison-Price N, De Oliveira DMP, Jespersen MG, et al. Pathogenesis, epidemiology and control of group A Streptococcus infection. Nat Rev Microbiol. 2023;21:431-47. Erratum in: Nat Rev Microbiol. 2023;21:619.
11. Kim IU, Yang MY, Jung HR, Kung EK, Huh HJ. Clinical manifestations of group A streptococcal pharyngitis and comparison of usefulness of two rapid streptococcal antigen tests. Lab Med Online. 2016;6:88-92.
12. Wächtler H, Kaduszkiewicz H, Kuhnert O, Malottki KA, Maaß S, Hedderich J, et al. Influence of a guideline or an additional rapid strep test on antibiotic prescriptions for sore throat: the cluster randomized controlled trial of HALS (Hals und Antibiotika Leitlinien Strategien). BMC Prim Care. 2023;24:75.
13. Chochua S, Metcalf B, Li Z, Mathis S, Tran T, Rivers J, et al. Invasive group A streptococcal penicillin binding protein 2× variants associated with reduced susceptibility to -lactam antibiotics in the United States, 2015-2021. Antimicrob Agents Chemother. 2022;66:e0080222.
14. Vannice KS, Ricaldi J, Nanduri S, Fang FC, Lynch JB, Bryson-Cahn C, et al. Streptococcus pyogenes pbp2x Mutation Confers Reduced Susceptibility to -Lactam Antibiotics. Clin Infect Dis. 2020;71:201-4. Erratum in: Clin Infect Dis. 2020;70:1265.
15. Musser JM, Beres SB, Zhu L, Olsen RJ, Vuopio J, Hyyryläinen HL, et al. Reduced in vitro susceptibility of Streptococcus pyogenes to -lactam antibiotics associated with mutations in the pbp2x gene is geographically widespread. J Clin Microbiol. 2020;58:e01993-19.
16. Anjos LM, Marcondes MB, Lima MF, Mondelli AL, Okoshi MP. Streptococcal acute pharyngitis. Rev Soc Bras Med Trop. 2014;47:409-13.
17. Lacroix L, Cherkaoui A, Schaller D, Manzano S, Galetto-Lacour A, Pfeifer U, et al. Improved diagnostic performance of an immunofluorescence-based rapid antigen detection test for group A streptococci in children with pharyngitis. Pediatr Infect Dis J. 2018;37:206-11.
18. Safizadeh Shabestari SA, Malik ZA, Al-Najjar FYA. Diagnostic accuracy of QuickVue® dipstick strep A test and its effect on antibiotic prescribing in children in the United Arab Emirates. BMC Pediatr. 2019;19:429.
19. Brennan-Krohn T, Ozonoff A, Sandora TJ. Adherence to guidelines for testing and treatment of children with pharyngitis: a retrospective study. BMC Pediatr. 2018;18:43.
20. Gerber MA, Shulman ST. Rapid diagnosis of pharyngitis caused by group A streptococci. Clin Microbiol Rev. 2004;17:571-80.
21. Gerber MA, Baltimore RS, Eaton CB, Gewitz M, Rowley AH, Shulman ST, et al. Prevention of rheumatic fever and diagnosis and treatment of acute Streptococcal pharyngitis: a scientific statement from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease in the Young, the Interdisciplinary Council on Functional Genomics and Translational Biology, and the Interdisciplinary Council on Quality of Care and Outcomes Research: endorsed by the American Academy of Pediatrics. Circulation. 2009;119:1541-51.
22. Cohen JF, Cohen R, Bidet P, Levy C, Deberdt P, d'Humières C, et al. Rapid-antigen detection tests for group a streptococcal pharyngitis: revisiting false-positive results using polymerase chain reaction testing. J Pediatr. 2013;162:1282-4.
23. Fox JW, Marcon MJ, Bonsu BK. Diagnosis of streptococcal pharyngitis by detection of Streptococcus pyogenes in posterior pharyngeal versus oral cavity specimens. J Clin Microbiol. 2006;44:2593-4.
24. Shulman ST, Bisno AL, Clegg HW, Gerber MA, Kaplan EL, Lee G, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. Clin Infect Dis. 2012;55:1279-82. Erratum in: Clin Infect Dis. 2014;58:1496.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):72-78
DOI: 10.4274/BMJ.galenos.2025.2025.4-3

Research

The TAP Block Reduces Oxidative Stress and Postoperative Pain in Laparoscopic Gynecological Surgery

TAP Bloğu Laparoskopik Jinekolojik Cerrahide Oksidatif Stresi ve Postoperatif Ağrıyı Azaltır

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ABSTRACT

Objective: Postoperative pain is a significant concern in laparoscopic gynecological surgery, and its management typically includes regional analgesia techniques, such as the transversus abdominis plane (TAP) block, alongside systemic analgesics. Thiol-disulphide homeostasis (TDH) measurements are used to assess oxidative stress. This study investigated the effect of TAP block on TDH and postoperative pain.

Methods: The study included patients who underwent laparoscopic total abdominal hysterectomy and bilateral salpingo-oophorectomy. While a TAP block was performed following anesthesia induction in Group T, local anesthetic infiltration was administered at the trocar insertion sites prior to trocar placement in Group I. Blood samples were taken at anesthesia induction and at the 24th postoperative hour.

Results: In Group T, we observed higher levels of native thiol (NT), total thiol (TT), and the NT/TT ratio, whereas disulphide/NT and disulphide/TT ratios, and ischemia-modified albumin values were lower than in Group I. Additionally, postoperative pain scores were lower in Group T at 0, 2, and 4 hours.

Conclusion: In this study, we found that TAP block combined with general anesthesia reduced oxidative stress and postoperative pain. We conclude that the combination of general anesthesia and regional analgesia has beneficial effects on both oxidative stress and pain management.

Keywords: Laparoscopic gynecological surgery, oxidative stress, pain, regional anesthesia, thiol-disulphide homeostasis, transversus abdominis plane block

ÖZ

Amaç: Laparoskopik jinekolojik cerrahilerde postoperatif ağrı önemli bir sorundur ve yönetiminde sistemik analjeziklere ek olarak transversus abdominis plan (TAP) bloğu gibi rejyonal analjezi teknikleri kullanılmaktadır. Tiyol-disülfit homeostazı (TDH) ölçümleri, oksidatif stresin değerlendirilmesinde kullanılmaktadır. Bu çalışmada, TAP bloğunun TDH ve postoperatif ağrı üzerindeki etkisi araştırılmıştır.

Gereç ve Yöntem: Çalışmaya laparoskopik total abdominal histerektomi ve bilateral salpingo-ooforektomi uygulanan hastalar dahil edilmiştir. Grup T'ye anestezi indüksiyonunu takiben TAP blok uygulanırken, Grup I'ya trokar yerleştirme işlemi öncesinde trokar yerlerine lokal anestezik infiltrasyonu uygulandı. Kan örnekleri anestezi indüksiyonu sırasında ve postoperatif 24. saatte alınmıştır.

Bulgular: Grup T'de, Grup I'ya kıyasla daha yüksek düzeyde natif tiyol (NT), total tiyol (TT) ve NT/TT oranı saptanırken, disülfit/NT, disülfit/TT oranları ve iskemi-modifiye albümin değerleri daha düşük bulunmuştur. Ayrıca, Grup T'de postoperatif ağrı skorları 0, 2 ve 4. saatlerde daha düşük seyretmiştir.

Sonuç: Bu çalışmada, genel anestezi ile kombine edilen TAP bloğunun oksidatif stresi ve postoperatif ağrıyı azalttığını bulduk. Genel anestezi ile rejyonal analjezi kombinasyonunun, hem oksidatif stres hem de ağrı yönetimi açısından olumlu etkiler sağladığı sonucuna vardık.

Anahtar Kelimeler: Laparoskopik jinekolojik cerrahi, oksidatif stres, ağrı, rejyonal anestezi, tiyol-disülfit homeostazı, transversus abdominis plan bloğu

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Cite as: Özgüner Y, Altınsoy S, Kültüroğlu G, Ergil J, Hanedan C, Özgürlük İ, et al. The TAP block reduces oxidative stress and postoperative pain in laparoscopic gynecological surgery. Med J Bakirkoy. 2026;22(1):72-78

Received: 08.04.2025
Accepted: 27.07.2025
Publication Date: 12.03.2026

INTRODUCTION

Although laparoscopic gynaecological surgery is considered less invasive than open gynaecological surgery, it still results in postoperative pain. In laparoscopic procedures, surgical trauma and pneumoperitoneum are significant contributors to postoperative discomfort (1). Inadequate management of postoperative pain may lead to decreased patient comfort, extended hospital stays, and the development of chronic pain. Postoperative pain is typically managed with systemic analgesics, local anaesthetic infiltration, and regional anaesthesia techniques (2,3).

Thiols interact with free radicals to form disulfides, thereby mitigating oxidative stress (4,5). The method of quantitatively measuring serum thiols is commonly employed to assess dynamic thiol-disulfide homeostasis (TDH). Dysregulations in TDH have been linked to degenerative and proliferative diseases. In addition, ischemia-modified albumin (IMA) is frequently utilized as a biomarker for oxidative stress in various conditions (6-8). Reduced native thiol (NT) and total thiol (TT) levels, increased disulphide thiol (DT) concentrations, and elevated IMA levels are associated with heightened oxidative stress (9,10).

The effects of different regional analgesia techniques on pain and oxidative stress have been investigated using various biochemical markers, including malondialdehyde, superoxide dismutase, and nitrotyrosine. (11,12). Surgical trauma induces tissue injury, which leads to increased sympathetic nervous system activity and the release of proinflammatory cytokines. This heightened inflammatory response is known to contribute to elevated levels of oxidative stress. Regional anesthesia techniques, by providing effective analgesia, have been shown to suppress the neuroendocrine stress response and consequently decrease the release of inflammatory cytokines (13-15).

This study aims to investigate the hypothesized positive effects of the transversus abdominis plane (TAP) block on TDH during laparoscopic gynecological surgery. Our secondary objective is to explore the effects of TAP block on IMA and postoperative pain.

METHODS

Trial Design

This single-centre, randomised controlled study complied with the ethical standards of the Declaration of Helsinki. Approval for the study was obtained from the Ethics Committee of University of Health Sciences Türkiye, Ankara Etlik City Hospital No. 1 Clinical Research (approval no: 037, date: 05.04.2023). Written informed consent was obtained from all the participants.

Participants

The study included patients aged between 18 and 80 years, classified as American Society of Anesthesiologists physical status I-II, who underwent laparoscopic total abdominal hysterectomy and bilateral salpingo-oophorectomy (TAH-BSO). Exclusion criteria were allergy to local anesthetics, chronic analgesic use, coagulopathy, surgical-site infection, neuropathy, chronic pain syndrome, and intraoperative complications.

Randomization

After patients who met the inclusion criteria were identified, they were divided into two groups. Patients were numbered sequentially and allocated to groups using opaque, sealed envelopes: those receiving a TAP block (Group T) and those not receiving it (Group I). Random identification numbers were assigned to patients, and a blinded anesthesiologist collected postoperative data using them (Figure 1). Surgical procedures in both groups were performed by the same surgical team. The anesthesiologist who collected postoperative data, the surgical team, and the patients were blinded to group allocation.

Interventions

All patients were monitored with standard techniques, including electrocardiography, pulse oximetry, non-invasive blood pressure, and bispectral index (BIS). Both patient groups received induction of anesthesia with propofol (2 mg/kg), lidocaine (1 mg/kg), fentanyl (1 mcg/kg), and rocuronium (0.6 mg/kg). Anesthesia was maintained with sevoflurane and a remifentanil infusion [0.05-0.3 mcg/kg/min intravenous (IV)], targeting a BIS value of 40-60. The remifentanil infusion dose was adjusted according to the patient's intraoperative hemodynamic parameters. The remifentanil dose was increased if the heart rate or the systolic blood pressure increased by more than 20%. Balanced fluid resuscitation was applied as the standard approach in both groups. IV tramadol (100 mg) and paracetamol (1 g) were administered for analgesia, and ondansetron (4 mg) was given as an antiemetic to all patients 20 minutes before the end of surgery. Neuromuscular blockade was reversed with 50 mcg/kg IV neostigmine and 10 mcg/kg IV atropine. After extubation, patients were transferred to the postanesthesia care unit.

Following anesthesia induction, patients in Group T received a bilateral subcostal TAP block with 30 mL of 0.25% bupivacaine (15 mL on each side). A subcostal

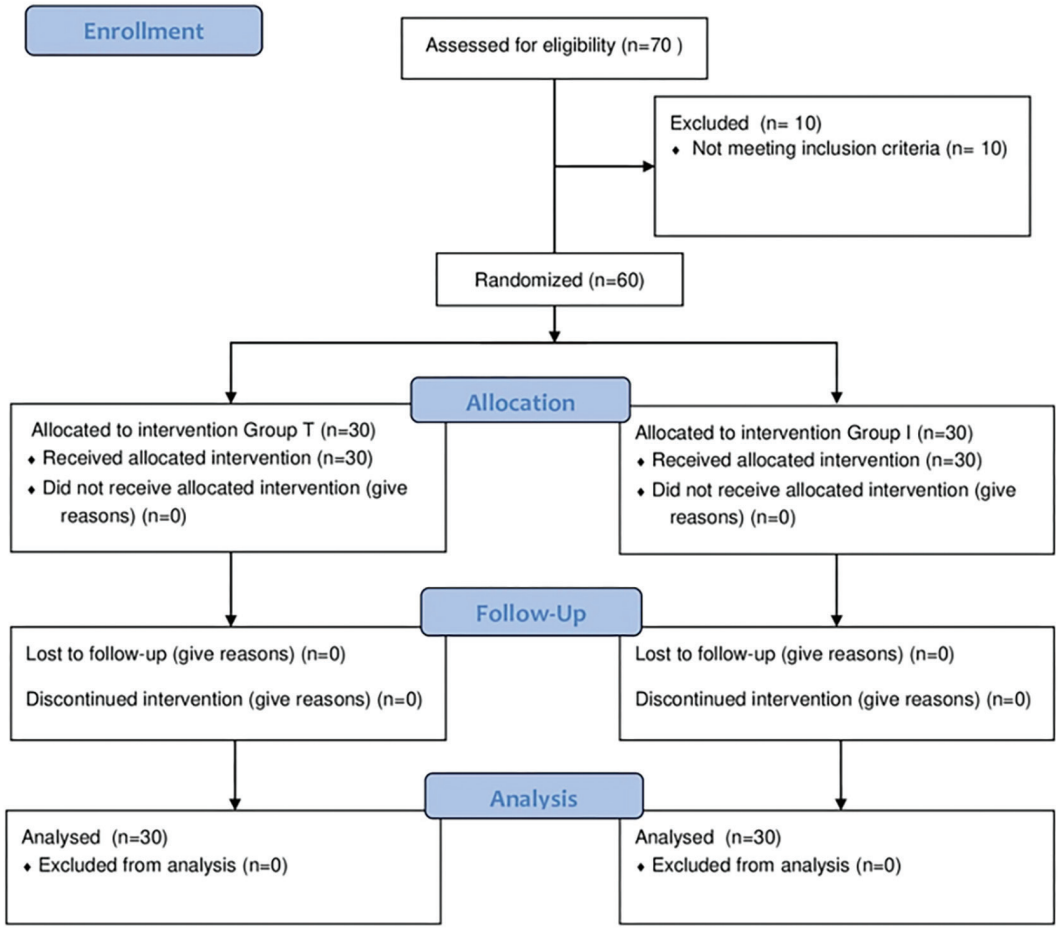

Figure 1. CONSORT diagram of the study
CONSORT: Consolidated standards of reporting trials

TAP block was performed by the same experienced anesthesiologist. A high-frequency (6-13 MHz) linear transducer (Sonosite, Bothell, Washington, USA) and an 80 mm 22G needle (Sonoplex, Pajunk, Geisingen, Germany) were used for the procedure. The needle was inserted in-plane from medial to lateral and advanced until it reached the plane between the internal oblique and transversus abdominis muscles. After confirming correct needle placement, 15 mL of 0.25% bupivacaine was injected. The same procedure was then performed on the contralateral side.

In Group I, 30 mL of 0.25% bupivacaine was infiltrated into the four trocar sites prior to trocar placement. The same experienced surgeon performed local anesthetic infiltration.

In this study, 3 mL blood samples were obtained from patients before induction of anesthesia (T1) and 24 hours postoperatively (T2). TDH and IMA levels were analyzed in the same blood samples. TDH tests were performed using the spectrophotometric assay described by Erel and Neselioglu (9), Erel and Erdoğan (10). The albumin cobalt binding test was used to evaluate IMA.

Standard Analgesia Protocol

All patients routinely received two 1 g doses of paracetamol and two 100 mg doses of tramadol in the postoperative period. Patients with a Numerical Rating Scale (NRS) pain score above 4 were administered 50 mg of dexketoprofen as a rescue analgesic.

Outcomes

The primary outcome of the study was TDH in both groups. Secondary outcomes included IMA, pain scores, and rescue analgesic consumption. Patients' pain scores on the NRS and consumption of rescue analgesics were assessed at 0, 2, 4, 8, 12, and 24 hours.

Statistical Analysis

SPSS 21.0 was used in the study. Shapiro-Wilk test (for normality), Student's t-test (for continuous, normally distributed variables), Mann-Whitney U test (for non-normally distributed variables), and chi-square test (for categorical variables) were used. The sample size was calculated using G*Power based on data from a preliminary study. A total of 10 patients were included in the preliminary study, with 5 patients in each group. Data from these patients were not included in the main study analysis. In the preliminary study, NT (mean±standard deviation) was 320.08±4.53 in Group T and 316.50±4.78 in Group I. Using alpha=0.05, beta=0.20, and effect size=0.76, the minimum required sample size was calculated to be 56.70 patients were included to allow for dropouts.

RESULTS

The study group consisted of patients who underwent laparoscopic TAH-BSO between July 15, 2023, and December 15, 2023 (Figure 1). Demographic characteristics and comorbidities were similar across groups (Table 1). The mean surgical durations for Group T and Group I were 122.33±16.38 minutes and 120.17±10.54 minutes, respectively (p=0.545) (Table 1). Mean arterial pressure was recorded intraoperatively at 0, 30, 60, and 90 minutes. In Group T, these values were 92.10±4.50, 87.23±4.43, 85.97±3.78, and 86.57±3.90, respectively. In Group I, the values were 91.77±4.77, 86.80±4.07, 87.00±3.23, and 87.07±2.91. Mean arterial pressure was similar between groups during the intraoperative period (p>0.05). Remifentanil consumption was found to be 0.74±0.15 mg in Group T and 0.80±0.16 mg in Group I (p=0.207) (Table 1). Preoperative TDH values were similar across groups (Table 2). During the postoperative period, the values of DT/NT, DT/TT, and IMA were lower in Group T, while NT, TT, and the NT/TT ratio were higher in Group T (Table 2). In Group T, thiol values in T1 and T2 were similar (p>0.05). In Group I, we observed decreases in NT, TT, and the NT/TT ratio, and increases in DT/NT, DT/TT, and IMA at T2 compared with T1 (Table 2). We found lower NRS scores in Group T at 0, 2, and 4 hours (Table 3). The time to first rescue analgesic was 135.83±30.45 minutes in Group T and 91.67±27.92 minutes in Group I (p<0.001). Total dexketoprofen consumption as a rescue analgesic was 58.33±18.95 mg in Group T and 76.66±31.44 mg in Group I (Table 3).

DISCUSSION

In this study, we investigated the effect of TAP block on TDH and postoperative pain in laparoscopic gynecological surgery. Our results demonstrated that the group receiving the TAP block had higher NT, TT, and NT/TT values, whereas DT/NT and DT/TT ratios and IMA levels were lower. Additionally, the TAP block group had lower pain scores at 0, 2, and 4 hours postoperatively. TDH values in the TAP block group remained stable between the preoperative and 24-hour postoperative time points. In contrast, the group that did not receive the TAP block exhibited decreases in NT, TT, and NT/TT ratios, accompanied by increases in DT/NT and DT/TT ratios and in IMA levels in the postoperative period compared with the preoperative period.

Omür et al. (16) compared combined epidural anaesthesia with general anaesthesia in caesarean section surgeries. They found higher IMA values and increased oxidative stress in patients receiving general anesthesia. Another study that examined the effects of spinal and general anaesthesia on TDH reported similar NT and TT values but lower DT values in the spinal anaesthesia, suggesting reduced oxidative stress in patients who received spinal anaesthesia (17). Furthermore, a study comparing the effects of interscalene block with general anaesthesia in shoulder arthroscopy found higher NT and TT values in patients receiving interscalene block (18). In alignment with these findings, this study demonstrated that patients who received the TAP block had higher levels of NT, TT and NT/TT ratios, while DT/NT, DT/TT ratios and IMA levels were lower compared to another group. We suggest that the changes in TDH observed in our study indicate that

Table 1. Demographic and clinic characteristic

	Group T (n=30)	Group I (n=30)	p-value
Age (year)	50.43±10.87	51.70±11.88	0.668
BMI (kg/m^2)	26.38±3.11	27.41±3.05	0.201
ASA score (n)			
I	5	6	0.739
II	25	24	
Surgery time (minute)	120.17±10.54	122.33±16.38	0.545
Comorbidity (n)			
Asthma	3	6	0.278
Coronary artery disease	4	2	0.389
Diabetes mellitus	3	4	0.688
Hypertension	7	6	0.754
Rheumatological disease	5	4	0.718
Psychiatric disease	2	4	0.389
Thyroid disease	6	8	0.542
Remifentanil consumption (mg)	0.74±0.15	0.80±0.16	0.207

Values are presented as mean±standard deviation and numbers
n: Number, BMI: Body mass index, ASA: American Society of Anesthesiologists

Table 2. Thiol/disulphide redox states according to groups and times

Parameter	Group T	p*	Group I	p*	p#
Native thiol, µmol/L					
Preoperative	333.78±79.81	0.793	333.15±84.03	**0.017**	0.976
Postoperative	328.88±62.80		278.42±87.88		**0.013**
Total thiol, µmol/L					
Preoperative	383.47±86.60	0.620	380.48±85.35	**0.026**	0.891
Postoperative	373.90±64.43		327.27±95		**0.03**
Disulphide, µmol/L					
Preoperative	24.84±4.81	0.051	23.65±4.20	0.504	0.313
Postoperative	22.51±4.27		24.42±4.63		0.101
Native thiol/total thiol					
Preoperative	86.55±2.88	0.138	86.91±3.72	**0.007**	0.673
Postoperative	87.65±2.78		84.03±4.27		**<0.001**
Disulphide/native thiol					
Preoperative	7.80±1.91	0.146	7.63±2.59	**0.01**	0.771
Postoperative	7.09±1.80		9.66±3.29		**<0.001**
Disulphide/total thiol					
Preoperative	6.70±1.44	0.150	6.53±1.86	**0.007**	0.701
Postoperative	6.17±1.39		7.98±2.13		**<0.001**
IMA					
Preoperative	0.70±0.03	0.681	0.70±0.02	**0.01**	0.622
Postoperative	0.71±0.01		0.72±0.02		**0.046**

p<0.05 was considered significant
*: Intra-group preoperative and postoperative values were compared, #: Values between groups were compared, IMA: Ischemia-modified albumin

Table 3. Pain scores and analgesic consumption

	Group T (n=30)	Group I (n=30)	p-value
NRS			
0	3 (4)	5 (5)	**<0.001**
2	3 (2)	3 (3)	**0.035**
4	2 (2)	3 (2)	**<0.001**
8	2 (2)	2 (2)	0.998
12	1 (3)	2 (2)	0.799
24	1 (2)	1 (2)	0.998
Rescue time (minute)	135.83±30.45	91.67±27.92	**<0.001**
Rescue analgesic consumption (Dexketoprofen, mg)	58.33±18.95	76.66±31.44	**0.009**

p<0.05 was considered significant
NRS: Numerical rating scale

the TAP block, when combined with general anaesthesia, effectively mitigates oxidative damage caused by surgical trauma. Acute pain resulting from surgical trauma induces a neuroendocrine stress response, leading to increased sympathetic activity, inflammation, and oxidative stress (14,19). It has been reported that poorly managed postoperative pain is associated with elevated oxidative stress (20). In patients who received a TAP block, lower pain scores observed in the early postoperative period suggest a more effective attenuation of the neuroendocrine stress response to surgery, which we believe contributed to the lower levels of oxidative stress.

Enhanced recovery after surgery (ERAS) protocols are evidence-based, multidisciplinary care pathways developed to accelerate postoperative recovery. Key components such as early mobilization, opioid-sparing analgesia, and attenuation of the inflammatory and oxidative stress responses to surgical trauma aim to reduce complications (21). Increased oxidative stress has been associated with a higher risk of infections, delayed wound healing, pulmonary complications such as acute respiratory distress syndrome, acute kidney injury, and postoperative delirium (22). Lower oxidative stress levels in patients undergoing oesophageal surgery have been associated with fewer postoperative complications and shorter hospital stays (23). Furthermore, the role of oxidative stress in the pathophysiology of sepsis has been well documented (24). Given these associations, we believe it is crucial to explore treatment strategies aimed at reducing oxidative stress.

Both TAP block and local anesthetic infiltration are commonly used techniques with proven analgesic efficacy in abdominal surgeries. The use of both methods is recommended within ERAS protocols as part of a multimodal analgesic approach (21). Several studies in the literature have reported comparable analgesic efficacy between TAP block and local anesthetic infiltration (25,26) Grape et al. (27) reported in a meta-analysis that TAP block provides superior analgesic efficacy compared with local anesthetic infiltration. Additionally, in a study involving patients undergoing laparoscopic gastric bypass surgery, the TAP block was associated with lower pain scores, reduced opioid consumption, and shorter hospital stays compared with trocar-site infiltration (28). In this study, patients who received the TAP block demonstrated lower pain scores and required less rescue analgesia at 0, 2, and 4 hours postoperatively. We believe that the similarity in pain scores at later time points may be attributable to the use of additional analgesics by patients who did not receive the TAP block. Although the literature reports conflicting results regarding the analgesic efficacy of TAP block versus trocar site infiltration, our findings suggest that TAP block provides superior analgesia compared with trocar site infiltration.

Study Limitations

This study has some limitations. First, we did not assess oxidative stress levels or pain scores beyond the 24-hour postoperative period. Consequently, we were unable to evaluate the long-term effects of oxidative stress and pain, including potential postoperative complications attributable to the former. Another limitation was that only patients who underwent surgery performed by a single surgical team using a single technique were included in the study, thereby precluding evaluation of other surgical techniques.

CONCLUSION

We found that the combination of TAP block with general anaesthesia effectively reduced both oxidative stress and postoperative pain. We believe that optimal management of postoperative pain reduces oxidative stress levels. Furthermore, we suggest that oxidative stress be further investigated across various surgical procedures and anaesthesia techniques.

ETHICS

Ethics Committee Approval: This single-centre, randomised controlled study complied with the ethical standards of the Declaration of Helsinki. Approval for the study was obtained from the Ethics Committee of University of Health Sciences Türkiye, Ankara Etlik City Hospital No. 1 Clinical Research (approval no: 037, date: 05.04.2023).

Informed Consent: Written informed consent was obtained from all the participants.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: Y.Ö., S.A., G.K., J.E., C.H., İ.Ö., Concept: Y.Ö., S.A., G.K., J.E., İ.Ö., G.O., Ö.E., Design: Y.Ö., S.A., G.K., C.H., İ.Ö., G.O., Ö.E., Data Collection or Processing: Y.Ö., J.E., C.H., İ.Ö., G.O., Ö.E., Analysis or Interpretation: Y.Ö., G.K., J.E., İ.Ö., G.O., Ö.E., Literature Search: Y.Ö., S.A., G.K., C.H., İ.Ö., Writing: Y.Ö., S.A., G.K., J.E., C.H., G.O.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Sao CH, Chan-Tiopianco M, Chung KC, Chen YJ, Horng HC, Lee WL, et al. Pain after laparoscopic surgery: focus on shoulder-tip pain after gynecological laparoscopic surgery. J Chin Med Assoc. 2019;82:819-26.
2. Chen YK, Boden KA, Schreiber KL. The role of regional anaesthesia and multimodal analgesia in the prevention of chronic postoperative pain: a narrative review. Anaesthesia. 2021;76(Suppl 1):8-17.
3. Baeriswyl M, Kirkham KR, Kern C, Albrecht E. The analgesic efficacy of ultrasound-guided transversus abdominis plane block in adult patients: a meta-analysis. Anesth Analg. 2015;121:1640-54.
4. Turell L, Radi R, Alvarez B. The thiol pool in human plasma: the central contribution of albumin to redox processes. Free Radic Biol Med. 2013;65:244-53.
5. Sen CK, Packer L. Thiol homeostasis and supplements in physical exercise. Am J Clin Nutr. 2000;72(2 Suppl):653S-69S.
6. Shevtsova A, Gordiienko I, Tkachenko V, Ushakova G. Ischemia-modified albumin: origins and clinical implications. Dis Markers. 2021;2021:9945424.
7. Ileri I, Eren F, Neselioglu S, Hafızoglu M, Karaduman D, Atbas C, et al. The role of thiol-disulfide homeostasis and ischemia-modified albumin in osteosarcopenia. Ir J Med Sci. 2024;193:2109-14.
8. Akunal C, Alisik M. Deteriorated thiol-disulphide and oxidized-reduced glutathione status in blood in Alzheimer's disease. Clin Biochem. 2024;133-134:110817.
9. Erel O, Neselioglu S. A novel and automated assay for thiol/disulphide homeostasis. Clin Biochem. 2014;47:326-32.
10. Erel Ö, Erdoğan S. Thiol-disulfide homeostasis: an integrated approach with biochemical and clinical aspects. Turk J Med Sci. 2020;50:1728-38.
11. Kuosmanen V, Saimanen I, Rahkola D, Kärkkäinen J, Selander T, Purdy M, et al. Rectus sheath block (RSB) analgesia could enhance significantly the patient satisfaction following midline laparotomy in benign disease and in cancer: a prospective study with special reference to nitrosative stress marker nitrotyrosine (NT) plasma concentrations. Anticancer Res. 2019;39:1383-9.
12. Purdy M, Kärkkäinen J, Kokki M, Anttila M, Aspinen S, Juvonen P, et al. Does rectus sheath block analgesia alter levels of the oxidative stress biomarker glutathione peroxidase: a randomised trial of patients with cancer and benign disease. Anticancer Res. 2017;37:897-902.

13. Liu D, Liu H, Wu J, Gong B. Effects of thoracic paravertebral blockon inflammatory response, stress response, hemodynamics and anesthesia resuscitation in gallbladder carcinoma. Cell Mol Biol (Noisy-le-grand). 2022;68:171-7.
14. Kim R, Kawai A, Wakisaka M, Kin T. Current status and prospects of anesthesia and breast cancer: does anesthetic technique affect recurrence and survival rates in breast cancer surgery? Front Oncol. 2022;12:795864.
15. McGarry T, Biniecka M, Veale DJ, Fearon U. Hypoxia, oxidative stress and inflammation. Free Radic Biol Med. 2018;125:15-24.
16. Omür D, Hacivelioglu SÖ, Oguzalp H, Uyan B, Kiraz HA, Duman C, et al. The effect of anaesthesia technique on maternal and cord blood ischaemia-modified albumin levels during caesarean section: a randomized controlled study. J Int Med Res. 2013;41:1111-9.
17. Akin F, Kozanhan B, Deniz CD, Sahin O, Goktepe H, Neselioglu S, et al. Effects of the anesthesia technique used during cesarean section on maternal-neonatal thiol disulfide homeostasis. Minerva Anestesiol. 2019;85:1175-83.
18. Oksuz M, Abitagaoglu S, Kaciroglu A, Koksal C, Ozturk BY, Erel O, et al. Effects of general anaesthesia and ultrasonography-guided interscalene block on pain and oxidative stress in shoulder arthroscopy: a randomised trial. Int J Clin Pract. 2021;75:e14948.
19. Schlereth T, Birklein F. The sympathetic nervous system and pain. Neuromolecular Med. 2008;10:141-7.
20. Savic Vujovic K, Zivkovic A, Dozic I, Cirkovic A, Medic B, Srebro D, et al. Oxidative stress and inflammation biomarkers in postoperative pain modulation in surgically treated patients with laryngeal cancer-pilot study. Cells. 2023;12:1391.
21. Nelson G, Fotopoulou C, Taylor J, Glaser G, Bakkum-Gamez J, Meyer LA, et al. Enhanced recovery after surgery (ERAS®) society guidelines for gynecologic oncology: addressing implementation challenges-2023 update. Gynecol Oncol. 2023;173:58-67.
22. Toro-Pérez J, Rodrigo R. Contribution of oxidative stress in the mechanisms of postoperative complications and multiple organ dysfunction syndrome. Redox Rep. 2021;26:35-44.
23. Tsuchiya M, Shiomoto K, Mizutani K, Fujioka K, Suehiro K, Yamada T, et al. Reduction of oxidative stress a key for enhanced postoperative recovery with fewer complications in esophageal surgery patients: randomized control trial to investigate therapeutic impact of anesthesia management and usefulness of simple blood test for prediction of high-risk patients. Medicine (Baltimore). 2018;97:e12845.
24. Prauchner CA. Oxidative stress in sepsis: pathophysiological implications justifying antioxidant co-therapy. Burns. 2017;43:71-485.
25. El Hachem L, Small E, Chung P, Moshier EL, Friedman K, Fenske SS, et al. Randomized controlled double-blind trial of transversus abdominis plane block versus trocar site infiltration in gynecologic laparoscopy. Am J Obstet Gynecol. 2015;212:182.e1-9.
26. Coşkun M, Yardimci S, Arslantaş MK, Altun GT, Uprak TK, Kara YB, et al. Subcostal transversus abdominis plane block for laparoscopic sleeve gastrectomy, is it worth the time? Obes Surg. 2019;29:3188-94.
27. Grape S, Kirkham KR, Akiki L, Albrecht E. Transversus abdominis plane block versus local anesthetic wound infiltration for optimal analgesia after laparoscopic cholecystectomy: a systematic review and meta-analysis with trial sequential analysis. J Clin Anesth. 2021;75:110450.
28. Ruiz-Tovar J, Garcia A, Ferrigni C, Gonzalez J, Levano-Linares C, Jimenez-Fuertes M, et al. Laparoscopic-guided transversus abdominis plane (TAP) block as part of multimodal analgesia in laparoscopic roux-en-y gastric bypass within an enhanced recovery after surgery (ERAS) program: a prospective randomized clinical trial. Obes Surg. 2018;28:3374-9.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):79-83
DOI: 10.4274/BMJ.galenos.2025.2025.5-12

Research

Endometrial Sampling Outcomes in A Tertiary Care Centre: October 2023-October 2024

Üçüncü Basamak Bir Sağlık Merkezindeki Endometrial Örnekleme Sonuçları: Ekim 2023-Ekim 2024

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ABSTRACT

Objective: We evaluated the association between pathological findings, menopausal status, and indications for endometrial biopsy.

Methods: We included 931 patients who underwent endometrial biopsy for various gynaecological indications at our clinic between October 2023-October 2024. Medical data were retrieved from patient records. Patients were evaluated according to age, menopausal status (premenopausal or postmenopausal), endometrial thickness, biopsy indication, and pathological findings. Pathological findings were compared across biopsy indications and menopausal status.

Results: The mean age of patients was 47.1±9.1 years, and the mean endometrial thickness was 9.8±5.2 mm. Of the total, 695 (74.7%) were premenopausal and 236 (25.3%) were postmenopausal. Menometrorrhagia was the most common indication for biopsy (32.8%) and endometrial polyps were the most frequent histopathological finding (32%). Of the 15 patients diagnosed with malignancy, 2 underwent biopsy for menometrorrhagia and 13 for postmenopausal bleeding; these correspond to 0.7% and 5.7% of the total cohort, respectively. Secretory endometrium, proliferative endometrium, and endometrial polyps were significantly more common in premenopausal women ($p<0.001$), whereas malignancy and endometrial atrophy were significantly more common in postmenopausal women ($p<0.001$).

Conclusion: Because endometrial cancer is more prevalent in older women, malignancy should be considered in the histopathological evaluation of endometrial samples obtained from women with postmenopausal bleeding.

Keywords: Endometrial biopsy, endometrial cancer, malignancy, postmenopausal, endometrial sampling, histopathological diagnosis

ÖZ

Amaç: Endometrial biyopsi endikasyonları ile patoloji sonuçlarının menopozal durum ile ilişkisini araştırmaktır.

Gereç ve Yöntem: Bu çalışmaya Ekim 2023-Ekim 2024 tarihleri arasında kliniğimize başvurmuş farklı jinekolojik endikasyonlarla endometrial biyopsi yapılmış 931 hasta dahil edildi. Tıbbi veriler hasta dosyalarından elde edildi. Hastalar yaş, menopoz durumu (premenopoz/postmenopoz), endometrial kalınlık, biyopsi endikasyonları ve patoloji sonuçları açısından incelendi. Hastaların patoloji sonuçları; endometrial biyopsi endikasyonları ve menopozal durum ile karşılaştırıldı.

Bulgular: Hastaların yaş ortalaması 47,1±9,1; endometrial kalınlık ortalaması 9,8±5,2 mm idi. Hastaların 695'i (%74,7) premenopoz, 236'sı (%25,3) postmenopozal dönemdeydi. Endometrial biyopsi endikasyonlarında en sık (%32,8) menometroraji görülürken; histopatoloji sonuçlarında en sık (%32) endometrial polip olduğu görüldü. Malign tanı görülen 15 hastanın 2'sinde (%0,7) menometroraji sebepli biyopsi yapılırken; 13'ünde (%5,7) postmenopozal kanama nedeniyle endometrial biyopsi yapıldığı gözlendi. Premenopozal dönemde sekretuar endometrium, proliferatif endometrium, endometrial polip daha sık görülürken ($p<0,001$); postmenopozal dönemde malignite ve endometrial atrofinin daha sık olduğu görüldü ($p<0,001$).

Sonuç: Endometrium kanseri ileri yaşta daha sık görüldüğü için postmenopozal kanama sebebiyle yapılan endometrial örnekleme sonuçlarında malignite ile karşılaşılabileceği akılda tutulmalıdır.

Anahtar Kelimeler: Endometrial biyopsi, endometrium kanseri, malignite, postmenopoz, endometrial örnekleme, histopatolojik tanı

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Cite as: Görgülü G, Şimşek E. Endometrial sampling outcomes in a tertiary care centre: October 2023-October 2024. Med J Bakirkoy. 2026;22(1):79-83

Received: 27.05.2025
Accepted: 02.09.2025
Publication Date: 12.03.2026

INTRODUCTION

Abnormal uterine bleeding (AUB) is defined as irregular bleeding that occurs outside the normal menstrual cycle (1). The PALM-COEIN (polyp; adenomyosis; leiomyoma; malignancy and hyperplasia; coagulopathy; ovulatory dysfunction; endometrial; iatrogenic; and not yet classified) classification system, introduced by the International Federation of Gynecology and Obstetrics in 2011, categorises the causes of AUB into structural and non-structural aetiologies (2). Haemorrhage during the postmenopausal period is a critical finding for the early diagnosis of malignancy (3). Endometrial biopsy performed in women presenting with postmenopausal bleeding detects endometrial cancer in 10-15% of cases (4). According to the American College of Obstetricians and Gynecologists 2013 guidelines, endometrial biopsy is recommended in women aged >45 years presenting with AUB and in women under 45 years with unopposed oestrogen exposure, to exclude underlying malignancies (5).

Endometrial sampling is commonly used for histopathological diagnosis of AUB, a frequent gynaecological presentation during the perimenopausal and postmenopausal periods (6). Sampling techniques include aspiration biopsy, hysteroscopy-guided biopsy, and dilatation and curettage (7). In contrast, an endocervical brush or endocervical curettage is used to diagnose endocervical cancer, another cause of abnormal bleeding (8).

We evaluated the associations among indications for endometrial biopsy, pathological findings, and menopausal status.

METHODS

This retrospective study included 931 patients who underwent an endometrial biopsy for various gynaecological indications between October 2023-October 2024. Seven patients were excluded due to insufficient biopsy specimens. Medical data were retrieved from patient records.

After comprehensive gynaecological examination and detailed history-taking, written informed consent was obtained, and an endometrial biopsy was performed. Biopsies were conducted either in the operating theatre under general anaesthesia or in the outpatient clinic using a paracervical block and a Karman cannula.

Indications for endometrial sampling included menometrorrhagia, menorrhagia, increased endometrial thickness, uterine myoma, and postmenopausal bleeding. Histopathological findings from endometrial biopsies were categorised as endometrial polyp, secretory endometrium, proliferative endometrium, endometrial intraepithelial neoplasia (EIN), endometrial hyperplasia (EH) without atypia, endometrial malignancy, and endometrial atrophy. Patients were analysed according to age, menopausal status (premenopausal or postmenopausal), endometrial thickness, biopsy indications, and pathological outcomes. Associations between pathological findings, biopsy indications, and menopausal status were evaluated.

Ethics Committee

The University of Health Sciences Türkiye, Gaziantep City Hospital Non-Interventional Clinical Research Ethics Committee approved the study protocol (approval no: 91/2024, date: 18.12.2024). The study was conducted in accordance with the Declaration of Helsinki and the principles of good clinical practice.

Statistical Analysis

Statistical analyses were performed using SPSS (version 22.0; IBM Corp., Armonk, NY, USA). Parametric data were compared using the independent t-test, whereas categorical variables were analysed using Pearson's chi-square test or Fisher's exact test, as appropriate. Categorical variables are presented as numbers and percentages, whereas continuous variables are expressed as mean±standard deviation. P-values <0.05 were considered statistically significant.

RESULTS

We included 931 patients with a mean age of 47.1±9.1 years and mean endometrial thickness of 9.8±5.2 mm. Of these patients, 695 (74.7%) were premenopausal and 236 (25.3%) were postmenopausal. Indications for endometrial biopsy included menometrorrhagia in 305 (32.8%) patients, menorrhagia in 298 (32.0%), postmenopausal bleeding in 229 (24.6%), increased endometrial thickness in 75 (8.1%), and uterine leiomyoma in 24 (2.6%).

Histopathological analysis revealed: endometrial polyps in 298 (32.0%) patients, secretory endometrium in 262 patients (28.1%), atrophic endometrium in 171 patients (18.4%), proliferative endometrium in 168 patients (18.0%), malignancy in 15 patients (1.6%), EH without atypia in 11 patients (1.2%), and EIN in 6 patients (0.6%) (Table 1).

When histopathological findings were analyzed by biopsy indication, endometrial polyp was the most frequent diagnosis among patients biopsied for menorrhagia. Secretory endometrium was the predominant finding in biopsies performed for menometrorrhagia, whereas an endometrial polyp was the most common diagnosis in biopsies performed for increased endometrial thickness.

Endometrial atrophy was the leading diagnosis among patients with postmenopausal bleeding and among those with myoma uteri. Of the 15 patients diagnosed with malignancy, 2 (0.7%) underwent biopsy for menometrorrhagia and 13 (5.7%) for postmenopausal bleeding (Table 2).

Analysis of biopsy results stratified by menopausal status revealed that proliferative endometrium, secretory endometrium, and endometrial polyps were significantly more frequent among premenopausal patients. Conversely, malignancies and endometrial atrophy were more common in the postmenopausal group, reflecting hormonal influences during the reproductive period ($p<0.001$). No significant differences were observed between premenopausal and postmenopausal groups regarding non-atypical EH and EIN ($p>0.05$; Table 3).

DISCUSSION

AUB is the most frequent presenting complaint among women attending gynaecology outpatient clinics (9). The underlying causes of AUB may be organic (e.g., fibroids, polyps, EH, and endometrial carcinoma) or systemic, hormonal, or iatrogenic (2). Consequently, in patients with AUB, endometrial biopsy is routinely performed for diagnostic purposes after a thorough history, physical examination, and ultrasonography. However, outpatient endometrial biopsy may yield false-negative results, with a reported post-test probability of 0.9% for endometrial carcinoma after a negative biopsy (10). Therefore, adequate tissue sampling is essential when performing an

Table 1. Distribution of biopsy indications and histopathological findings

		Number (n)	Percentage (%)
Indications	Menorrhagia	298	32.0
	Menometrorrhagia	305	32.8
	Endometrium thickness	75	8.1
	Postmenopausal bleeding	229	24.6
	Myoma uteri	24	2.6
Histopathological findings	Proliferative endometrium	168	18.0
	Secretory endometrium	262	28.1
	Endometrial polyp	298	32.0
	EH without atypia	11	1.2
	EIN	6	0.6
	Malignancy	15	1.6
	Endometrial atrophy	171	18.4

EH: Endometrial hyperplasia, EIN: Endometrial intraepithelial neoplasia

Table 2. Distribution of histopathological findings according to biopsy indication

	Proliferative endometrium	Secretory endometrium	Endometrial polyp	EH without atypia	EIN	Malignancy	Endometrial atrophy
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Menorrhagia	86 (28.9)	78 (26.2)	112 (37.6)	8 (2.7)	2 (0.7)	0 (0.0)	12 (4.0)
Menometrorrhagia	47 (15.4)	138 (45.2)	89 (29.2)	2 (0.7)	0 (0.0)	2 (0.7)	27 (8.9)
Endometrium thickness	9 (12.0)	16 (21.3)	44 (58.7)	1 (1.3)	1 (1.3)	0 (0.0)	4 (5.3)
Postmenopausal bleeding	20 (8.7)	25 (10.9)	49 (21.4)	0 (0.0)	3 (1.3)	13 (5.7)	119 (52.0)
Myoma uteri	6 (25.0)	5 (20.8)	5 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	9 (37.5)

EH: Endometrial hyperplasia, EIN: Endometrial intraepithelial neoplasia

Table 3. Histopathological findings according to menopausal status

	Premenopausal	Postmenopausal	p-value
	n=695 (%)	n=236 (%)	
Proliferative endometrium	147 (21.2)	21 (8.9)	**<0.001**
Secretory endometrium	237 (34.1)	25 (10.6)	**<0.001**
Endometrial polyp	245 (35.3)	53 (22.5)	**<0.001**
EH without atypia	11 (1.6)	0 (0.0)	>0.05
EIN	3 (0.4)	3 (1.3)	>0.05
Malignancy	2 (0.3)	13 (5.5)	**<0.001**
Endometrial atrophy	50 (7.2)	121 (51.3)	**<0.001**

EH: Endometrial hyperplasia, EIN: Endometrial intraepithelial neoplasia

endometrial biopsy (11). We retrospectively analysed the histopathological findings of 931 patients who underwent endometrial biopsy for various gynaecological indications, aiming to elucidate the relationships among menopausal status, biopsy indications, and these findings.

In our study, endometrial polyps were the most frequent histopathological finding, identified in 298 patients (32%), consistent with previous studies (12). Similarly, Öz and Kalelioğlu (13), Çintesun et al. (14), and Aker et al. (15) reported prevalences of 37.9%, 53.5%, and 33.3%, respectively. In our study, endometrial polyps were observed more frequently in the premenopausal group. Although previous studies have reported higher prevalence in premenopausal women, none have demonstrated statistically significant differences (15,16). In our study, proliferative and secretory endometrium were observed in 18% and 28.1% of patients, respectively, and were both significantly more frequent in the premenopausal group. In contrast, previous studies have reported rates of 72.8% and 63% for proliferative and secretory endometrium, respectively (17,18). This discrepancy is likely related to hormonal influences during the reproductive period.

In our study, endometrial atrophy was observed in 18.4% of patients and was significantly more frequent in the postmenopausal group. In contrast, Turhan Çakır et al. (16) reported a prevalence of 8.8%. Notably, the higher frequency of endometrial atrophy in the postmenopausal period is likely attributable to ovarian dysfunction. The presence of atypia in EH is recognised as a risk factor for progression to endometrial carcinoma (19). In our study, the prevalences of EH and EIN without atypia were 1.2% and 0.6%, respectively, with no significant association with menopausal status. In a study of EH patients, atypia was reported in 17 (22.9%) patients (20).

After colorectal, lung, and breast cancers, endometrial cancer is the most common gynaecological malignancy in women; increasing age is one of its most important risk factors (21). In our study, malignancy was observed in 15 patients (1.6%), with a significantly higher prevalence in the postmenopausal group. Of these, biopsies were performed in 2 patients for menometrorrhagia and in 13 patients for postmenopausal bleeding. Although malignancy has been reported in approximately 10% of biopsies performed for postmenopausal bleeding (22), the corresponding rate in our cohort was 5.7%. The higher prevalence of malignancy in the postmenopausal group is likely related to advancing age.

Study Limitations

The limitations of our study include its retrospective design, the unavailability of data on body mass index and comorbidities, and the lack of information regarding patients' treatment status. A key strength is the large sample size, which enhances the reliability of the findings.

CONCLUSION

In conclusion, because endometrial cancer is more prevalent in older women, endometrial sampling should be performed in all individuals presenting with postmenopausal bleeding, with the understanding that histopathological examination may detect malignancy.

ETHICS

Ethics Committee Approval: The University of Health Sciences Türkiye, Gaziantep City Hospital Non-Interventional Clinical Research Ethics Committee approved the study protocol (approval no: 91/2024, date: 18.12.2024). The study was conducted in accordance with the Declaration of Helsinki and the principles of good clinical practice.

Informed Consent: Written informed consent was obtained.

FOOTNOTES

Authorship Contributions

Concept: G.G., Design: G.G., Data Collection or Processing: E.Ş., Analysis or Interpretation: E.Ş., Literature Search: G.G., Writing: G.G.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Doraiswami S, Johnson T, Rao S, Rajkumar A, Vijayaraghavan J, Panicker VK. Study of endometrial pathology in abnormal uterine bleeding. J Obstet Gynaecol India. 2011;61:426-30.
2. Munro MG, Critchley HO, Broder MS, Fraser IS; FIGO Working Group on Menstrual Disorders. FIGO classification system (PALM-COEIN) for causes of abnormal uterine bleeding in nongravid women of reproductive age. Int J Gynaecol Obstet. 2011;113:3-13.
3. Sorosky JI. Endometrial cancer. Obstet Gynecol. 2008;111:436-47.
4. Mahajan N, Aggarwal M, Bagga A. Health issues of menopausal women in North India. J Midlife Health. 2012;3:84-7.
5. Committee on Practice Bulletins-Gynecology. Practice bulletin no. 128: diagnosis of abnormal uterine bleeding in reproductive-aged women. Obstet Gynecol. 2012;120:197-206.
6. Antoni J, Folch E, Costa J, Foradada CM, Cayuela E, Combalia N, et al. Comparison of cytospat and pipelle endometrial biopsy instruments. Eur J Obstet Gynecol Reprod Biol. 1997;72:57-61.

7. Yılmaz N, Öztürk İnal Z, Hançerlioğulları N, İnal HA. *In vitro* fertilizasyon öncesi infertilitenin değerlendirilmesinde ofis histeroskopinin kullanılabilirliği [The usefullness of office hysteroscopy in evaluation of infertil women prior to *in vitro* fertilization cycles]. J Clin Obstet Gynecol. 2016;26:13-7.
8. Bestel M, Erdem B, Bestel A, Karaaslan O. Agreement between endocervical brush and endocervical curettage in the diagnosis of cervical cancer. East J Med. 2019;24:86-90.
9. Kjerulff KH, Erickson BA, Langenberg PW. Chronic gynecological conditions reported by US women: findings from the National Health Interview Survey, 1984 to 1992. Am J Public Health. 1996;86:195-9.
10. Taraboanta C, Britton H, Plotkin A, Azordegan N, Clement PB, Gilks CB. Performance characteristics of endometrial sampling in diagnosis of endometrial carcinoma. Int J Gynecol Pathol. 2020;39:19-25.
11. Vitale SG, Buzzaccarini G, Riemma G, Pacheco LA, Di Spiezio Sardo A, Carugno J, et al. Endometrial biopsy: indications, techniques and recommendations. An evidence-based guideline for clinical practice. J Gynecol Obstet Hum Reprod. 2023;52:102588.
12. Bakour SH, Khan KS, Gupta JK. The risk of premalignant and malignant pathology in endometrial polyps. Acta Obstet Gynecol Scand. 2000;79:317-20.
13. Öz ME, Kalelioğlu MB. Tokat ili 2020 yılı endometrial biyopsi sonuçlarının analizi [Tokat province endometrial biopsy results' analyse in 2020 year]. Gaziosmanpaşa Tıp Dergisi. 2021;12:120-4.
14. Çintesun E, Çintesun FN, Aslan BK, Uçar MG, Yarıkkaya E. Endometrial örnekleme sonuçlarımız: 655 olgunun analizi [Results of our endometrial samplings: analysis of 655 cases]. Jinek Obstet Neonatol Tıp Derg. 2017;14:56-9.
15. Aker SŞ, Yüce T, Acar D, Atabekoğlu CS. Endometrial sampling results of women evaluated for abnormal uterine bleeding: a retrospective analysis of 765 women. Cukurova Med J. 2015;40:306-10.
16. Turhan Çakır A, Öz İŞ, Ün B. Endometrial örnekleme sonuçlarımız: 365 olgunun analizi [Results of our endometrial samplings: analysis of 365 cases]. Bozok Tıp Derg. 2020;10:28-32.
17. Kucur S, Şencan H, Yüksel K, Gözükara İ, Keskin N, Seven A, et al. Endometrial örnekleme sonuçlarımız: 744 olgunun analizi [Evaluation of endometrial biopsy results in our clinic; analysis of 744 cases]. Zeynep Kamil Tıp Bülteni. 2014;45:146-50.
18. Jetley S, Rana S, Jairajpuri ZS. Morphological spectrum of endometrial pathology in middle-aged women with atypical uterine bleeding: a study of 219 cases. J Midlife Health. 2013;4:216-20.
19. Kurman RJ, Kaminski PF, Norris HJ. The behavior of endometrial hyperplasia. A long-term study of "untreated" hyperplasia in 170 patients. Cancer. 1985;56:403-12.
20. Demir B, Kılınç N, Güven ES dağ, Güven S, Gül T. Endometrial hiperplazi olgularının değerlendirilmesi. TRSGO Dergisi. 2006;9:14-8.
21. Colombo N, Creutzberg C, Amant F, Bosse T, González-Martín A, Ledermann J, et al.; ESMO-ESGO-ESTRO Endometrial Consensus Conference working group. ESMO-ESGO-ESTRO Consensus Conference on endometrial cancer: diagnosis, treatment and follow-up. Ann Oncol. 2016;27:16-41. Erratum in: Ann Oncol. 2017;28(Suppl 4):iv167-8.
22. Inal ZO, Inal HA, Kucukosmanoglu I, Kucukkendirci H. Assessment of endometrial sampling and histopathological results: analysis of 4,247 cases. Eurasian J Med. 2017;49:44-7.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):84-90
DOI: 10.4274/BMJ.galenos.2025.2025.6-6

Research

The Effect of Various Pacing Modes on Microvolt T-Wave Alternans in Patients Receiving Cardiac Resynchronization Therapy

Kardiyak Resenkronizasyon Tedavisi Alan Hastalarda Çeşitli Kalp Pili Modlarının Mikrovolt T-Dalgası Alternansı Üzerindeki Etkisi

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ABSTRACT

Objective: Microvolt T-wave alternans (MTWA) test is a non-invasive method for risk assessment before sudden cardiac death and malignant ventricular tachycardia. Cardiac resynchronization therapy (CRT) is effective in improving left ventricular (LV) systolic function and cardiac electrical activity. The present study investigates the effect of various pacemaker stimulation modes on MTWA in patients receiving CRT.

Methods: The study included 35 patients who received CRT. MTWA was measured in LV, right ventricular (RV), biventricular (BV), and right atrial (RA) modes at 6±2 months after CRT implementation. MTWA results were classified as negative or non-negative. Positive and indeterminate results were considered non-negative. Continuous variables were expressed as mean±standard deviation, and Cohen's kappa statistic was used to compare various pacing modes, with analyses conducted in SPSS at a significance level of $p<0.05$.

Results: RA pacing was concordant with RV pacing in 27 (76.2%) patients (kappa=0.509; p=0.001); with LV pacing in 23 (65.7%) patients (kappa=0.263; p=0.094); and with BV pacing in 26 (74.3%) patients (kappa=0.463; p=0.003). The positive and negative predictive values of results obtained during RA pacing for predicting similar results obtained during RV pacing were 73.1% and 88.9%, respectively; for LV pacing, 65.4% and 66.7%, respectively; and for BV pacing, 69.2% and 88.9%, respectively. We did not find any differences in non-negative MTWA results across different pacing modes with respect to types of cardiomyopathies, statin or amiodarone treatment, and presence or absence of diabetes mellitus or hypertension.

Conclusion: Similar results are achieved when comparing the MTWA results following RA, LV, RV, and BV pacemaker stimulations in patients receiving CRT.

Keywords: Cardiac resynchronization, biventricular pacemaker, microvolt T-wave alternans

ÖZ

Amaç: Mikrovolt T-dalgası değişim testi (MTDDT) ani kardiyak ölüm ve tehlikeli ventriküler taşikardiden önce risk değerlendirmesi için kullanılan girişimsel olmayan bir yöntemdir. Kardiyak resenkronizasyon tedavisi (KRT) sol ventrikül (SV) sistolik fonksiyonunu iyileştirmede ve kardiyak elektriksel aktivite üzerinde etkilidir. Bu çalışmada yer alan hastalarda çeşitli kalp pili stimülasyon modlarının MTDDT üzerindeki etkisi araştırılmıştır.

Gereç ve Yöntem: Çalışmaya KRT alan 35 hasta dahil edilmiştir. MTDDT, KRT uygulamasından 6±2 ay sonra SV, sağ ventrikül (SaV), biventriküler (BV) ve sağ atriyal (SaA) modları aracılığıyla ölçülmüştür. MTDDT sonuçları negatif ve negatif olmayan olarak değerlendirilmiştir. Pozitif ve belirsiz sonuçlar toplu olarak negatif olmayan olarak değerlendirilmiştir. Sürekli değişkenler ortalama±standart sapma olarak ifade edilmiş ve çeşitli kalp pili modlarını karşılaştırmak için Cohen'in kappa istatistikleri kullanılmış ve analizler SPSS'de $p<0,05$ anlamlılık düzeyinde gerçekleştirilmiştir.

Bulgular: SaA uyarımı 27 (%76,2) hastada SaV uyarımı ile (kappa=0,509; p=0,001), 23 (%65,7) hastada SV uyarımı ile (kappa=0,263; p=0,094) ve 26 (%74,3) hastada BV uyarım ile (kappa=0,463; p=0,003) uyumluydu. SaA uyarımı sırasında elde edilen sonuçların SaV uyarımı sırasında elde edilen benzer sonuçlar için pozitif ve negatif öngörü değerleri sırasıyla %73,1 ve %88,9; SV uyarımı için sırasıyla %65,4 ve %66,7; BV uyarım için

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Cite as: Erciyes D, Gülbaran M, Yıldız C, Yazıcıoğlu N. The effect of various pacing modes on microvolt T-wave alternans in patients receiving cardiac resynchronization therapy. Med J Bakirkoy. 2026;22(1):84-90

Received:25.06.2025
Accepted: 21.09.2025
Publication Date: 12.03.2026

ÖZ

sırasıyla %69,2 ve %88,9 olarak bulundu. Farklı kalp pili modlarında, kardiyomiyopati tipleri, statin, amiodaron tedavisi, diyabetli ve diyabetsiz veya hipertansiyonlu hastalar açısından negatif olmayan MTDDT sonuçlarında herhangi bir fark bulunmadı.

Sonuç: KRT alan hastalarda SaA, SV, SaV ve BV kalp pili uyarılarını takiben MTDDT sonuçları karşılaştırıldığında benzer sonuçlar elde edilmiştir.

Anahtar Kelimeler: Kardiyak resenkronizasyon, biventriküler kalp pili, mikrovolt T-dalgası alternansı

INTRODUCTION

Cardiac resynchronization therapy (CRT) is recommended as the first choice for patients with severe left ventricular (LV) dysfunction [LV ejection fraction (LVEF) ≤35%] accompanied by interventricular conduction delay and with advanced heart failure (HF) that does not respond to optimal medical treatment (functional capacity III-IV according to the New York Heart Association functional classification) (1-3). CRT improves LV systolic function and cardiac electrical activity. Microvolt T-wave alternans (MTWA) on the electrocardiogram is a prominent non-invasive method for predicting sudden cardiac death and malignant ventricular tachycardia (VT) and for risk assessment (4-8). Positive MTWA is an indicator of poor prognosis in patients with ischemic or dilated cardiomyopathy (CMP) (9,10). The present study aims to assess the effects of various pacemaker stimulation methods [right atrial (RA), right ventricular (RV), LV, and biventricular (BV)] on MTWA in patients receiving CRT.

METHODS

The study included patients with HF who received CRT at our center in accordance with the American College of Cardiology/American Heart Association/European Society of Cardiology 2006 guidelines. A total of 35 consecutive patients who received CRT between 2012 and 2020 were enrolled. Patients who had acute coronary syndrome within the last thirty days, who received coronary revascularization therapy within the last six weeks, and who had a history of prolonged VT were excluded from the study. MTWA was measured in LV, RV, BV, and RA modes 6±2 months after wound healing in patients who received CRT. Patients' medications were not discontinued; medical treatment was continued unchanged.

Ethical approval was obtained from the Demiroğlu Science University Clinical Research Ethics Committee (approval no: 44140529/8737, date: 07.09.2021). The study was conducted in accordance with the Declaration of Helsinki. All patients provided written informed consent after receiving detailed information.

Microvolt T-Wave Alternans Test

The test was performed, based on the method recommended by Bloomfield et al. (11), using a Heartwave™ system (Cambridge Heart, MA, USA) and high-resolution electrodes (High Res™, Cambridge Heart). To measure MTWA, the patient's skin was prepared, and electrocardiography (ECG) signals comprising at least 128 beats were recorded from three Frank orthogonal leads using specialized electrodes. Alternans voltage (Valt) and alternans rate (K-score) were calculated. If the K-score was ≥3 and Valt was ≥1.9 mV, MTWA was considered significant (10). Suspected or uncertain results were considered indeterminate and could not be classified as positive or negative. The MTWA test was performed using RA pacemaker stimulation first in atrium paced-atrium sensed-inhibited mode, followed by RV, LV, and BV pacemaker stimulation. The MTWA was measured by initiating pacemaker stimulation at 90 pulses/minute and increasing the heart rate every 90 seconds to 100, 110, and 120 pulses/minute. The result was obtained by the device's analysis of the summed pulse counts and was evaluated individually as positive, negative, or indeterminate. Positive and indeterminate results were evaluated collectively and classified as non-negative. This differentiation was made based on previous studies (12,13).

The MTWA results obtained through pacemaker stimulation in four different modes in each patient have been evaluated by comparing the modes with each other using appropriate statistical methods. Various pacing modes were also compared with respect to LVEF; non-ischemic and ischemic CMP; use of statins, angiotensin receptor blockers (ARBs), digoxin, diuretics, angiotensin converting enzyme inhibitors (ACE-Is), and amiodarone; presence of CRT therapy defibrillator (CRT-D); diabetes mellitus (DM); and hypertension. The main data of the article are summarized in the Figure 1.

Statistical Analysis

Continuous variables were expressed as mean±standard deviation; categorical variables were expressed as numbers and percentages. Normality of the data was assessed using the Shapiro-Wilk test. Comparisons of categorical variables were performed using the chi-square test. Various pacing modes were analyzed and compared using Cohen's kappa statistic. Statistical analyses were completed using the SPSS, version 25. A p-value of less than 0.05 was considered significant.

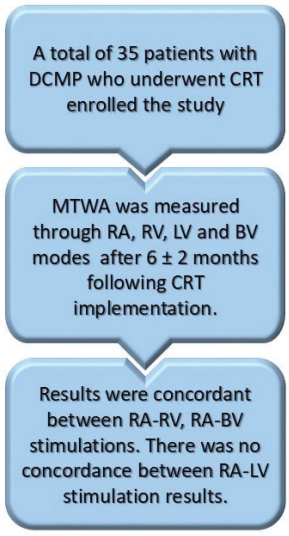

Figure 1. Flow-chart of our study

RESULTS

Characteristics of the Patients

The mean age of the patients included in the study was 67.8±9.6 years. The mean LVEF was 27.0±4.8. Twenty-one (60%) patients had ischemic CMP; 12 (34%) had hypertension; and 6 (17%) had atrial fibrillation. Eleven patients (31%) also received CRT-D. The patients' clinical characteristics are also presented in Table 1. During the evaluation, no patient developed an atrioventricular (A+V) block.

A total of 140 MTWA tests were performed, of which 85 (60.7%) were non-negative. Non-negative tests were observed in 26 patients (74.3%) during RA pacing, 20 (57.1%) during RV pacing, 20 (57.1%) during LV pacing, and 19 (54.3%) during BV pacing. Results were indeterminate in six patients during RA pacing, in two patients during RV pacing, and in two patients during LV pacing. There were no indeterminate results in the BV pacing group. Six patients (17.1%) had negative results at all pacing sites.

Concordance of RA pacing with other sites showed agreement with RV pacing in 27 patients (76.2%; kappa=0.509; p=0.001), with LV pacing in 23 patients (65.7%; kappa=0.263; p=0.094), and with BV pacing in 26 patients (74.3%; kappa=0.463; p=0.003).

The positive and negative predictive values of results obtained during RA pacing for similar results obtained during RV pacing were 73.1% and 88.9%, respectively; for LV pacing 65.4% and 66.7%, respectively; for BV pacing 69.2% and 88.9%, respectively.

Table 1. Patient characteristics

Age (years)	67.8±9.6
Gender (n, %)	
Male	28 (80)
Female	7 (20)
LVEF (%)	27.0±4.8
Ischaemic CMP	21 (60)
PTCA (n)	6 (17.1)
CABG (n)	13 (37.1)
FC	3.07±0.5
QRS time (ms)	144/-19.8
Diabetes	9 (25.7)
Hypertension	12 (34.3)
Atrial fibrillation (paroxysmal)	6 (17.1)
ACE-I therapy	16 (45.7)
ARB therapy	14 (40)
Diuretic therapy	33 (94.3)
Carvedilol therapy	19 (54.3)
Beta-blocker (other) therapy	14 (40)
Amiodarone therapy	6 (17.1)
Digoxin therapy	18 (51.4)
Statin therapy	20 (57.1)
CRT-D therapy	11 (31.4)

LVEF: Left ventricular ejection fraction, CMP: Cardiomyopathy, PTCA: Coronary angioplasty, CABG: Coronary artery bypass surgery, FC: Functional capacity, QRS: Q wave+R wave+S wave, ACE-I: Angiotensin converting enzyme inhibitor, ARB: Angiotensin receptor blocker, CRT-D: Cardiac resynchronization therapy defibrillator

We did not find any differences in non-negative MTWA results with different pacing modes with respect to types of cardiomyopathies (Table 2), statin, amiodarone, digoxin treatment (Table 3), patients with and without DM or hypertension (Table 4), CRT-D patients (Table 5), LVEF results (Table 6), ACE-I, ARB, diuretic users or non-users (Table 7), of the 35 patients in our study, 33 were receiving beta-blocker therapy, including 19 with carvedilol. Therefore, patients using beta-blockers and those not using them were not analyzed separately.

DISCUSSION

The present study investigates the effect of various pacemaker stimulation methods on MTWA results in patients receiving CRT.

The MTWA test is evaluated by atrial pacemaker stimulation in patients without stimulation-conduction problems in the A+V node, or by submaximal cycling exercise, reflecting technical differences in application (11,14). MTWA test results obtained during exercise are similar to those

obtained during RA pacemaker stimulation (15). The results of both stimulation techniques have recently been shown to be similar when MTWA outcomes from separate RA and RV pacemaker stimulations are compared during an electrophysiological test (12).

The MTWA test detects beat-to-beat T-wave alternans on the ECG that occur at increased heart rates induced by exercise or atrial pacemaker stimulation, to predict sudden cardiac death (8,9). The T-wave alternans measured by the MTWA test reflects intracardiac repolarization alternans.

Table 2. Comparison of pacing modes in patients with ischemic and non-ischemic cardiomyopathy

	Non-ischemic CMP	Ischemic CMP	p
RA pacing (n, %)	12 (85.7)	14 (66.7)	0.262
RV pacing (n, %)	9 (64.3)	11 (52.4)	0.484
LV pacing (n, %)	8 (57.1)	12 (57.1)	1.000
Biventricular pacing (n, %)	9 (64.3)	10 (47.6)	0.330

RA: Right atrium, RV: Right ventricle, LV: Left ventricle, CMP: Cardiomyopathy

Table 3. Comparison of pacing modes with respect to statin, amiodarone and digoxin treatment

	Statin non-users	Statin users	p	Amiodarone non-users	Amiodarone users	p	Digoxin non-users	Digoxin users	p
RA pacing (n, %)	13 (81.3)	13 (68.4)	0.460	13 (81.3)	13 (68.4)	0.460	13 (76.5)	13 (72.2)	0.454
RV pacing (n, %)	9 (56.3)	11 (57.9)	0.922	9 (56.3)	11 (57.9)	0.922	8 (47.1)	12 (66.7)	0.833
LV pacing (n, %)	10 (62.5)	10 (52.6)	0.556	10 (62.5)	10 (52.6)	0.556	8 (47.1)	12 (66.7)	0.833
Biventricular pacing (n, %)	11 (68.8)	8 (42.1)	0.112	11 (68.8)	8 (42.1)	0.112	9 (52.9)	10 (55.6)	0.900

RA: Right atrium, RV: Right ventricle, LV: Left ventricle

Table 4. Comparison of pacing modes in patients with and without diabetes mellitus and hypertension

	Non-diabetic patients	Diabetic patients	p	Hypertension (-)	Hypertension (+)	p
RA pacing (n, %)	19 (73.1)	7 (77.8)	0.781	17 (73.9)	9 (75)	0.781
RV pacing (n, %)	13 (50)	7 (77.8)	0.147	14 (60.9)	6 (50)	0.538
LV pacing (n, %)	15 (57.7)	5 (55.6)	0.911	14 (60.9)	6 (50)	0.538
Biventricular pacing (n, %)	16 (61.5)	3 (33.3)	0.143	13 (56.5)	6 (50)	0.713

RA: Right atrium, RV: Right ventricle, LV: Left ventricle

Table 5. Comparison of pacing modes in patients with and without CRT-D status

	CRT-D negative	CRT-D positive	p
RA pacing (n, %)	18 (75)	8 (72.7)	0.886
RV pacing (n, %)	15 (62.5)	5 (45.5)	0.467
LV pacing (n, %)	15 (62.5)	5 (45.5)	0.467

RA: Right atrium, RV: Right ventricle, LV: Left ventricle, CRT-D: Cardiac resynchronization therapy defibrillator

Table 6. Comparison of pacing modes in patients with LVEF

	RA pacing negative MTWA result	RA pacing positive MTWA result	p
LVEF (%)	27.00±4.71	26.61±4.73	0.753
	RV pacing negative MTWA result	**RV pacing positive MTWA result**	
LVEF (%)	28.73±5.03	25.20±3.81	0.036
	LV pacing negative MTWA result	**LV pacing negative MTWA result**	
LVEF (%)	28.00±4.64	25.75±4.55	0.139
	Biventricular pacing negative MTWA result	**Biventricular pacing positive MTWA result**	
LVEF (%)	26.50±5.40	26.89±4.08	0.481

LVEF: Left ventricular ejection fraction, MTWA: Microvolt T-wave alternans, RA: Right atrium, RV: Right ventricle, LV: Left ventricle

Table 7. Comparison of pacing modes in patients ACE-I, ARB and diuretics non-users/users

	ACE-I non-users	ACE-I users	p	ARB non-users	ARB users	p	Diuretic non-users	Diuretic users	p
RA pacing (n, %)	15 (78.9)	11 (68.8)	0.700	15 (71.4)	11 (78.6)	0.712	1 (50)	25 (75.8)	0.454
RV pacing (n, %)	10 (52.6)	10 (62.5)	0.556	13 (61.9)	7 (50)	0.468	1 (50)	19 (57.6)	0.833
LV pacing (n, %)	11 (57.9)	9 (56.3)	0.922	12 (57.1)	8 (57.1)	1.000	1 (50)	19 (57.6)	0.833
Biventricular pacing (n, %)	10 (52.6)	9 (56.3)	0.830	10 (47.6)	9 (64.3)	0.330	1 (50)	18 (54.5)	0.900

RA: Right atrium, RV: Right ventricle, LV: Left ventricle, ACE-I: Angiotensin converting enzyme inhibitor, ARB: Angiotensin receptor blocker

The predictive value of T-wave alternans may decline in proportion to the Q wave+R wave+S wave width (14-16).

BV pacemaker stimulation has been shown in several studies to reduce T-wave alternans by decreasing left LV (11,12). Therefore, it is more likely to obtain a negative MTWA result during BV pacemaker stimulation than during RA, LV, or RV pacemaker stimulation. However, some studies suggest that BV pacemaker stimulation may enhance arrhythmogenicity (13). Among other studies similar to the present one, Shalaby et al. (12) studied 42 patients and compared MTWA results by separately analyzing RA and RV pacemaker stimulation during an electrophysiological test. The MTWA test was found to be negative in 47% of patients due to RA pacemaker stimulation. The mean LVEF of the patients was 33±13%. This study concluded that the MTWA results from RA and RV pacemaker stimulation were similar (kappa=0.62; p<0.001) (12). Another study by Raatikainen et al. (16) analyzed MTWA results in 80 post-myocardial infarction patients (mean LVEF 30±7%) and found MTWA positivity rates of 24% with exercise, 45% with atrial pacing, and 50% with ventriculoatrial (V+A) pacing. Similarity rates were 71% between exercise and A+V consecutive pacemaker stimulations; 79% between exercise and RA pacemaker stimulations; and 95% between RA pacemaker stimulations and V+A consecutive pacemaker stimulations. The sympathetic discharge elicited by the cycling exercise test explains the discrepancy between its result and that obtained by electrophysiological testing. The similarity of the test results suggests that the pacemaker stimulation method can also be used in patients who are unable to exercise. This finding supports our use of pacemaker stimulation during the MTWA test, since the patients included in the present study had severely impaired LV function and markedly reduced exercise capacity. The study by Medina-Ravell et al. (17), which included 29 patients with ischemic or dilated cardiomyopathy, suggested that BV pacemaker stimulation CRT may have an arrhythmogenic effect. Another study by Ehrlich et al. (18), which included 30 patients, demonstrated that BV pacemaker stimulation was not arrhythmogenic; MTWA results were similar across different pacemaker stimulation methods and were not affected by BV pacemaker stimulation therapy in HF patients. The study by Anh et al. (19), conducted in 44 patients with implanted intracardiac defibrillators, 27 of whom also received BV pacemaker stimulation CRT therapy, compared the MTWA results from RA, LV, RV, and BV pacemaker stimulations, and observed a significant similarity between the MTWA results from RA pacemaker stimulation and ventricular pacemaker stimulation. This study also demonstrated that such similarity varied among ventricular stimulation sites and that BV pacing reduced MTWA positivity.

The study by Kowal et al. (20) compared BV and RV pacemaker stimulation and showed that BV stimulation reduced the development of arrhythmia compared with RV stimulation. Another study by Anh et al. (21), involving 33 patients who received CRT, analyzed MTWA test results obtained during RA, LV, RV, and BV pacemaker stimulation and demonstrated that BV pacemaker stimulation improved MTWA results. The superiority of the exercise test over the pacemaker stimulation test during the MTWA test has also been demonstrated in a study by Rashba et al. (22).

Consistent with most of these studies, the present study found similar MTWA test results across various pacemaker stimulation modes. A significant similarity has been shown between the results of RA and RV pacemaker stimulation, and between RA and BV pacemaker stimulation. Different from the study by Medina-Ravel et al. (17), 19 the present study did not observe torsade de pointes in any of the patients during the MTWA test and did not find arrhythmogenic potential with BV pacemaker stimulation. Likewise, in contrast to the study by Anh et al. (21), the present study did not observe any significant reduction in MTWA with BV pacemaker stimulation. This may have resulted from differences in patient characteristics, despite the number of patients being approximately the same in the present study. Because we did not discontinue medical treatment during the study, ongoing treatment may have influenced the evaluation results. It should be noted that various medications, which we could not discontinue because of

the clinical status of our patients, have also affected MTWA measurements.

Study Limitation

This may be considered a limitation in our evaluation of the results. A predominance of male patients (n=28; 80%) in our study group of 35 suggests a gender-related imbalance. Contrary to the study by Rashba et al. (22), since the patients included in our study group had extremely impaired LV function and very low functional capacity, and the objective of the present study was to compare various pacemaker stimulation modes, we conducted our examinations using pacemaker stimulation instead of exercise. The study's relatively small sample size is a limitation that may reduce statistical power, particularly for detecting small or subgroup-specific effects. Future studies with larger, multicenter cohorts are needed to confirm and generalize our findings.

CONCLUSION

Similar MTWA results are observed when comparing RA, LV, RV, and BV pacemaker stimulation in patients receiving CRT. The predictive value of data from various pacemaker stimulation modes also differs. Homogeneous studies with larger sample sizes are required to determine the effects of various pacemaker stimulation modes on MTWA. Such studies may explain the relationships between changes in T-wave amplitude and MTWA, and between repolarization dispersion and potential arrhythmogenic effects (23,24). The present study found that, under effective antiarrhythmic medication, various pacemaker stimulation modes did not significantly alter T-wave alternans test results.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from the Demiroğlu Science University Clinical Research Ethics Committee (approval no: 44140529/8737, date: 07.09.2021). The study was conducted in accordance with the Declaration of Helsinki.

Informed Consent: All patients provided written informed consent after receiving detailed information.

FOOTNOTES

Authorship Contributions

Concept: D.E., C.Y., Design: D.E., M.G., N.Y., Data Collection or Processing: D.E., M.G., C.Y., N.Y., Analysis or Interpretation: M.G., C.Y., N.Y., Literature Search: D.E., M.G., C.Y., Writing: D.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Bradley DJ, Bradley EA, Baughman KL, Berger RD, Calkins H, Goodman SN, et al. Cardiac resynchronization and death from progressive heart failure: a meta-analysis of randomized controlled trials. JAMA. 2003;289:730-40.
2. Rivero-Ayerza M, Theuns DA, Garcia-Garcia HM, Boersma E, Simoons M, Jordaens LJ. Effects of cardiac resynchronization therapy on overall mortality and mode of death: a meta-analysis of randomized controlled trials. Eur Heart J. 2006;27:2682-8.
3. Cazeau S, Leclercq C, Lavergne T, Walker S, Varma C, Linde C, et al.; Multisite Stimulation in Cardiomyopathies (MUSTIC) Study Investigators. Effects of multisite biventricular pacing in patients with heart failure and intraventricular conduction delay. N Engl J Med. 2001;344:873-80.
4. Narayan SM. T-wave alternans and the susceptibility to ventricular arrhythmias. J Am Coll Cardiol. 2006;47:269-81.
5. Bloomfield DM, Bigger JT, Steinman RC, Namerow PB, Parides MK, Curtis AB, et al. Microvolt T-wave alternans and the risk of death or sustained ventricular arrhythmias in patients with left ventricular dysfunction. J Am Coll Cardiol. 2006;47:456-63.
6. Ikeda T, Saito H, Tanno K, Shimizu H, Watanabe J, Ohnishi Y, et al. T-wave alternans as a predictor for sudden cardiac death after myocardial infarction. Am J Cardiol. 2002;89:79-82.
7. Klingenheben T, Zabel M, D'Agostino RB, Cohen RJ, Hohnloser SH. Predictive value of T-wave alternans for arrhythmic events in patients with congestive heart failure. Lancet. 2000;356:651-2.
8. El-Sherif N, Turitto G, Pedalino RP, Robotis D. T-wave alternans and arrhythmia risk stratification. Ann Noninvasive Electrocardiol. 2001;6:323-32.
9. Bloomfield DM, Steinman RC, Namerow PB, Parides M, Davidenko J, Kaufman ES, et al. Microvolt T-wave alternans distinguishes between patients likely and patients not likely to benefit from implanted cardiac defibrillator therapy: a solution to the Multicenter Automatic Defibrillator Implantation trial (MADIT) II conundrum. Circulation. 2004;110:1885-9.
10. Hohnloser SH, Klingenheben T, Bloomfield D, Dabbous O, Cohen RJ. Usefulness of microvolt T-wave alternans for prediction of ventricular tachyarrhythmic events in patients with dilated cardiomyopathy: results from a prospective observational study. J Am Coll Cardiol. 2003;41:2220-4.
11. Bloomfield DM, Hohnloser SH, Cohen RJ. Interpretation and classification of microvolt T wave alternans tests. J Cardiovasc Electrophysiol. 2002;13:502-12.
12. Shalaby AA, Voigt A, El-Saed A, Mains M, Shusterman V. Microvolt T-wave alternans during atrial and ventricular pacing. Pacing Clin Electrophysiol. 2007;30(Suppl 1):S178-82. Erratum in: Pacing Clin Electrophysiol. 2007;30:1428.
13. Chow T, Kereiakes DJ, Bartone C, Booth T, Schloss EJ, Waller T, et al. Prognostic utility of microvolt T-wave alternans in risk stratification of patients with ischemic cardiomyopathy. J Am Coll Cardiol. 2006;47:1820-7.
14. Morin DP, Zacks ES, Mauer AC, Ageno S, Janik M, Markowitz SM, et al. Effect of bundle branch block on microvolt T-wave alternans and electrophysiologic testing in patients with ischemic cardiomyopathy. Heart Rhythm. 2007;4:904-12.
15. Rashba EJ, Osman AF, MacMurdy K, Kirk MM, Sarang S, Peters RW, et al. Influence of QRS duration on the prognostic value of T wave alternans. J Cardiovasc Electrophysiol. 2002;13:770-5.

16. Raatikainen MJ, Jokinen V, Virtanen V, Hartikainen J, Hedman A, Huikuri HV; CARISMA Investigators. Microvolt T-wave alternans during exercise and pacing in patients with acute myocardial infarction. Pacing Clin Electrophysiol. 2005;28(Suppl 1):S193-7.
17. Medina-Ravell VA, Lankipalli RS, Yan GX, Antzelevitch C, Medina-Malpica NA, Medina-Malpica OA, et al. Effect of epicardial or biventricular pacing to prolong QT interval and increase transmural dispersion of repolarization: does resynchronization therapy pose a risk for patients predisposed to long QT or torsade de pointes? Circulation. 2003;107:740-6.
18. Ehrlich JR, Wegener FT, Anneken L, Duray G, Israel CW, Hohnloser SH. Biventricular pacing does not affect microvolt T-wave alternans in heart failure patients. Heart Rhythm. 2008;5:348-52.
19. Anh D, Vasconcellos S, Srivatsa U, McCormick N, Narayan SM. Biventricular pacing reduces the positivity of T-wave alternans. Heart Rhythm. 2005;2:S144.
20. Kowal RC, Wasmund SL, Smith ML, Sharma N, Carayannopoulos GN, Le B, et al. Biventricular pacing reduces the induction of monomorphic ventricular tachycardia: a potential mechanism for arrhythmia suppression. Heart Rhythm. 2004;1:295-300.
21. Anh D, Srivatsa U, Bui HM, Vasconcellos S, Narayan SM. Biventricular pacing attenuates T-wave alternans and T-wave amplitude compared to other pacing modes. Pacing Clin Electrophysiol. 2008;31:714-21.
22. Rashba EJ, Osman AF, MacMurdy K, Kirk MM, Sarang S, Peters RW, et al. Exercise is superior to pacing for T wave alternans measurement in subjects with chronic coronary artery disease and left ventricular dysfunction. J Cardiovasc Electrophysiol. 2002;13:845-50.
23. Hua W, Chen K, Zhou X, Dai Y, Chen R, Wang J, et al. Cardiac resynchronization therapy reduces T-wave alternans in patients with heart failure. Europace. 2015;17:281-8.
24. Nayyar S, Suszko A, Porta-Sanchez A, Dalvi R, Chauhan VS. Reduced T wave alternans in heart failure responders to cardiac resynchronization therapy: evidence of electrical remodeling. PLoS One. 2018;13:e0199637.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):91-97
DOI: 10.4274/BMJ.galenos.2025.2025.11-4

Research

Uric Acid-to-Albumin Ratio as A Prognostic Marker after Carotid Artery Stenting

Karotis Arter Stentleme Sonrası Prognostik Bir Belirteç Olarak Ürik Asit/Albümin Oranı

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ABSTRACT

Objective: To evaluate the prognostic value of the uric acid-to-albumin ratio (UAR) for predicting major adverse cardiovascular and cerebrovascular events (MACCE) after carotid artery stenting (CAS).

Methods: A total of 332 patients who underwent CAS were retrospectively enrolled in the study. For each patient, the uric acid level was divided by the corresponding serum albumin level to calculate the UAR. Patients were followed up for the occurrence of MACCE. The association between UAR and MACCE was analyzed to determine its predictive value.

Results: Patients were followed up for an average of 45.30±27.26 months. Those who experienced MACCE were significantly older and were more likely to have undergone prior carotid endarterectomy. Additionally, they exhibited elevated serum creatinine and uric acid levels. In contrast, serum albumin and hemoglobin levels were significantly lower in the MACCE group. Furthermore, patients who developed MACCE had longer lesion lengths, required longer stents, and experienced higher rates of periprocedural stroke and in-hospital mortality. Multivariable logistic regression analysis identified a history of endarterectomy, elevated serum creatinine levels, and higher UAR as independent predictors of MACCE.

Conclusion: Higher UAR values were significantly associated with increased risk of adverse outcomes. These findings suggest that UAR may serve as a simple, accessible, and cost-effective biomarker for risk stratification and prognosis in patients undergoing CAS.

Keywords: Carotid artery, stent, uric acid, albumin, prognosis

ÖZ

Amaç: Bu çalışmanın amacı, karotis arter stentleme (CAS) sonrası majör kardiyovasküler ve serebrovasküler olayları (MACCE) öngörmede ürik asit/albümin oranının (UAR) prognostik değerini değerlendirmektir.

Gereç ve Yöntem: CAS uygulanan toplam 332 hasta retrospektif olarak çalışmaya dahil edildi. Her hastada, serum ürik asit düzeyi ilgili serum albümin düzeyine bölünerek UAR hesaplandı. Hastalar, MACCE gelişimi açısından takip edildi. UAR ile MACCE arasındaki ilişki, öngörü değerini belirlemek amacıyla analiz edildi.

Bulgular: Hastalar ortalama 45,30±27,26 ay süreyle takip edildi. MACCE gelişen hastalar anlamlı olarak daha ileri yaşta olup, daha yüksek oranda önceden karotis endarterektomi öyküsüne sahipti. Ayrıca, bu grupta serum kreatinin ve ürik asit düzeyleri daha yüksek bulundu. Buna karşın, serum albümin ve hemoglobin düzeyleri MACCE grubunda anlamlı olarak daha düşüktü. Bunun yanı sıra, MACCE gelişen hastalarda lezyon uzunluğu daha fazla, daha uzun stent kullanımı, periprosedürel inme ve hastanede yatış sırasında mortalite oranı daha yüksek saptandı. Çok değişkenli lojistik regresyon analizinde, endarterektomi öyküsü, yüksek serum kreatinin düzeyi ve yüksek UAR değeri, MACCE için bağımsız belirleyiciler olarak tespit edildi.

Sonuç: Yüksek UAR değerleri, olumsuz sonuç riskinde anlamlı bir artış ile ilişkili bulundu. Bu bulgular, UAR'nin CAS uygulanan hastalarda risk sınıflandırması ve prognozun değerlendirilmesinde basit, kolay erişilebilir ve maliyet etkin bir biyobelirteç olarak kullanılabileceğini düşündürmektedir.

Anahtar Kelimeler: Karotis arter, stent, ürik asit, albümin, prognoz

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Cite as: Koyuncu A, Yıldız C, Oflar E, Kalyoncuoğlu M, Sinoplu HA, Karabulut D, et al. Uric acid-to-albumin ratio as a prognostic marker after carotid artery stenting. Med J Bakirkoy. 2026;22(1):91-97

Received: 07.11.2025
Accepted: 17.12.2025
Publication Date: 12.03.2026

INTRODUCTION

Carotid artery stenosis represents a significant and potentially preventable risk factor for ischemic stroke (1). Even moderate degrees of luminal narrowing can substantially compromise cerebral blood flow and increase the propensity for thromboembolic events. The predominant etiology of this condition is atherosclerosis, characterized by the progressive accumulation of lipids, inflammatory cells, and fibrous tissue within the arterial wall (2,3). Advanced plaques may undergo rupture or erosion, releasing thrombogenic material capable of obstructing intracranial arteries and precipitating acute ischemic episodes. Evidence from both clinical observations and large-scale epidemiological studies indicates that individuals with carotid atherosclerotic lesions—regardless of the presence of symptoms—exhibit a markedly elevated stroke risk compared with those with normal carotid anatomy (4,5). Therefore, early detection and timely preventive interventions are essential strategies to mitigate the overall burden of cerebrovascular disease. Carotid artery stenting (CAS) has emerged as a less invasive alternative to carotid endarterectomy in the management of extracranial carotid artery stenosis, particularly in patients at high surgical risk. CAS is often preferred in cases in which surgery poses technical or anatomical challenges, including high carotid bifurcation, prior endarterectomy with restenosis, or prior neck irradiation (6,7).

A growing body of research has shown that atherosclerosis is not merely a lipid accumulation disorder but involves sustained inflammatory activity at multiple stages of the disease (8,9). The uric acid-to-albumin ratio (UAR) is recognized as a novel combined biomarker that enables the simultaneous assessment of oxidative stress and the inflammatory response. During inflammatory processes, serum albumin levels decrease because albumin is a negative acute-phase reactant, while uric acid levels rise and are associated with oxidative stress and cellular damage, making UAR a comprehensive indicator of inflammatory and oxidative burden (10-13). Clinical studies have demonstrated that elevated UAR has value in cardiovascular and cerebrovascular diseases, coronavirus disease 2019 infection, and malignancies (14-17). Therefore, UAR is emerging not merely as a biochemical ratio but as an accessible, low-cost, and practical marker with growing clinical relevance in both prognostic risk assessment and the evaluation of the systemic inflammation-oxidative stress axis. Since carotid revascularization procedures carry a residual risk of post-interventional complications, identifying accessible and reliable biomarkers is of growing clinical interest. The UAR may serve as a useful indicator for risk stratification in this population. By examining its association with adverse outcomes after stenting, we sought to determine whether this parameter can help predict prognosis and guide patient management, and to evaluate the UAR's potential to predict major adverse cardiovascular and cerebrovascular events (MACCE) following CAS.

METHODS

The records of patients treated with CAS at a tertiary care center between January 2018-January 2024 were retrospectively reviewed. Eligible individuals had either symptomatic carotid stenosis of ≥70% or asymptomatic stenosis of ≥90%. The diagnosis of carotid artery stenosis was established in line with the criteria of the European Stroke Organization guidelines (18). A total of 545 files were evaluated; after applying the exclusion criteria, 332 patients remained in the final cohort. The study received approval from University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (approval no: 2025-01-05, date: 24.10.2025) and adhered to the principles of the Declaration of Helsinki.

Patients with infection, inflammatory diseases, hematological disorders, malignancy, end-stage renal or hepatic disease, total occlusion of the carotid artery, those receiving uricosuric therapy, or those who had a recent acute coronary syndrome were excluded from the study. As part of the initial work-up at hospital presentation, venous blood was obtained from each patient. These samples were subsequently analyzed in the clinical laboratory to assess biochemical indicators and to perform a complete blood count. The uric acid level measured for each patient was divided by the corresponding albumin value to calculate the UAR.

All CAS procedures were conducted via the transfemoral approach under local anesthesia. An 8F introducer sheath was initially inserted to obtain arterial access. Diagnostic angiography of the carotid arteries was then performed, most frequently using an 8F JR4 guiding catheter. The catheter was advanced to a position proximal to the stenotic segment, and angiographic imaging was acquired in ipsilateral oblique projections of approximately 30-45 degrees, as well as in lateral projections from the contralateral side, to ensure adequate visualization of the lesion. The extent of luminal narrowing was quantified in accordance with the European Carotid Surgery trial method. All angiographic images were reviewed by two interventional physicians with substantial procedural experience, both of whom were blinded to the demographic and clinical characteristics of the patients to avoid observer bias. In every case, a

distal embolic protection device was utilized prior to stent deployment to minimize the risk of periprocedural cerebral embolization. The selection of stent type—whether closed-cell or open-cell—and the decision to perform predilatation or postdilatation were left to the operator's clinical judgment based on vascular anatomy and lesion morphology. Self-expanding stents were implanted in all interventions. Following stent placement, a final biplane angiographic assessment of both the treated carotid segment and the intracranial circulation was performed prior to the retrieval of the protection device. Technical success was defined as residual stenosis of less than 30% in the treated arterial segment under optimal inflation pressure, or the restoration of satisfactory antegrade flow if precise measurement was not feasible.

All patients were monitored at scheduled clinical visits in months 1, 3, 6, and 12 during the first year following the intervention and annually thereafter. In-stent restenosis requiring revascularization was defined as a ≥70% luminal reduction within the stented segment after the index procedure (19). To reduce the risk of thromboembolic events, all participants received dual antiplatelet therapy prior to the intervention. Aspirin was administered at a dose of 100 mg daily, and clopidogrel was prescribed at 75 mg daily following a a 300 mg loading dose. After CAS, clopidogrel therapy was continued for 4-6 weeks in asymptomatic patients and for approximately three months in symptomatic patients. Aspirin treatment was maintained indefinitely across all study participants. In addition, unless a contraindication was present, high-dose statin therapy was routinely recommended for all patients.

The primary endpoint of the study was the occurrence of MACCE. This composite outcome included cardiovascular mortality, non-fatal myocardial infarction, non-fatal cerebrovascular events—such as ischemic stroke or transient ischemic attack—and in-stent restenosis requiring revascularization during the follow-up period.

Statistical Analysis

All statistical analyses were performed using IBM SPSS statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±standard deviation and compared using the independent samples t-test or Mann-Whitney U test, depending on the distribution assessed by the Shapiro-Wilk test. Categorical variables were presented as counts and percentages and compared using the chi-square or Fisher's exact test, as appropriate.

Univariable logistic regression analyses were conducted to identify potential predictors of MACCE. Variables with a p-value <0.05 in the univariable analysis were entered into multivariable logistic regression models to determine independent predictors. Two models were constructed: model A included clinical and procedural variables (age, prior endarterectomy, creatinine, uric acid, albumin, hemoglobin, and lesion length), while model B incorporated the UAR. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported for all regression models. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

A total of 332 individuals were monitored for an average of 45.30±27.26 months. The mean age of the cohort was 66.90±8.59 years, and 90 participants (25.6%) were female. MACCE occurred in 65 patients. When comparing those who experienced MACCE with those who did not, several differences emerged. Patients with MACCE were older (68.98±8.02 years vs. 66.43±8.66 years; p=0.030) and had a higher prevalence of prior endarterectomy history (7.7% vs. 1.0%; p=0.007). They also demonstrated elevated creatinine levels (1.37±1.17 mg/dL vs. 0.96±0.26 mg/dL; p=0.021) and uric acid levels (7.32±5.83 mg/dL vs. 5.96±1.43 mg/dL; p=0.001). In contrast, albumin levels (3.89±0.68 g/dL vs. 4.07±0.47 g/dL; p=0.027) and hemoglobin levels (12.10±1.96 g/dL vs. 12.95±1.65 g/dL; p=0.001) were significantly lower in the MACCE group. Additionally, patients who developed MACCE had longer lesion lengths (27.47±6.28 mm vs. 25.24±6.28 mm; p=0.025), received longer stents (39.69±10.45 mm vs. 36.43±7.76 mm; p=0.013), and had higher rates of periprocedural stroke (13.8% vs. 1.7%; p<0.001) and in-hospital mortality (4.6% vs. 0%; p<0.001). Clinical and procedural characteristics of the patients are presented in Tables 1 and 2.

Univariable logistic regression revealed that several clinical and procedural parameters were independent predictors of MACCE (Table 3). According to the univariable logistic regression results, age, a prior history of endarterectomy, increased creatinine and uric acid levels, and longer lesion and stent lengths were associated with a higher risk of MACCE, whereas higher albumin and hemoglobin levels were associated with a decreased risk. Multivariable logistic regression identified key predictors of MACCE across two models (Table 4). In model A, a history of endarterectomy (OR: 5.007; 95% CI: 1.015-24.702; p=0.048) and elevated creatinine (OR: 2.277; 95% CI: 1.286-4.032; p=0.005) were significantly associated with a higher risk of MACCE, while age, albumin, hemoglobin, uric acid, and lesion length were not significantly associated with MACCE risk. In model B, which included UAR, history of endarterectomy (OR: 4.874;

95% CI: 1.014-23.984; p=0.049) and creatinine (OR: 2.225; 95% CI: 1.251-3.958; p=0.006) remained significant, and UAR emerged as an independent predictor (OR: 1.904; 95% CI: 1.074-3.377; p=0.028), whereas age, hemoglobin, and lesion length were not significant. These findings indicate that a history of endarterectomy, creatinine, and UAR were relevant factors in MACCE risk stratification.

DISCUSSION

The principal finding of our investigation was that prior endarterectomy, elevated baseline creatinine, and UAR emerged as significant and independent predictors of MACCE. Notably, the strong associations of prior endarterectomy and creatinine with adverse outcomes were robust across two multivariable models, underscoring their importance as risk markers. These findings suggest that patients with a combination of prior surgery and underlying renal dysfunction were at a particularly high risk. While univariable analysis also identified factors such as advanced age, lower hemoglobin and albumin levels, and lesion and stent lengths as predictors of MACCE, our multivariable analysis identified prior endarterectomy, creatinine, and UAR as the core factors for risk stratification in this patient cohort.

The UAR has recently been proposed as a composite biomarker that reflects interconnected mechanisms involved in the pathogenesis of atherosclerosis. Elevated serum uric acid contributes to oxidative stress, endothelial dysfunction, and vascular inflammation, all of which promote plaque initiation and progression (20). Hyperuricemia can reduce nitric oxide bioavailability, stimulate smooth muscle cell proliferation, and enhance proinflammatory cytokine activity (21). In contrast, albumin has antioxidant and anti-inflammatory properties and plays a stabilizing role in

Table 1. Clinical and biochemical variables of the patients

	All population (n=332)	MACCE (-) (n=287)	MACCE (+) (n=65)	p-value
Age, years	66.90±8.59	66.43±8.66	68.98±8.02	**0.030**
Gender, n (%)				0.410
Male	262 (74.4)	211 (73.5)	51 (78.5)	
Female	90 (25.6)	76 (26.5)	14 (21.5)	
Hypertension, n (%)	276 (78.6)	224 (78.3)	52 (80)	0.764
Diabetes mellitus, n (%)	143 (40.6)	115 (40.1)	28 (43.1)	0.656
Hyperlipidemia, n (%)	208 (59.1)	173 (60.3)	35 (53.8)	0.341
Smoking, n (%)	134 (38.1)	109 (38)	25 (38.5)	0.942
CAD history, n (%)	253 (71.9)	201 (70)	52 (80)	0.107
PAD history, n (%)	48 (13.6)	37 (12.9)	11 (16.9)	0.404
Presence of symptoms, n (%)	103 (29.3)	82 (28.6)	21 (32.3)	0.550
Endarterectomy history, n (%)	8 (2.3)	3 (1.0)	5 (7.7)	**0.007**
Glucose, mg/dL	128.93±58.14	127.79±59.34	133.94±52.65	0.246
Creatinine, mg/dL,	1.04±0.58	0.96±0.26	1.37±1.17	**0.021**
Uric acid, mg/dL	6.21±2.85	5.96±1.43	7.32±5.83	**0.001**
Albumin	4.03±0.52	4.07±0.47	3.89±0.68	**0.027**
CRP, mg/dL	1.70±2.33	1.66±2.38	1.85±2.15	0.284
TC, mg/dL	194.68±54.86	196.23±53.71	187.56±55.43	0.260
LDL-C, mg/dL	120.99±44.3	122.28±44.28	115.12±44.28	0.349
HDL-C, mg/dL	41.23±10.38	41.36±10.06	40.63±11.67	0.214
Triglycerides, mg/dL	163.11±91.15	162.70±80.94	165.01±128.81	0.310
Hemoglobin, g/dL	12.79±1.74	12.95±1.65	12.10±1.96	**0.001**
WBC, 10^3/μL	8.02±2.17	7.99±2.09	8.17±2.53	0.735
Platelets, 10^3/μL	249.17±84.33	249.56±83.55	247.42±88.34	0.543
UAR	1.58±0.91	1.48±0.39	2.01±1.91	0.001

MACCE: Major adverse cardiovascular and cerebrovascular events, CAD: Coronary artery disease, PAD: Peripheral artery disease, CRP: C-reactive protein, TC: Total cholesterol, LDL-C: Low-density lipoprotein cholesterol, HDL-C: High-density lipoprotein cholesterol, UAR: Uric acid-to-albumin ratio, WBC: White blood count

maintaining endothelial integrity. Lower albumin levels may therefore indicate impaired vascular protection and heightened inflammatory burden. When assessed together, an increased UAR may signify a shift toward a pro-oxidative and pro-atherogenic state (22).

Inflammatory markers have emerged as significant predictors of clinical outcomes following CAS (23,24). This chronic inflammatory milieu promotes endothelial dysfunction, smooth muscle cell proliferation, and extracellular matrix remodeling, all of which increase the susceptibility to restenosis and thromboembolic complications after stent deployment. Furthermore, heightened inflammation can accelerate atherosclerotic progression both locally and systemically, contributing to a higher incidence of MACCE (25). In line with earlier studies, our findings indicated that an elevated UAR was associated with worse clinical outcomes in patients undergoing CAS, suggesting that this composite biomarker might reflect underlying pro-atherogenic and pro-inflammatory processes that contribute to post-stent complications and increased cardiovascular risk.

Other findings of the present study merit consideration. Patients with a history of carotid endarterectomy may have an increased risk of subsequent MACCE, as prior carotid endarterectomy does not eliminate the long-term vulnerability to vascular events. Indeed, longitudinal data indicate that approximately 31.5% of patients who undergo carotid endarterectomy develop new major coronary events—such as myocardial infarction, coronary artery bypass grafting, or percutaneous coronary intervention—within 10 years (26). Furthermore, the presence of polyvascular disease, defined as stenosis involving multiple vascular territories, has been identified as a significant predictor of long-term MACCE in this patient population (27). Renal function has emerged as an important determinant of adverse outcomes following CAS. Elevated serum creatinine levels, even in the absence of overt renal failure, have been associated with a higher likelihood of long-term MACCE (28). A study by Donahue et al. (29) found that patients with chronic kidney disease who underwent CAS had a higher incidence of acute kidney injury and of subsequent adverse events, including myocardial infarction and stroke. Furthermore, research by AbuRahma et al. (30) demonstrated that chronic renal insufficiency, as indicated by elevated serum creatinine levels, adversely affects both early and late clinical outcomes post-CAS. These findings underscore the importance of renal function assessment in the preoperative evaluation of patients undergoing CAS, as impaired renal function may exacerbate the risk of adverse vascular events.

Table 2. Angiographic and procedural characteristics of the patients

	All population (n=332)	MACCE (-) (n=287)	MACCE (+) (n=65)	p-value
Lesion localization, n (%)				0.085
ICA	344 (97.7)	282 (98.3)	62 (95.4)	
CCA	7 (2)	5 (1.7)	2 (3.1)	
Both ICA and CCA	1 (0.3)	0 (0)	1 (1.5)	
Lesion length (mm)	25.67±6.38	25.24±6.28	27.47±6.28	**0.025**
Predilatation, n (%)	50 (14.2)	40 (13.9)	10 (15.4)	0.765
Stent type, n (%)				0.530
Open-cell design	113 (32.1)	90 (231.4)	23 (35.4)	
Closed-cell design	239 (67.9)	197 (68.6)	42 (64.6)	
Stent length (mm)	37.04±8.40	36.43±7.76	39.69±10.45	**0.013**
Stent expansion rate, %	83.12±8.45	83.29±8.37	82.42±8.79	0.633
Postdilatation, n (%)	309 (87.8)	253 (88.2)	56 (86.2)	0.861
Jumping, n (%)	31 (8.8)	23 (8)	8 (12.3)	0.289
Periprocedural MI, n (%)	2 (0.6)	1 (0.3)	1 (1.5)	0.336
Periprocedural stroke, n (%)	14 (4)	5 (1.7)	9 (13.8)	**<0.001**
Hospitalization period, days	3.60±4.29	3.43±4.13	4.36±4.92	0.252
In-hospital mortality, n (%)	3 (0.9)	0 (0.0)	3 (4.6)	**<0.001**
Follow-up (months), IQR	45.30±27.26	45.24±27.71	45.58±25.35	0.889

MACCE: Major adverse cardiovascular and cerebrovascular events, ICA: Internal carotid artery, CCA: Common carotid artery, IQR: Interquartile range, MI: Myocardial infarction

Study Limitation

This study has several limitations that should be acknowledged. First, it is a single-center, retrospective analysis, which may limit the generalizability of the findings and introduce the potential for selection and information biases. Second, residual confounding from unmeasured variables, such as medication adherence, lifestyle factors, or procedural nuances, cannot be excluded. Finally, because this was a retrospective study, causality cannot be established; the observed associations between a history of endarterectomy, creatinine, UAR, and MACCE should be interpreted as associative rather than causal. prospective multicenter studies with larger cohorts are warranted to validate these findings and to further clarify the prognostic role of UAR in risk stratification.

Table 3. Univariable logistic regression for prediction of MACCE

	p-value	OR	95% CI
Age	0.031	1.037	1.003-1.072
Endarterectomy history	0.006	7.861	1.829-33.789
Creatinine	0.001	3.007	1.609-5.618
Uric acid	0.014	1.175	1.034-1.335
Albumin	0.013	0.524	0.314-0.875
Hemoglobin	0.001	0.759	0.650-0.888
Lesion length	0.018	1.057	1.010-1.107
Stent length	0.007	1.040	1.011-1.070

MACCE: Major adverse cardiovascular and cerebrovascular events, OR: Odds ratio, CI: Confidence interval

Table 4. Multivariable logistic regression for prediction of MACCE

Model A			
	p-value	**OR**	**95% CI**
Age	0.242	1.026	0.983-1.071
Endarterectomy history	0.048	5.007	1.015-24.702
Creatinine	0.005	2.277	1.286-4.032
Uric acid	0.079	1.136	0.985-1.309
Albumin	0.258	0.697	0.373-1.302
Hemoglobin<	0.185	0.884	0.736-1.061
Lesion length	0.058	1.050	0.998-1.103
Model B			
Age	0.257	1.025	0.982-1.070
Endarterectomy history	0.049	4.874	1.014-23.984
Creatinine	0.006	2.225	1.251-3.958
Hemoglobin<	0.160	0.880	0.735-1.052
Lesion length	0.053	1.051	0.999-1.105
UAR	0.028	1.904	1.074-3.377

MACCE: Major adverse cardiovascular and cerebrovascular events, OR: Odds ratio, CI: Confidence interval, UAR: Uric acid-to-albumin ratio

CONCLUSION

In conclusion, elevated UAR, prior carotid endarterectomy, and higher baseline creatinine independently predict long-term MACCE in patients undergoing carotid interventions. The findings underscore the value of UAR as a composite biomarker reflecting oxidative stress, inflammation, and vascular dysfunction, which can help identify high-risk patients and guide targeted strategies to reduce future cardiovascular and cerebrovascular events.

ETHICS

Ethics Committee Approval: The study received approval from University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (approval no: 2025-01-05, date: 24.10.2025) and adhered to the principles of the Declaration of Helsinki.

Informed Consent: Retrospective study.

FOOTNOTES

Authorship Contributions

Concept: A.K., E.O., H.A.S., D.K., F.N.T.Ç., L.Ö., Design: A.K., E.O., M.K., H.A.S., L.Ö., M.Ç., Data Collection or Processing: A.K., C.Y., E.O., M.K., D.K., F.N.T.Ç., L.Ö., M.Ç., Analysis or Interpretation: A.K., C.Y., M.K., H.A.S., D.K., F.N.T.Ç., L.Ö., M.Ç., Literature Search: A.K., C.Y., H.A.S., D.K., M.Ç., Writing: A.K., C.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Aliotta L, Gavazzi LM, Malfa P, Foti PV, Palmucci S, Lo Greco MC, et al. Management and treatment of carotid stenosis: overview of therapeutic possibilities and comparison between interventional radiology, surgery and hybrid procedure. Diagnostics (Basel). 2025;15:1679.
2. Bir SC, Kelley RE. Carotid atherosclerotic disease: a systematic review of pathogenesis and management. Brain Circ. 2022;8:127-36.
3. Libby P, Hansson GK. From focal lipid storage to systemic inflammation: JACC review topic of the week. J Am Coll Cardiol. 2019;74:1594-607.
4. Rothwell PM, Gibson R, Warlow CP. Interrelation between plaque surface morphology and degree of stenosis on carotid angiograms and the risk of ischemic stroke in patients with symptomatic carotid stenosis. On behalf of the European Carotid Surgery Trialists' Collaborative group. Stroke. 2000;31:615-21.
5. Nicolaides AN, Kakkos SK, Griffin M, Sabetai M, Dhanjil S, Tegos T, et al.; Asymptomatic Carotid Stenosis and Risk of Stroke (ACSRS) study group. Severity of asymptomatic carotid stenosis and risk of

ipsilateral hemispheric ischaemic events: results from the ACSRS study. Eur J Vasc Endovasc Surg. 2005;30:275-84.

6. AbuRahma AF. The new 2023 European Society for vascular surgery (ESVS) carotid guidelines: the transatlantic perspective. Eur J Vasc Endovasc Surg. 2023;65:5-6.
7. White CJ, Brott TG, Gray WA, Heck D, Jovin T, Lyden SP, et al. Carotid artery stenting: JACC state-of-the-art review. J Am Coll Cardiol. 2022;80:155-70.
8. Hansson GK, Libby P. The immune response in atherosclerosis: a double-edged sword. Nat Rev Immunol. 2006;6:508-19.
9. Hansson GK. Inflammation, atherosclerosis, and coronary artery disease. N Engl J Med. 2005;352:1685-95.
10. Roche M, Rondeau P, Singh NR, Tarnus E, Bourdon E. The antioxidant properties of serum albumin. FEBS Lett. 2008;582:1783-7.
11. Sautin YY, Johnson RJ. Uric acid: the oxidant-antioxidant paradox. Nucleosides Nucleotides Nucleic Acids. 2008;27:608-19.
12. Wen S, Arakawa H, Tamai I. Uric acid in health and disease: from physiological functions to pathogenic mechanisms. Pharmacol Ther. 2024;256:108615.
13. Du L, Zong Y, Li H, Wang Q, Xie L, Yang B, et al. Hyperuricemia and its related diseases: mechanisms and advances in therapy. Signal Transduct Target Ther. 2024;9:212.
14. Duman H, İpek E, Durak H, Şahin MA, Ergül E, Yılmaz AS, et al. Uric acid to albumin ratio as a predictive marker for intracoronary thrombus severity in ST-segment elevation myocardial infarction (STEMI) patients undergoing primary percutaneous coronary intervention (PCI). Med Sci Monit. 2024;30:e945832.
15. Çakır Güney B, Küçük İ, Güney B, Tükel N, Serindağ Z, Önal Taştan Y, et al. The effect of uric acid/albumin ratio on prognosis of patients followed up with COVID-19 diagnosis. Nam Kem Med J. 2025;13:125-32.
16. Gao B, Bao Y, Meng M, Yu L, Lu Y, Sa R, et al. Association of serum uric acid with risk of stroke in US adults: a cross-sectional study from NHANES 1999-2020. J Stroke Cerebrovasc Dis. 2023;32:107206.
17. Sayan M, Satir Turk M, Ozkan D, Kankoc A, Tombul I, Celik A. The role of serum uric acid and uric acid to albumin ratio for predicting of lymph node metastasis in lung cancer treated surgically by vats. Port J Card Thorac Vasc Surg. 2023;30:31-6.
18. Bonati LH, Kakkos S, Berkefeld J, de Borst GJ, Bulbulia R, Halliday A, et al. European Stroke Organisation guideline on endarterectomy and stenting for carotid artery stenosis. Eur Stroke J. 2021;6:I-XLVII.
19. Garcia-Garcia HM, McFadden EP, Farb A, Mehran R, Stone GW, Spertus J, et al.; Academic Research Consortium. Standardized end point definitions for coronary intervention trials: the academic research consortium-2 consensus document. Circulation. 2018;137:2635-50.
20. Kuwabara M, Niwa K, Hisatome I, Nakagawa T, Roncal-Jimenez CA, Andres-Hernando A, et al. Asymptomatic hyperuricemia without comorbidities predicts cardiometabolic diseases: five-year Japanese cohort study. Hypertension. 2017;69:1036-44.
21. Feig DI, Kang DH, Johnson RJ. Uric acid and cardiovascular risk. N Engl J Med. 2008;359:1811-21. Erratum in: N Engl J Med. 2010;362:2235.
22. Ramirez AJ, Christen AI, Sanchez RA. Serum uric acid elevation is associated to arterial stiffness in hypertensive patients with metabolic disturbances. Curr Hypertens Rev. 2018;14:154-60.
23. Wijeratne T, Menon R, Sales C, Karimi L, Crewther S. Carotid artery stenosis and inflammatory biomarkers: the role of inflammation-induced immunological responses affecting the vascular systems. Ann Transl Med. 2020;8:1276.
24. Scalise E, Costa D, Bolboac SD, Ielapi N, Bevacqua E, Cristodoro L, et al. The role of inflammation biomarkers in carotid artery stenosis procedures. Ann Vasc Surg. 2025;110(Pt A):34-46.
25. Wasser K, Schnaudigel S, Wohlfahrt J, Psychogios MN, Knauth M, Gröschel K. Inflammation and in-stent restenosis: the role of serum markers and stent characteristics in carotid artery stenting. PLoS One. 2011;6:e22683.
26. Go C, Avgerinos ED, Chaer RA, Ling J, Wazen J, Marone L, et al. Long-term clinical outcomes and cardiovascular events after carotid endarterectomy. Ann Vasc Surg. 2015;29:1265-71.
27. Thierstein L, Pereira-Macedo J, Duarte-Gamas L, Reis P, Myrcha P, Andrade JP, et al. Polyvascular disease influences long-term cardiovascular morbidity in carotid endarterectomy. Ann Vasc Surg. 2024;102:236-43.
28. Karbasi-Afshar R, Saburi A, Taheri S. Clinical associations between renal dysfunction and vascular events: a literature review. ARYA Atheroscler. 2013;9:203-9.
29. Donahue M, Visconti G, Focaccio A, Selvetella L, Baldassarre M, Viviani Anselmi C, et al. Acute kidney injury in patients with chronic kidney disease undergoing internal carotid artery stent implantation. JACC Cardiovasc Interv. 2015;8:1506-14.
30. AbuRahma AF, Alhalbouni S, Abu-Halimah S, Dean LS, Stone PA. Impact of chronic renal insufficiency on the early and late clinical outcomes of carotid artery stenting using serum creatinine vs glomerular filtration rate. J Am Coll Surg. 2014;218:797-805.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):98-104
DOI: 10.4274/BMJ.galenos.2025.2025.8-10

Research

The Neuropathic Dimension of Shoulder Pain: The Effects of Neuropathic Pain on Shoulder Function and Functional Limitation

Omuz Ağrısının Nöropatik Boyutu: Nöropatik Ağrının Omuz Fonksiyonu ve Fonksiyonel Kısıtlılık Üzerine Etkileri

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ABSTRACT

Objective: To determine the effects of neuropathic pain on pain intensity and shoulder function in patients with chronic shoulder pain.

Methods: A total of 102 patients experiencing chronic shoulder pain were enrolled in this cross-sectional observational study. Neuropathic pain was assessed using the Douleur Neuropathique 4 (DN4) questionnaire. Patients were grouped according to DN4 cut-off scores into a neuropathic pain group (≥4) and a non-neuropathic pain group (<4). The visual analogue scale (VAS) and the shoulder pain and disability index (SPADI) were used to measure pain intensity and functional status, respectively.

Results: No significant differences were observed between the groups with respect to demographic characteristics (p>0.05). The incidence of pain on the dominant side was significantly lower in the neuropathic pain group (p=0.022). The neuropathic pain group had significantly higher VAS and total SPADI scores (p≤0.001). The SPADI pain and disability subscores were also significantly higher in the neuropathic group (p=0.001 and p=0.002; respectively). DN4 scores correlated positively with VAS (r=0.383; p<0.001), SPADI pain subscores (r=0.393; p<0.001), SPADI disability subscores (r=0.333; p=0.001), and total SPADI scores (r=0.359; p<0.001).

Conclusion: The presence of a neuropathic component in patients with chronic shoulder pain is associated with greater pain intensity and increased functional limitation. These findings suggest that neuropathic pain should be systematically assessed in this population.

Keywords: Shoulder pain, neuropathic pain, pain intensity, visual analogue pain scale

ÖZ

Amaç: Bu çalışmanın amacı kronik omuz ağrısı olan hastalarda nöropatik ağrının ağrı şiddeti ve omuzun fonksiyonel durumu üzerine etkilerini belirlemektir.

Gereç ve Yöntem: Bu kesitsel gözlemsel çalışmaya kronik omuz ağrısı olan 102 hasta dahil edilmiştir. Nöropatik ağrı, Douleur Neuropathique 4 (DN4) anketi kullanılarak değerlendirilmiştir. Hastalar DN4 kesme puanlarına göre nöropatik ağrı grubu (≥4) ve nöropatik olmayan ağrı grubu (<4) olarak gruplandırılmıştır. Ağrı şiddeti vizüel analog skala (VAS) ile ölçülmüştür ve fonksiyonel durum omuz ağrısı ve sakatlık indeksi (SPADI) ile değerlendirilmiştir.

Bulgular: Gruplar arasında demografik özellikler açısından anlamlı bir fark bulunmamıştır (p>0,05). Nöropatik ağrı grubunda dominant tarafta ağrı görülme sıklığı istatistiksel olarak anlamlı derecede düşük bulunmuştur (p=0,022). Nöropatik ağrı grubunda VAS skorları ve toplam SPADI skorları anlamlı derecede daha yüksekti (p≤0,001). SPADI ağrı ve sakatlık alt skorları da nöropatik grupta anlamlı derecede yüksekti (sırasıyla p=0,001 ve p=0,002). DN4 skorları VAS (r=0,383; p<0,001), SPADI ağrı alt skorları (r=0,393; p<0,001), SPADI sakatlık alt skorları (r=0,333; p=0,001) ve toplam SPADI skorları (r=0,359; p<0,001) ile pozitif korelasyon gösterdi.

Sonuç: Kronik omuz ağrısı olan hastalarda nöropatik bir bileşenin varlığı, daha şiddetli ağrı yoğunluğu ve fonksiyonel kısıtlılıkla ilişkilidir. Bu bulgular doğrultusunda, bu popülasyonda nöropatik ağrı değerlendirmesinin sistematik olarak yapılması önerilmektedir.

Anahtar Kelimeler: Omuz ağrısı, nöropatik ağrı, ağrı şiddeti, vizüel analog ağrı skalası

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Received: 22.08.2025
Accepted: 30.12.2025
Publication Date: 12.03.2026

Cite as: Kalaoğlu E, Kesiktaş N, Şirin Ahısha B, Bucak ÖF. The neuropathic dimension of shoulder pain: the effects of neuropathic pain on shoulder function and functional limitation. Med J Bakirkoy. 2026;22(1):98-104

INTRODUCTION

The shoulder joint, which has the widest range of motion in the human body, is prone to traumatic and non-traumatic injuries, making shoulder pain one of the most common musculoskeletal problems in the general population (1). The lifetime prevalence ranges from 0.67% to 55.2% and differs by age group (1). Shoulder pain is a condition in which various pathologies that play a role in its etiopathogenesis, such as subacromial impingement syndrome, adhesive capsulitis, rotator cuff injuries, glenohumeral osteoarthritis, and tendinopathies, often interact to produce complex clinical presentations that complicate the diagnostic process (2).

The traditional approach has attributed musculoskeletal pain mainly to nociceptive mechanisms and has organized treatment strategies accordingly (3). Recent evidence has revealed that shoulder pain is not just a nociceptive issue resulting from local tissue damage, but a complex condition that can also involve central sensitization and neuropathic mechanisms that aggravate the clinical picture and delay recovery in a significant proportion of patients (4,5). Neuropathic pain is a significant contributor to treatment resistance in shoulder pain due to maladaptive changes in the central nervous system (6). This suggests that central modulation disorders contribute to the failure of peripherally focused interventions (7).

Neuropathic pain is pain caused by a disease or lesion affecting the central or peripheral nervous system; it typically manifests with symptoms such as burning, stinging, and tingling and is usually severe (8). Shoulder pain accompanied by a neuropathic component is associated with adverse clinical outcomes, including increased pain intensity, unresponsiveness to conventional treatments, functional limitations, and a significant decrease in quality of life (9).

Despite its clinical importance, studies investigating the prevalence of neuropathic pain among patients with chronic shoulder pain and the impact of neuropathic pain on clinical outcomes are limited. This lack of information hinders the optimization of both diagnostic and treatment strategies (10,11). Therefore, systematically investigating the presence of a neuropathic component in shoulder pain is critical for developing more effective and personalized treatment approaches for this patient population.

This study aims to determine the effects of neuropathic pain on intensity of pain and functional status of shoulder in patients with chronic shoulder pain.

METHODS

Study Design

This study was designed as a descriptive, cross-sectional observational study. The study was conducted at the physical medicine and rehabilitation outpatient clinic between February 15, 2025 and April 15, 2025. Ethics committee approval was received from the University of Health Sciences Türkiye, İstanbul Physical Therapy and Rehabilitation Training and Research Hospital Scientific Research Ethics Committee (approval no: 2025-18, date: 06.02.2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, and all participants provided written informed consent before participating.

Participants

Of 126 patients assessed for eligibility, 102 were included in the study. A detailed analysis of the patient selection process and exclusion criteria is shown in the Figure 1. Participants were eligible if they were between 18 and 70 years old, had experienced shoulder pain for at least three months, and agreed to participate in the study voluntarily. Exclusion criteria included having a history of trauma or surgery to the affected shoulder; having received injections or physical therapy for the affected shoulder within the past six months; or having a diagnosed psychiatric disorder, such as severe depression, anxiety disorder, or psychosis. Additional exclusion criteria included central nervous system disorders (e.g., Parkinson's disease or multiple sclerosis), diabetes mellitus, pregnancy, severe cognitive impairment that could hinder cooperation or the ability to complete study-related questionnaires, and chronic decompensated cardiac, renal, or hepatic failure.

Data Collection and Assessments

Data for all participants were recorded, including demographic details (age, gender, level of education, occupation, marital status), anthropometric measurements [height, weight, body mass index (BMI)], and clinical information (symptom duration in months, dominant extremity, affected shoulder). Patient assessments were conducted using the Douleur Neuropathique 4 (DN4) to identify neuropathic pain, the visual analogue scale (VAS) to assess pain intensity, and the shoulder pain and disability index (SPADI) to measure shoulder-related functional limitations.

Douleur Neuropathique 4

The DN4 questionnaire consists of 10 items based on patient interviews and clinical examinations, with a total

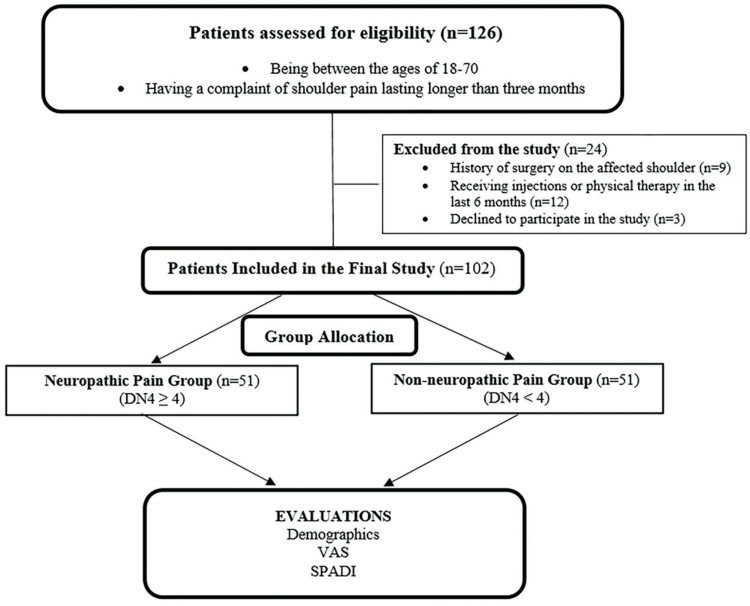

Figure 1. Flow chart of the study
Of the 126 patients assessed for eligibility, 102 were included in the final study after excluding 24 who did not meet the inclusion criteria or declined to participate. Participants were allocated into two groups based on their Douleur Neuropathique 4 (DN4) questionnaire scores: the neuropathic pain group (DN4≥4; n=51) and the non-neuropathic pain group (DN4<4; n=51)
VAS: Visual analogue scale, SPADI: Shoulder pain and disability index

score ranging from 0 to 10. Scores of 4 or higher indicate neuropathic pain (12). Participants were categorized into two groups based on their DN4 scores: a neuropathic pain group (DN4≥4) and a non-neuropathic pain group (DN4<4).

Visual Analogue Scale

VAS is a 10 centimeter scale used to assess pain, with one end representing "no pain" and the other end indicating "worst possible pain" Participants were asked to indicate their pain on a scale from 0 (no pain) to 10 (worst possible pain).

Shoulder Pain and Disability Index

The SPADI is a valid and reliable instrument in Turkish, as reported by Bumin et al. (13). It consists of two subscales: pain (five items) and disability (eight items). All subscale scores and the total score are standardized and expressed on a 0-100 scale. Total scores range from 0 to 100; higher scores indicate greater pain and functional limitation in the affected shoulder (13).

Sample Size

The sample size was calculated using G*Power software (version 3.1.9.4; Franz Faul, Universität Kiel, Germany). The analysis assumed a t-test for between-group comparisons with a statistical power of 80%, a significance level of 5% (α=0.05), and a medium effect size (d=0.5). Based on these parameters, the required sample size was calculated as 102 participants in total (51 participants per group).

Statistical Analysis

The normality of the distribution of continuous variables was assessed using the Kolmogorov-Smirnov test with Lilliefors correction. Continuous variables were summarized as mean±standard deviation and range (minimum-maximum). Categorical variables were presented as frequencies and percentages. Comparisons between two independent groups were made using the Mann-Whitney U test for non-normally distributed data and the independent samples t-test for normally distributed data. The homogeneity of categorical variables across groups was assessed using Pearson's chi-square test. Spearman's rank correlation coefficient was used to evaluate the relationships between variables because the data did not meet the normality assumption. Statistical significance was defined as $p<0.05$. Data analyses were performed using IBM SPSS Statistics version 21.0.

RESULTS

Tables 1 and 2 summarize the demographic and clinical characteristics of the 102 patients enrolled in the study. Among the participants, 70.6% were female, and the right shoulder was the most commonly affected side (57.8%). No statistically significant differences were observed between groups in terms of demographic variables, including age, BMI, pain duration, gender, and education level ($p>0.05$).

The neuropathic pain group had significantly higher VAS pain intensity and total SPADI scores than the non-neuropathic pain group (p≤0.001). Additionally, the SPADI pain and disability subscores were significantly higher in the neuropathic pain group (p=0.001 and p=0.002; respectively) (Table 1). The incidence of pain on the dominant side was found to be significantly lower in the neuropathic pain group (p=0.022) (Table 2).

No statistically significant correlations were found between DN4 scores and age, height, weight, duration of pain, or BMI (p>0.05). However, DN4 scores were positively correlated with VAS pain intensity [r=0.383; p<0.001; 95% confidence interval (CI) (0.214, 0.533)], the SPADI pain subscore [r=0.393; p<0.001; 95% CI (0.211, 0.554)], the SPADI disability subscore [r=0.333; p=0.001; 95% CI (0.138, 0.511)], and the total SPADI score [r=0.359; p<0.001, 95% CI (0.162, 0.540)] (Table 3).

Table 1. Comparison of demographic and clinical characteristics of the groups

	Neuropathic pain group (n=51)		Non-neuropathic pain group (n=51)		p-value
	Mean±SD	Min-max	Mean±SD	Min-max	
Age (years)	52.16±11.45	24-74	54.33±11.74	24-81	0.418**
Height (cm)	165.41±10.50	150-188	161.49±6.57	144-185	0.636**
Weight (kg)	76.22±17.33	49-128	71.37±12.70	49-95	0.111*
BMI (kg/m²)	27.81±5.53	19.10-40.89	26.58±4.70	19.92-37.58	0.235**
Duration of pain (months)	10.61±7.94	3-36	10.27±8.57	3-36	0.535**
VAS	8.08±1.51	4-10	6.84±1.79	3-10	**<0.001****
SPADI pain subscores	80.78±14.63	44-100	68.04±20.43	0-100	**0.001****
SPADI disability subscores	67.92±20.16	5-98.80	54.97±20.71	7.5-87.50	**0.002****
Total SPADI score	72.85±16.52	33.90-97.70	59.93±19.58	11.50-89.20	**<0.001***

*: Independent samples t-test, **: Mann-Whitney U test, SD: Standard deviation, BMI: Body mass index, SPADI: Shoulder pain and disability index, VAS: Visual analogue scale

Table 2. Distribution and comparison of categorical demographic characteristics of the groups

		Neuropathic pain group (n=51) n (%)	Non-neuropathic pain group (n=51) n (%)	p-value
Affected side	Right	25 (49%)	34 (66.7%)	0.71
	Left	26 (51%)	17 (33.3%)	
Dominan side	Right	48 (94.1%)	46 (90.2%)	0.461
	Left	3 (5.9%)	5 (9.8%)	
Dominant side affected	Yes	28 (54.9%)	39 (76.5%)	**0.022**
	No	23 (45.1%)	12 (23.5%)	
Education level	Primary school	23 (45.1%)	22 (43.1%)	0.844
	Middle school	7 (13.7%)	6 (11.8%)	
	High school	16 (31.4%)	15 (29.4%)	
	University	5 (9.8%)	8 (15.7%)	
Marital status	Married	40 (78.4%)	40 (78.4%)	1.000
	Single	11 (21.6%)	11 (21.6%)	
Gender	Male	13 (25.5%)	17 (33.3%)	0.385
	Female	38 (74.5%)	34 (66.7%)	
Employment status	Employed	37 (72.5%)	33 (64.7%)	0.393
	Unemployed	14 (27.5%)	18 (35.3%)	

Pearson chi-square

Table 3. Correlation between DN4 scores and other parameters

	DN4 Scores		
	r	**p-value**	**95% confidence interval**
Age (years)	-0.087	0.386	-0.302, 0.124
Height (cm)	-0.023	0.819	-0.214, -0.172
Weight (kg)	0.072	0.469	-0.128, 0.258
BMI (kg/m²)	0.110	0.271	-0.098, 0.314
Duration of pain (months)	0.087	0.384	-0.103, 0.265
VAS	0.383	<0.001	0.214, 0.533
SPADI pain subscores	0.393	<0.001	0.211, 0.554
SPADI disability subscores	0.333	0.001	0.138, 0.511
Total SPADI score	0.359	<0.001	0.162, 0.540

r: Spearman correlation coefficient, DN4: Douleur Neuropathique 4, BMI: Body mass index, SPADI: Shoulder pain and disability index, VAS: Visual analogue scale

DISCUSSION

This study demonstrates that neuropathic mechanisms in patients with chronic shoulder pain are strongly associated with higher pain intensity and significantly poorer functional capacity. The findings suggest that the pathophysiology of chronic shoulder pain is not limited to nociceptive mechanisms; neuropathic processes also play a critical role. These results highlight the prognostic importance of neuropathic mechanisms in the assessment and management of shoulder pain and are consistent with current literature (14,15).

Although our study was not designed to assess prevalence, neuropathic pain was detected in half of the patients using the DN4 scale. This rate approaches the upper end of the reported prevalence range for neuropathic pain (20-55%) (5,14,16). Several demographic and methodological factors may account for this finding. First, our study included a broader age range compared with earlier reports, which typically focused on younger or surgically selected populations. The inclusion of older individuals may have increased the likelihood of age-related changes in nociceptive and neuropathic processing. Second, only patients with chronic shoulder pain (≥3 months) were enrolled, resulting in a sample enriched with persistent pain mechanisms and potential central sensitization. Third, the proportion of female participants in our cohort was higher, and previous studies have shown that women tend to report neuropathic pain symptoms more frequently due to both biological and psychosocial influences (15,16). Moreover, the application of strict exclusion criteria—such as the omission of patients with diabetes or neurological disorders—yielded a homogeneous sample in which neuropathic symptoms were more directly attributable to shoulder pathology. Finally, the use of the DN4, a sensitive screening questionnaire, as the sole assessment tool may have contributed to the higher detection rate compared with studies that employed additional confirmatory methods. Collectively, these methodological and demographic differences likely account for the higher prevalence of neuropathic pain observed in our study.

In this study, VAS scores were also found to be significantly higher in the neuropathic pain group. This can be explained by several mechanisms. Neuropathic pain is characterized by structural and functional alterations in the peripheral and central nervous systems, including abnormal neurotransmission and ectopic discharges, which contribute to heightened pain perception (17). In addition, the presence of hyperalgesia and allodynia, which are important components of neuropathic pain, may contribute to an increased perception of pain intensity (18). Another possible mechanism is central sensitization, which refers to increased sensitivity of central pain-related structures. Although our study did not directly investigate central sensitization, previous studies have reported that central sensitization and neuropathic pain often coexist (19). Moreover, reduced responsiveness to treatment has been reported in several studies, both because of the inherent characteristics of neuropathic pain and because of the coexistence of central sensitization (20). Sanchis et al. (14) reported that central sensitization significantly increases pain intensity and negatively affects treatment response. Bucak et al. (21) reported elevated somatic amplification levels in patients with shoulder impingement syndrome who did not respond to subacromial injection therapy. Similarly, Gwilym et al. (9) demonstrated that neuropathic pain in patients with shoulder impingement syndrome results in delayed postoperative recovery and persistently high pain levels. The lack of a favorable treatment response

promotes pain chronification and increases its perceived intensity at the central level. It also predisposes patients to catastrophize their pain, which further contributes to higher reported pain levels (22). In this context, the results of our study are consistent with the existing literature.

In terms of functional outcomes, the significantly higher SPADI scores across all subdimensions in the neuropathic pain group suggest that these patients experience substantial limitations in their daily lives. Previous studies have reported a strong association between increased symptoms of central sensitization and functional limitations (5,23). Nijs et al. (4) demonstrated that central sensitization exacerbates functional impairment and negatively influences treatment outcomes. Taken together, these findings imply that neuropathic mechanisms and sensory amplification may have a shared pathophysiological basis that impedes functional recovery in patients with shoulder pain.

In the shoulder pathology literature, the dominant side is more frequently affected, owing to increased mechanical loading, repetitive movements, and greater functional use (24). However, the presence of neuropathic pain appears to disrupt this typical pattern of predominant involvement of the dominant side (25). In our study, the prevalence of dominant-side involvement in individuals with neuropathic pain was significantly lower. This finding may reflect central mechanisms overriding peripheral load-related influences. Chronic nociceptive input from the shoulder can induce cortical reorganization and altered interhemispheric connectivity, leading to bilateral pain perception or a shift of pain representation independent of mechanical dominance (26). Moreover, neuroplastic changes in the somatosensory cortex and thalamus have been shown to cause pain perception to spread beyond the initially affected region, supporting the concept of central sensitization (4,7,27). These findings are consistent with the bilateral cortical reorganization processes described by Flor (26), which explain why pain localization in chronic neuropathic conditions may be determined more by central nervous system alterations than by peripheral mechanical factors. In this context, the reduced dominant-side involvement observed in our study provides important insights into the transition from peripherally driven nociceptive pain to centrally mediated neuropathic mechanisms in chronic shoulder pain.

Additionally, the lack of a significant correlation between DN4 scores and age or BMI indicates that neuropathic pain may influence the clinical course independently of these demographic factors. As conventional approaches primarily target nociceptive mechanisms, they may be ineffective in the treatment of neuropathic pain. Gabapentinoids and serotonin-norepinephrine reuptake inhibitors are recommended as first-line pharmacological agents for the management of neuropathic pain (28). However, integrating exercise protocols that address central sensitization alongside multimodal treatment strategies is essential to achieve optimal therapeutic outcomes (29). These findings reinforce the understanding that neuropathic pain is a distinct pathophysiological mechanism with significant implications for functional capacity, highlighting the need for comprehensive, individualized treatment planning.

The strengths of this study include an adequate sample size determined by power analysis, the use of validated measurement tools (DN4, VAS, and SPADI), and homogeneous inclusion criteria. These methodological features enhance the reliability and internal validity of the findings.

Study Limitations

This study has several limitations that should be acknowledged. First, its cross-sectional design limits the ability to draw causal inferences. Second, as a single-center study, the findings may have limited generalizability to broader populations. Third, neuropathic pain was evaluated solely using the DN4 questionnaire. Although DN4 is a validated and widely used screening tool, it primarily relies on subjective reports and a brief clinical examination, which may limit its sensitivity in detecting subtle neuropathic features. Additional confirmatory methods, such as quantitative sensory testing or neurophysiological assessments, could have provided a more comprehensive evaluation; however, these methods were not feasible in our outpatient clinical setting due to practical and resource-related constraints. Lastly, psychosocial variables were not included in the analysis; their omission may have influenced pain perception and functional outcomes.

CONCLUSION

In conclusion, this study highlights that the presence of a neuropathic component in patients with chronic shoulder pain is associated with greater pain intensity and increased functional limitations. These findings suggest that neuropathic pain should be systematically assessed in this population. Future research should focus on validating multimodal treatment approaches that incorporate evidence-based strategies for neuropathic pain, such as specific pharmacological agents and exercise protocols addressing central sensitization, within this patient group.

ETHICS

Ethics Committee Approval: Ethics committee approval was received from the University of Health Sciences Türkiye, İstanbul Physical Therapy and Rehabilitation Training and Research Hospital Scientific Research Ethics Committee (approval no: 2025-18, date: 06.02.2025).

Informed Consent: All participants provided written informed consent before participating.

FOOTNOTES

Authorship Contributions

Concept: E.K., N.K., B.Ş.A., Ö.F.B., Design: E.K., N.K., B.Ş.A., Ö.F.B., Data Collection or Processing: E.K., Analysis or Interpretation: E.K., N.K., Literature Search: E.K., B.Ş.A., Ö.F.B., Writing: E.K., B.Ş.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Lucas J, van Doorn P, Hegedus E, Lewis J, van der Windt D. A systematic review of the global prevalence and incidence of shoulder pain. BMC Musculoskelet Disord. 2022;23:1073.
2. Lewis J, McCreesh K, Roy JS, Ginn K. Rotator cuff tendinopathy: navigating the diagnosis-management conundrum. J Orthop Sports Phys Ther. 2015;45:923-37.
3. Kosek E, Clauw D, Nijs J, Baron R, Gilron I, Harris RE, et al. Chronic nociplastic pain affecting the musculoskeletal system: clinical criteria and grading system. Pain. 2021;162:2629-34.
4. Nijs J, George SZ, Clauw DJ, Fernández-de-Las-Peñas C, Kosek E, Ickmans K, et al. Central sensitisation in chronic pain conditions: latest discoveries and their potential for precision medicine. Lancet Rheumatol. 2021;3:e383-92.
5. Bilika P, Nijs J, Fandridis E, Dimitriadis Z, Strimpakos N, Kapreli E. In the shoulder or in the brain? Behavioral, psychosocial and cognitive characteristics of unilateral chronic shoulder pain with symptoms of central sensitization. Healthcare (Basel). 2022;10:1658.
6. Baron R, Binder A, Wasner G. Neuropathic pain: diagnosis, pathophysiological mechanisms, and treatment. Lancet Neurol. 2010;9:807-19.
7. Woolf CJ. Central sensitization: implications for the diagnosis and treatment of pain. Pain. 2011;152(3 Suppl):S2-15.
8. Finnerup NB, Haroutounian S, Kamerman P, Baron R, Bennett DLH, Bouhassira D, et al. Neuropathic pain: an updated grading system for research and clinical practice. Pain. 2016;157:1599-606.
9. Gwilym SE, Oag HC, Tracey I, Carr AJ. Evidence that central sensitisation is present in patients with shoulder impingement syndrome and influences the outcome after surgery. J Bone Joint Surg Br. 2011;93:498-502.
10. Vrouva SD, Sopidou VK, Chanopoulos KP, Bakalidou DF, Papatsimpas VC, Sorras N, et al. Is shoulder pain and disability index a prognostic factor for neuropathic shoulder pain? Cureus. 2021;13:e19173.
11. Yücel FN, Özgüç S, Bahar-Özdemir Y, Ata E. The impact of central sensitization-related symptoms on subacromial steroid injection outcomes in patients with subacromial impingement syndrome: an observational study. Korean J Pain. 2025;38:29-42.
12. Unal-Cevik I, Sarioglu-Ay S, Evcik D. A comparison of the DN4 and LANSS questionnaires in the assessment of neuropathic pain: validity and reliability of the Turkish version of DN4. J Pain. 2010;11:1129-35.
13. Bumin G, Tüzün EH, Tonga E. The shoulder pain and disability index (SPADI): cross-cultural adaptation, reliability, and validity of the Turkish version. J Back Musculoskelet Rehabil. 2008;21:57-62.
14. Sanchis MN, Lluch E, Nijs J, Struyf F, Kangasperko M. The role of central sensitization in shoulder pain: a systematic literature review. Semin Arthritis Rheum. 2015;44:710-6.
15. Ko S, Choi C, Kim S, Chae S, Choi W, Kwon J. Prevalence and risk factors of neuropathic pain in patients with a rotator cuff tear. Pain Physician. 2018;21:E173-80.
16. Ucar M, Cebicci MA, Koca I, Arik HO. Frequency of neuropathic pain in patients with shoulder pain. Eur Rev Med Pharmacol Sci. 2022;26:5422-5.
17. Costigan M, Scholz J, Woolf CJ. Neuropathic pain: a maladaptive response of the nervous system to damage. Annu Rev Neurosci. 2009;32:1-32.
18. Jensen TS, Finnerup NB. Allodynia and hyperalgesia in neuropathic pain: clinical manifestations and mechanisms. Lancet Neurol. 2014;13:924-35.
19. Lütolf R, Rosner J, Curt A, Hubli M. Indicators of central sensitization in chronic neuropathic pain after spinal cord injury. Eur J Pain. 2022;26:2162-75.
20. Hansson P, Backonja M, Bouhassira D. Usefulness and limitations of quantitative sensory testing: clinical and research application in neuropathic pain states. Pain. 2007;129:256-9.
21. Bucak ÖF, Cengiz Çavuşoğlu E, Öncel A, Kalaoğlu E. Subacromial injection failure in shoulder impingement: is somatic amplification the missing link? Eur Res J. 2025;11:1057-66.
22. Mankovsky T, Lynch M, Clark A, Sawynok J, Sullivan MJ. Pain catastrophizing predicts poor response to topical analgesics in patients with neuropathic pain. Pain Res Manag. 2012;17:10-4.
23. McKenna L, Lowry T, Beales D. Increased central sensitivity is associated with greater shoulder disability in people with musculoskeletal shoulder symptoms: a cross-sectional study. Musculoskelet Sci Pract. 2025;78:103334.
24. Miranda H, Viikari-Juntura E, Martikainen R, Takala EP, Riihimäki H. A prospective study of work related factors and physical exercise as predictors of shoulder pain. Occup Environ Med. 2001;58:528-34.
25. Sasaki T, Shitara H, Tajika T, Ichinose T, Hamano N, Kamiyama M, et al. Relationship between nontraumatic shoulder disorders and neuropathic pain: retrospective observational analyses of clinical features and background factors. Anesthesiol Res Pract. 2023;2023:6046746.
26. Flor H. Cortical reorganisation and chronic pain: implications for rehabilitation. J Rehabil Med. 2003;(41 Suppl):66-72.
27. Paul TM, Soo Hoo J, Chae J, Wilson RD. Central hypersensitivity in patients with subacromial impingement syndrome. Arch Phys Med Rehabil. 2012;93:2206-9.
28. Finnerup NB, Attal N, Haroutounian S, McNicol E, Baron R, Dworkin RH, et al. Pharmacotherapy for neuropathic pain in adults: a systematic review and meta-analysis. Lancet Neurol. 2015;14:162-73.
29. Nijs J, Leysen L, Vanlauwe J, Logghe T, Ickmans K, Polli A, et al. Treatment of central sensitization in patients with chronic pain: time for change? Expert Opin Pharmacother. 2019;20:1961-70.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):105-110
DOI: 10.4274/BMJ.galenos.2026.2025.8-12

Research

Retrospective Evaluation of Chemotherapy Induced Nausea and Vomiting in Pediatric Oncology Patients

Pediatrik Onkoloji Hastalarında Kemoterapiye Bağlı Bulantı ve Kusmanın Retrospektif Değerlendirilmesi

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ABSTRACT

Objective: Nausea and vomiting are among the most common and distressing side effects caused by chemotherapy. This study aimed to evaluate the effectiveness of the antiemetic protocol used in our center and to explore possible improvements.

Methods: In this study, the medical records of patients aged between 1 month and 18 years who were diagnosed with solid tumors and lymphomas and who received chemotherapy and radiotherapy in our clinic were retrospectively reviewed.

Results: Of the patients included in the study, 60.9% (n=53) were male, and 39.1% (n=34) were female. Among the 151 chemotherapy cycles administered, acute and delayed vomiting were observed in 26.5% and 18% of cycles, respectively. Refractory and anticipatory vomiting occurred in 6% and 18% of cases, respectively. Refractory vomiting was detected in adolescents, in the germ cell tumor group, and during the initial chemotherapy cycles. The lowest incidence of acute vomiting (0%-20%) occurred in patients who engaged in play activities or watched television or videos during treatment. In 70.2% of the chemotherapy cycles, granisetron was administered alone, while aprepitant was added in 23.2%.

Conclusion: Chemotherapy-associated vomiting is a frequent and undesirable side effect in pediatric patients. The relationship between nausea and vomiting and factors such as parental smoking, educational background, and activities during chemotherapy administration warrants further investigation.

Keywords: Nausea-vomiting, chemotherapy, childhood

ÖZ

Amaç: Bulantı-kusma kemoterapinin en sık neden olduğu, rahatsız edici yan etkilerdir. Bu çalışmada merkezimizdeki antiemetik protokolün etkinliğinin değerlendirilmesi ve antiemetik protokolün iyileştirilmesi amaçlandı.

Gereç ve Yöntem: Bu çalışmada kliniğimizde tedavi gören solid tümör ve lenfoma tanısı ile kemoterapi ve radyoterapi alan, 1 ay-18 yaş arasında olan hastaların dosyaları retrospektif olarak incelendi.

Bulgular: Çalışmaya alınan hastaların %60,9'u (n=53) erkek ve %39,1'i (n=34) kadındı. Hastalara verilen 151 kürün %26,5'inde akut kusma, %18'inde geç kusma görüldü. Dirençli kusma oranı %6, beklenti kusması oranı %18 idi. Dirençli kusma ergenlerde, germ hücreli tümör grubunda ve ilk kemoterapi kürlerinde saptandı. En yüksek akut kusma tek kemoterapötik ilaç alanlarda gözlendi. En düşük düzeyde akut kusma kür sırasında oyun oynayan, televizyon ve video izleyen hastalarda (%0 ile %20) gözlendi. Kürlerin %70,2'sinde granisetron tek başına verildi, %23,2'sinde aprepitant eklendi.

Sonuç: Kemoterapi ile ilişkili kusma çocukluk çağında sık görülen ve istenmeyen bir yan etkidir. Ebeveyn sigara içiciliği, eğitimi ve kemoterapi alırken yapılan aktivitelerle bulantı-kusma arasındaki ilişki irdelenebilir.

Anahtar Kelimeler: Bulantı-kusma, kemoterapi, çocukluk çağı

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Cite as: Abdulaliyeva G, Temuroğlu A, Aksoy GR, Sevinir BB. Retrospective evaluation of chemotherapy induced nausea and vomiting in pediatric oncology patients. Med J Bakirkoy. 2026;22(1):105-110

Received: 03.09.2025
Accepted: 23.01.2026
Publication Date: 12.03.2026

INTRODUCTION

Nausea and vomiting are among the most common side effects of chemotherapy (1). They significantly impair the patient's quality of life and may lead to metabolic disturbances, malnutrition, and reduced physical and mental performance. Prolonged hospitalizations and delays in subsequent chemotherapy cycles are other undesirable consequences (2). Ultimately, nausea and vomiting can hinder the optimal delivery of treatment. In addition, chronic nausea and vomiting related to the disease or treatment may occur in patients with advanced-stage cancer or in those undergoing radiotherapy (3).

Nausea and vomiting caused by chemotherapy can be acute, delayed, anticipatory, or refractory. Acute vomiting refers to vomiting that occurs within the first 24 hours of chemotherapy. Delayed vomiting refers to vomiting that occurs between 24 hours and 5 days. Anticipatory vomiting occurs after prior chemotherapy and before treatment in subsequent cycles. Refractory vomiting refers to episodes of vomiting that persist despite antiemetic protocols. The frequency and severity of nausea and vomiting in patients receiving chemotherapy or radiotherapy can be influenced by numerous factors, including the dose and combination of chemotherapy agents; the radiotherapy target areas (such as total body, abdomen, or brain); and individual patient factors, such as age, sex, and comorbidities (4).

The availability of antiemetic drugs for children is limited. Over time, the administration of higher doses and more frequent dosing of chemotherapeutic agents, as well as the inclusion of newly developed anticancer drugs in treatment protocols, necessitates a re-evaluation of the adequacy of current antiemetic regimens. This study aimed to investigate the factors influencing chemotherapy-induced nausea and vomiting.

METHODS

Patients aged 1 month to 18 years who were diagnosed with solid tumors and lymphomas and who received chemotherapy and radiotherapy at our clinic between October 1, 2021, and July 21, 2022, were included in this study. Patients over 18 years of age and those diagnosed with leukemia were excluded. Data from 151 chemotherapy cycles administered to 87 eligible patients were retrospectively reviewed. Ethical approval was obtained from the Bursa Uludağ University Faculty of Medicine, Clinical Research Ethics Committee (approval no: 2021-13/7, date: 22.09.2021).

Patients' age, sex, oncological diagnoses, chemotherapeutic agents used in their protocols, date of the first chemotherapy session, dates of chemotherapy cycles considered for evaluation, and antiemetic medications used were recorded. If applicable, surgical history and radiotherapy status, including sites and doses, were evaluated. The presence of acute, delayed, anticipatory, and refractory vomiting was identified through medical records. The patients' social activities during chemotherapy [such as reading books, playing games on the phone, engaging in playdough, puzzles, or coloring, and watching television (TV) or videos] were documented. Patient activities were prospectively observed and recorded during the thesis period; however, the current study was designed as a retrospective analysis based on the review of these pre-existing records. The caregivers' educational background and the smoking status of both caregivers and patients were also assessed.

A standard form was created for each patient included in the study. The emetogenic potential of chemotherapy protocols was evaluated based on the literature (5,6). Based on the number of vomiting episodes in the medical records and data on appetite and nutritional intake, the severity of acute and delayed nausea/vomiting was determined (7). In our clinic, 5-hydroxytryptamine 3 (5-HT_3) receptor antagonists and dexamethasone or aprepitant are used as antiemetics in patients undergoing highly emetogenic chemotherapy. A 5-HT_3 receptor antagonist is used in patients receiving moderately emetogenic or low-emetogenic chemotherapy. Patients who continued to experience vomiting despite these treatments were assessed for their additional treatment needs.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics 22.0 software. Categorical variables were presented as frequencies (n) and percentages (%). Pearson's chi-square tests were used to compare oncological diagnoses, age, sex, chemotherapeutic agents, and number of drugs. The significance level was set at $p<0.05$.

RESULTS

Of the patients included in the study, 60.9% (n=53) were male and 39.1% (n=34) were female. The mean age at diagnosis was 9.08±5.43 years (range: 0.58-17.9 years). Among the patients, 32.2% (n=28) were younger than 5 years of age, 23% (n=20) were 5-9 years of age, 26.6% (n=23) were 10-14 years of age, and 18.4% (n=16) were 15 years of age or older.

When evaluated by diagnosis, the most common diagnoses were central nervous system tumors (19.5%; n=17), followed by malignant bone tumors (18.4%; n=16), germ cell tumors (13.8%; n=12), and non-Hodgkin lymphoma (11.5%; n=10) (Figure 1).

With respect to treatment modalities, 82.8% (n=72) of patients received chemotherapy, and 17.2% (n=15) received radiotherapy. Across the entire patient cohort, 12.6% (n=19) were undergoing their first chemotherapy cycle, while 87.4% (n=132) had previously received chemotherapy. According to the emetogenic risk of the chemotherapeutic agents administered, 95.4% (n=144) of chemotherapy cycles were classified as highly emetogenic, 3.3% (n=5) as moderately emetogenic, and 1.3% (n=2) as minimally emetogenic. Table 1 presents the patients' demographic characteristics and treatments received.

Acute vomiting was observed in 26.5% (n=40) of chemotherapy cycles. Among these cases, 20.8% (n=19) were observed in males and 35% (n=21) in females (p=0.062). Among participants older than 15 years, acute vomiting was present in 39.3% (n=13) (p=0.069). Delayed vomiting occurred in 18% (n=27) of chemotherapy cycles. Of these, 55.5% (n=15) and 44.4% (n=12) were observed in male and female patients, respectively (p=0.666). With respect to age, 12.1% (n=4) were older than 15 years (p=0.337).

Refractory vomiting was noted in 6.0% (n=9) of cycles. In all cases, the patients were aged 13.5 years or older. The male-to-female ratio was 8:1. Among those receiving their first chemotherapy cycle, the incidence of refractory vomiting was 15.5%, compared with 4.5% among those receiving subsequent cycles; this difference was not statistically significant (p=0.087). The distribution of patients by vomiting type is presented in Table 2.

When examining rates of acute and delayed vomiting by tumor type, 45% (n=18) of patients with acute vomiting had malignant bone tumors, while 18.6% (n=5) of patients with delayed vomiting had Wilms tumors. Patients with malignant bone tumors were the most likely to experience persistent vomiting despite receiving an antiemetic protocol appropriate for their diagnosis and required additional doses of granisetron. The use of aprepitant was most frequently required for malignant bone tumors and germ cell tumors (Figure 2 and Table 2).

Regarding additional therapies, 25 cycles (16.5%) included radiotherapy targeting the cranium, craniospinal axis, abdomen, pelvis, or thorax, administered non-concurrently with chemotherapy. Intrathecal therapy was administered over nine cycles. Additional doses of granisetron were required in 66.6% of cycles with intrathecal therapy and 33.4% of those without. This difference was statistically significant (p=0.004).

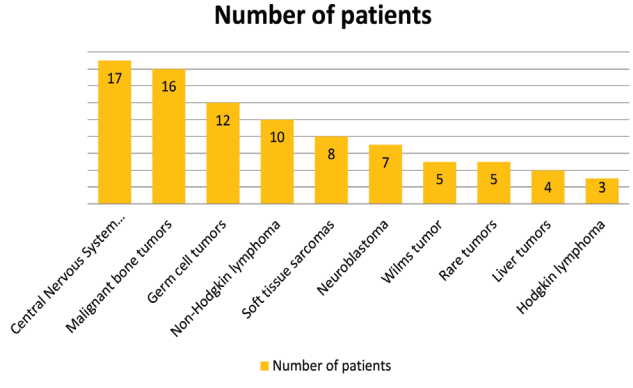

Figure 1. Distribution of patients by oncological diagnosis

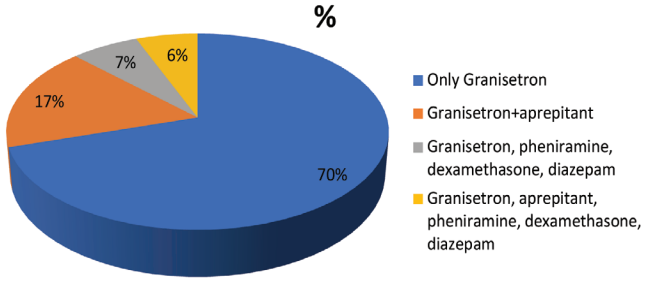

Figure 2. Antiemetic drugs used in patients

Table 1. Demographic data and treatments received by patients

Data	Number of patients	Percentage of patients (%)
Sex		
Female	34	39.1%
Male	53	60.9%
Age (years)		
<5	28	32.2%
5-9	20	23%
10-14	23	26.4%
>15	16	18.4%
Distribution of chemotherapy cycles by emetogenicity	**Number of cycles**	**Percentage of cycles (%)**
Low emetogenicity	2	1.3%
Moderate emetogenicity	5	3.3%
High emetogenicity	144	95.4%
Distribution by anticipatory vomiting		
With anticipatory vomiting	27	18%
Without anticipatory vomiting	124	82%
Distribution by acute vomiting		
With acute vomiting	40	26.5%
Without acute vomiting	111	73.5%
Distribution by delayed vomiting		
With delayed vomiting	27	18%
Without delayed vomiting	124	82%
Distribution by refractory vomiting		
With refractory vomiting	9	6%
Without refractory vomiting	142	94%

Table 2. Patients' tumor types and vomiting rates

Tumor type	Acute vomiting present n=40 (%)	Acute vomiting absent n=111 (%)	Delayed vomiting present n=27 (%)	Delayed vomiting absent n=124 (%)
Non-Hodgkin lymphoma	2 (5)	18 (16.2)	2 (7.4)	18 (14.5)
Hodgkin lymphoma	2 (5)	1 (0.9)	2 (7.4)	1 (0.8)
Neuroblastoma	0 (0)	9 (8.1)	2 (7.4)	7 (5.6)
CNS tumors	4 (10)	24 (21.6)	3 (11.1)	25 (20.2)
Soft tissue sarcoma	4 (10)	9 (8.1)	2 (7.4)	11 (8.9)
Malignant bone tumors	18 (45)	21 (18.9)	4 (14.8)	35 (28.2)
Liver tumors	1 (2.5)	5 (4.5)	1 (3.7)	4 (6.4)
Wilms tumor	5 (12.5)	5 (4.5)	5 (18.6)	5 (4)
Germ cell tumors	3 (7.5)	13 (11.7)	3 (11.1)	13 (10.5)
Rare tumors	1 (2.5)	5 (4.5)	3 (11.1)	3 (2.5)
Total	40 (100)	111 (100)	27 (100)	124 (100)

CNS: Central nervous system

Surgery was performed in 125 of the 151 chemotherapy cycles. An additional dose of granisetron was required in 32 of these cycles (25.6%), while it was not required in 93 cycles (74.4%). There was no significant association between surgery and the need for additional granisetron (p=0.819).

Patients' activities during chemotherapy were also assessed. Patients engaged in play during 68.8% (n=104) of cycles. Readings were observed in 30 cycles (19.8% of cycles). The incidence of acute vomiting during play and while watching TV or videos ranged from 0% to 20%, indicating a low frequency.

Among caregivers, 17% (n=14) were illiterate; 15% (n=13) had completed primary education; 30% (n=26) had completed middle school; 30% (n=26) had completed high school; and 8% (n=8) had completed university degrees. No association was found between caregiver education and the presence of early or delayed vomiting.

Caregiver smoking was reported in 23% (n=20), and patient smoking was reported in 2.3% (n=2). Among the 40 cycles with acute vomiting, 17.5% (n=7) had a smoking caregiver (p=0.387). Among the 27 cycles with delayed vomiting, 22.2% (n=6) involved a smoking caregiver, indicating a statistically significant association (p=0.017).

DISCUSSION

Adverse effects of treatment in pediatric oncology patients significantly compromise treatment adherence. Nausea and vomiting are the most common acute side effects (1). Very few randomized clinical trials have investigated antiemetic protocols in pediatric cancer patients. Moreover, both parents and healthcare professionals may underestimate nausea and vomiting when patients with cancer experience other serious medical problems. In particular, recognizing the severity of symptoms in delayed nausea and vomiting remains a challenge (8). At our center, data on pediatric patients with cancer receiving chemotherapy, including the effectiveness of the antiemetic protocol, were evaluated. Based on the results of this study, we aimed to improve control of patients' nausea and vomiting.

Nausea and vomiting are reported more frequently in females than in males, and more frequently in adolescents than in younger children (9-11). In our study, no statistically significant difference in sex distribution was found between patients with acute and delayed vomiting. When stratified by age group, the highest rate of acute vomiting was observed in patients older than 15 years.

Vomiting is more frequently observed in patients with tumors that exert pressure on the gastrointestinal organs or increase intracranial pressure (10). In our cohort, acute vomiting was most frequently observed in patients with malignant bone tumors, whereas delayed vomiting was most common in patients with Wilms tumor. In contrast, no acute vomiting episodes were observed among patients with neuroblastoma. In our clinic, treatments for Wilms tumor are administered in the outpatient chemotherapy unit, which consists of 10 beds. Therefore, we consider that the shared treatment environment may have contributed to acute vomiting. In this unit, chemotherapy is administered following granisetron infusion. Granisetron should ideally be administered half an hour before chemotherapy; however, this timing may not always be followed due to patient volume. In malignant bone tumors, the increased frequency of vomiting may be attributed to the high emetogenicity of the administered agents.

Refractory vomiting is more frequently observed in patients who do not receive adequate antiemetic prophylaxis during

their initial chemotherapy cycles (11). In our study, refractory vomiting was more commonly observed in older patients and in those with germ cell tumors. This may be related to the administration of platinum-based chemotherapy in germ cell tumors. Furthermore, anticipatory vomiting was observed in 17.9% of the cycles. These were patients in whom nausea and vomiting had not been adequately controlled during previous chemotherapy cycles. This suggests that stricter antiemetic management is necessary from the very first cycle.

The incidence of radiation-induced nausea and vomiting ranges from 40% to 80% (12). It is associated with either direct irradiation of tissues during radiotherapy or the release of emetogenic substances from the irradiated regions (7). In our cohort, radiotherapy was not administered concurrently with chemotherapy. Among patients who received radiotherapy, additional granisetron was most frequently required in those with a history of abdominal irradiation (50%). However, no statistically significant difference was found with respect to the irradiation site (p=0.827).

Surgical intervention is a fundamental component of oncology treatment. Nausea and vomiting of varying severity may occur following surgery (13). Surgeries lasting longer than 30 minutes, patients older than 3 years, and a family history of postoperative nausea and vomiting are among the factors that increase the risk of postoperative vomiting (14). At our center, chemotherapy cycles were administered at least six weeks after craniotomy, and between one and six weeks after other surgical interventions. No association was observed between surgical treatment and nausea or vomiting. Intrathecal therapy may cause nausea and vomiting. However, because sedatives and intravenous chemotherapeutic agents are often co-administered, it is difficult to determine which agent is responsible for the reaction. In patients with leukemia, excellent antiemetic responses have been achieved with prophylaxis among those receiving intrathecal methotrexate and intravenous vincristine (15). In our study, intrathecal therapy was administered to patients diagnosed with non-Hodgkin lymphoma according to standard chemotherapy protocols. Midazolam was used for sedation. No routine antiemetic prophylaxis was administered before the procedure, and 66.6% of these patients required granisetron afterward.

International pediatric oncology groups, such as the Children's Oncology Group, define the treatment of chemotherapy-induced nausea and vomiting as a cornerstone of supportive care in pediatric patients with cancer (16). Due to its minimal side effects and lower interindividual metabolic variability, granisetron is often preferred in clinical practice. In our study, granisetron was the most commonly used antiemetic. In Türkiye, relatively low use of aprepitant is attributed to reimbursement restrictions. The study highlighted the need to increase training in the effective use of antiemetic guidelines.

In addition to pharmacological measures, complementary approaches that promote patient comfort are recommended for the prevention of chemotherapy-induced nausea and vomiting. Non-pharmacological strategies such as mindfulness, distraction, and relaxation techniques may be employed (17). However, evidence supporting the efficacy of non-pharmacological methods remains limited, and they are therefore not included in most standard guidelines (18). The Pediatric Oncology Group of Ontario guidelines include these measures only as weak recommendations (19,20). In our study, lower frequencies of acute vomiting were observed among patients who engaged in play activities or watched TV or videos during chemotherapy. However, no association was observed between these activities and delayed vomiting.

Parents' education level may lead to improved monitoring of children with chronic illnesses. However, we found no studies investigating the relationship between chemotherapy-induced nausea and vomiting and parental education level. While we believe that parents with higher education levels may report nausea to healthcare personnel more promptly, no statistically significant association was found in our study.

Among adults receiving chemotherapy, those who smoke experience nausea and vomiting more frequently than non-smokers (21). In our study, there was no statistically significant difference in the incidence of vomiting between patients with smoking caregivers and patients with non-smoking caregivers. Nevertheless, we believe that unpleasant odors from caregivers who smoke may trigger nausea and vomiting in children.

Study Limitations

The study may have included a limited number of patients and was conducted at a single center, which may limit the generalizability of the findings. Differences in age, type of cancer, chemotherapy protocols, and supportive care regimens may have introduced variability that influenced the results.

CONSLUSION

Chemotherapy-induced nausea and vomiting are common adverse effects. Further studies may be needed to reduce these side effects in pediatric cancer cases. Administering

effective antiemetic treatment during therapy enhances both treatment success and patient adherence. Further research into alternative treatments may improve adherence among pediatric patients. In addition to clinical factors, our study uniquely evaluated the potential associations of parental smoking, patients' activities during chemotherapy, and parental education level with chemotherapy-induced nausea and vomiting in a pediatric population.

Beyond pharmacological antiemetic strategies, clinicians should emphasize supportive care interventions in the management of chemotherapy-induced nausea and vomiting. Developing standardized institutional chemotherapy-induced nausea and vomiting protocols and regularly monitoring their implementation and feasibility in clinical practice may improve symptom control in pediatric patients.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from the Bursa Uludağ University Faculty of Medicine, Clinical Research Ethics Committee (approval no: 2021-13/7, date: 22.09.2021).

Informed Consent: Retrospective study.

FOOTNOTES

Derived from Gunel Abdulaliyeva's thesis.

Authorship Contributions

Concept: A.T., Design: A.T., Data Collection or Processing: G.A., G.R.A., Analysis or Interpretation: G.A., Literature Search: G.A., Writing: G.A., A.T., B.B.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Rodgers C, Kollar D, Taylor O, Bryant R, Crockett K, Gregurich MA, et al. Nausea and vomiting perspectives among children receiving moderate to highly emetogenic chemotherapy treatment. Cancer Nurs. 2012;35:203-10.
2. Mitchell EP. Gastrointestinal toxicity of chemotherapeutic agents. Semin Oncol. 2006;33:106-20.
3. Schwartzberg L. Chemotherapy-induced nausea and vomiting: state of the art in 2006. J Support Oncol. 2006;4(2 Suppl 1):3-8.
4. Herrstedt J. Antiemetics: an update and the MASCC guidelines applied in clinical practice. Nat Clin Pract Oncol. 2008;5:32-43.
5. Merrow M, King N. Optimizing antiemetic therapy for children undergoing chemotherapy. J Pediatr Nurs. 2022;66:136-42.
6. Paw Cho Sing E, Robinson PD, Flank J, Holdsworth M, Thackray J, Freedman J, et al. Classification of the acute emetogenicity of chemotherapy in pediatric patients: a clinical practice guideline. Pediatr Blood Cancer. 2019;66:e27646. Erratum in: Pediatr Blood Cancer. 2021;68:e28990.
7. Faivre JC, Tomaszewski F, Demoor-Goldschmitt C, Beddok A, Malgras A, Schmitt A, et al. AFSOS-SFRO-SFH-SFNEP-SFCE-GFRP guidelines on radio-induced nausea and vomiting. Crit Rev Oncol Hematol. 2022;180:103825.
8. Tyc VL, Mulhern RK, Fairclough D, Ward PM, Relling MV, Longmire W. Chemotherapy induced nausea and emesis in pediatric cancer patients: external validity of child and parent emesis ratings. J Dev Behav Pediatr. 1993;14:236-41.
9. LeBaron S, Zeltzer LK, LeBaron C, Scott SE, Zeltzer PM. Chemotherapy side effects in pediatric oncology patients: drugs, age, and sex as risk factors. Med Pediatr Oncol. 1988;16:263-8.
10. Roy S, Kulshrestha R, Shankar A, Rath G, Kharade V. Prevention of chemotherapy induced nausea and vomiting in pediatric cancer patients. Indian J Soc Prev Rehabil Oncol. 2017;1:23-30.
11. Sigsgaard T, Herrstedt J, Christensen P, Andersen O, Dombernowsky P. Antiemetic efficacy of combination therapy with granisetron plus prednisolone plus the dopamine D2 antagonist metopimazine during multiple cycles of moderately emetogenic chemotherapy in patients refractory to previous antiemetic therapy. Support Care Cancer. 2000;8:233-7.
12. Feyer PC, Maranzano E, Molassiotis A, Roila F, Clark-Snow RA, Jordan K; MASCC/ESMO. Radiotherapy-induced nausea and vomiting (RINV): MASCC/ESMO guideline for antiemetics in radiotherapy: update 2009. Support Care Cancer. 2011;19(Suppl 1):S5-14.
13. Ewig CL, Yung WY, Ng HHM, Wong CL, Leung AWK, Li CK, et al. A scoping review of nausea, vomiting and retching measurement methods in children with cancer. Pediatr Neonatol. 2022;63:331-40.
14. Kovac AL. Postoperative nausea and vomiting in pediatric patients. Paediatr Drugs. 2021;23:11-37.
15. Flank J, Nadeem K, Moledina S, Khanna M, Schindera C, Punnett A, et al. Nausea and vomiting in children and adolescents receiving intrathecal methotrexate: a prospective, observational study. Pediatr Blood Cancer. 2017;64.
16. Sung L, Zaoutis T, Ullrich NJ, Johnston D, Dupuis L, Ladas E; Children's Oncology Group Cancer Control and Supportive Care Committee. Children's Oncology Group's 2013 blueprint for research: cancer control and supportive care. Pediatr Blood Cancer. 2013;60:1027-30.
17. Kapogiannis A, Tsoli S, Chrousos G. Investigating the effects of the progressive muscle relaxation-guided imagery combination on patients with cancer receiving chemotherapy treatment: a systematic review of randomized controlled trials. Explore (NY). 2018;14:137-43.
18. Hesketh PJ, Kris MG, Basch E, Bohlke K, Barbour SY, Clark-Snow RA, et al. Antiemetics: ASCO guideline update. J Clin Oncol. 2020;38:2782-97. Erratum in: J Clin Oncol. 2020;38:3825. Erratum in: J Clin Oncol. 2021;39:96.
19. Dupuis LL, Boodhan S, Holdsworth M, Robinson PD, Hain R, Portwine C, et al.; Pediatric Oncology Group of Ontario. Guideline for the prevention of acute nausea and vomiting due to antineoplastic medication in pediatric cancer patients. Pediatr Blood Cancer. 2013;60:1073-82.
20. Patel P, Robinson PD, Thackray J, Flank J, Holdsworth MT, Gibson P, et al. Guideline for the prevention of acute chemotherapy-induced nausea and vomiting in pediatric cancer patients: a focused update. Pediatr Blood Cancer. 2017;64.
21. Simino GPR, Reis IA, Acurcio FA, Andrade EIG, Brazil NML, Cherchiglia ML. Risk factors associated with antineoplastic chemotherapy-induced nausea and vomiting. Rev Saude Publica. 2020;54:106.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):111-114
DOI: 10.4274/BMJ.galenos.2025.2024.11-13

Case Report

Staphylococcus aureus Pneumonia Following Closed Thoracic Trauma: A Case Presentation

Kapalı Toraks Travmasını Takiben *Staphylococcus aureus* Pnömonisi: Bir Olgu Sunumu

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ABSTRACT

In this article, a less common course of methicillin-resistant *Staphylococcus aureus (S. aureus)* (MRSA) is presented to raise awareness. A 14-year-old male patient who developed necrotizing pneumonia due to MRSA after blunt trauma is described. MRSA can cause high mortality and severe morbidity. In community-acquired pneumonia, MRSA should be considered, especially when there is a history of blunt trauma.

Keywords: Blunt chest trauma, methicillin-resistant *Staphylococcus aureus*, necrotizing pneumonia

ÖZ

Bu makalede, farkındalığı artırmak için daha az yaygın bir metisiline dirençli *Staphylococcus aureus (S. aureus)* (MRSA) seyri sunulmaktadır. Künt travmadan sonra MRSA nedeniyle nekrotizan pnömoni geliştiren 14 yaşında bir erkek hasta sunulmaktadır. MRSA çok ciddi mortalite ve şiddetli morbidite neden olabilir. Toplum kaynaklı pnömonide MRSA künt travma öyküsünde akılda tutulmalıdır.

Anahtar Kelimeler: Künt göğüs travması, metisiline dirençli *Staphylococcus aureus*, nekrotizan pnömoni

INTRODUCTION

Staphylococcus aureus (S. aureus) is a Gram-positive coccus and a component of the commensal flora found on human and warm-blooded animal skin and mucous membranes (1). It contaminates hospital and community surfaces (1,2). Classrooms, lockers, cellphones, elevators, toilet sets, fitness center, public computers, light switches, doorknobs, toilet flush handles, and bathroom flooring are just a few of the high-touch surfaces on campuses and universities where methicillin-resistant *S. aureus* (MRSA) has been isolated (1). *S. aureus* causes serious infections such as pneumonia, bacteremia, endocarditis, skin and soft tissue infections, central nervous system infections, bone and joint infections, and toxic shock syndrome (2). Necrotizing pneumonia is a clinical condition characterized by lung parenchyma destruction mostly caused by *S. aureus, Streptococcus pneumoniae,* and *Mycoplasma pneumoniae,* but sometimes by other bacteria, viruses and fungi (3,4). Here, a case of necrotizing pneumonia with trauma as its pathophysiology is presented.

CASE REPORT

A previously healthy 14-year-old male patient staying in a student dormitory was brought to the hospital with

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Cite as: Parlak B, Öcal Demir S, Akkoç G, Yılmaz S, Aslan Tuncay S, Büyüktaş Aytaç D, et al. *Staphylococcus aureus pneumonia* following closed thoracic trauma: a case presentation. Med J Bakirkoy. 2026;22(1):111-114

***This article is derived from the poster number 0087 of the Marmara Pediatrics Days 2024 Congress.**

Received: 27.11.2024
Accepted: 08.07.2025
Publication Date: 12.03.2026

complaints of chest pain, shortness of breath, and fever. It was found that his chest was stuck in the door, 2 weeks ago. On examination, he was weak, tachypneic, dyspneic, and confused. He had neck stiffness, coarse rhonchi at the base of the lung, tenderness in the abdomen, but no defense or rebound, and the liver was palpable 2 cm below the costal margin. Laboratuary tests revealed white blood cell count 18600x10^3/mL, neutrophil 16700x10^3/mL, hemoglobin 12.2 g/dL, platelet 234000x10^3/mL, C-reactive protein 313 mg/L (0-5), D-dimer 3.65 mg/L, fibrinogen 773 mg/dL (200-400), NT-pro-BNP 120 ng/L (0-62), ferritin: 1783 mg/L, creatine kinase: 758 U/L (0-190), procalcitonin: 19 mg/L (0-0.5), erythrocyte sedimentation rate 44 mm/h (0-15), alanine aminotransferase 239 U/L, aspartate aminotransferase 113 U/L, sodium: 128 mEq/L. Patchy consolidations were seen on the chest X-ray (Figure 1). The patient was connected to Vapotherm at 25 L/minute with an FIO_2 of 30%. Empirical vancomycin, cefotaxime, azithromycin, and acyclovir were started. Lumbar puncture was performed due to suspected neck stiffness, late response to questions, and drowsiness. There were no cells in the cerebrospinal fluid (CSF); glucose in the CSF was 59 mg/dL, protein was 29 g/dL, and simultaneous blood sugar was 136 mg/dL. CSF opening pressure was 28 cmH_2O. Then, a 2 g/kg/day dose of intravenous immunoglobulin was given. During the follow-up, respiratory distress increased and he was placed on high-flow nasal oxygen support. Respiratory multiplex polymerase chain reaction (PCR) was found to be negative. In the thorax tomography, there were nodular, patchy consolidation areas and 7x2.5 cm of dense fluid in the pleural space (Figure 2). The patient was considered to have necrotizing pneumonia. Other preliminary diagnoses were malignancy, multisystem inflammatory syndrome in children, infective endocarditis-associated septic embolism, mesothelioma, and tuberculosis. Coronavirus disease PCR resulted negative. On the second day of admission, he was transferred to the pediatric intensive care unit due to confusion and superficial breathing. The next day, acyclovir and azithromycin were discontinued because the meningitis encephalitis panel was negative and atypical pneumonia was not considered. Acute respiratory distress syndrome was considered on the sixth day of admission (Figure 3). No acid-fast bacteria were

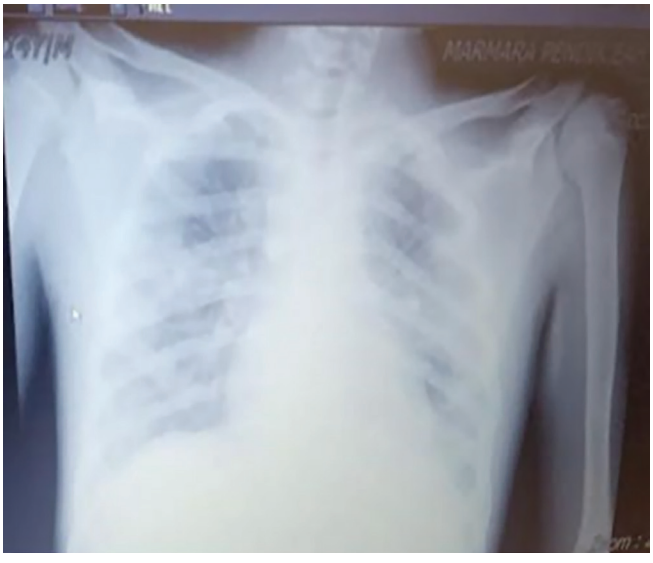

Figure 1. Chest X-ray on day 3, going to ARDS
ARDS: Acute respiratory distress syndrome

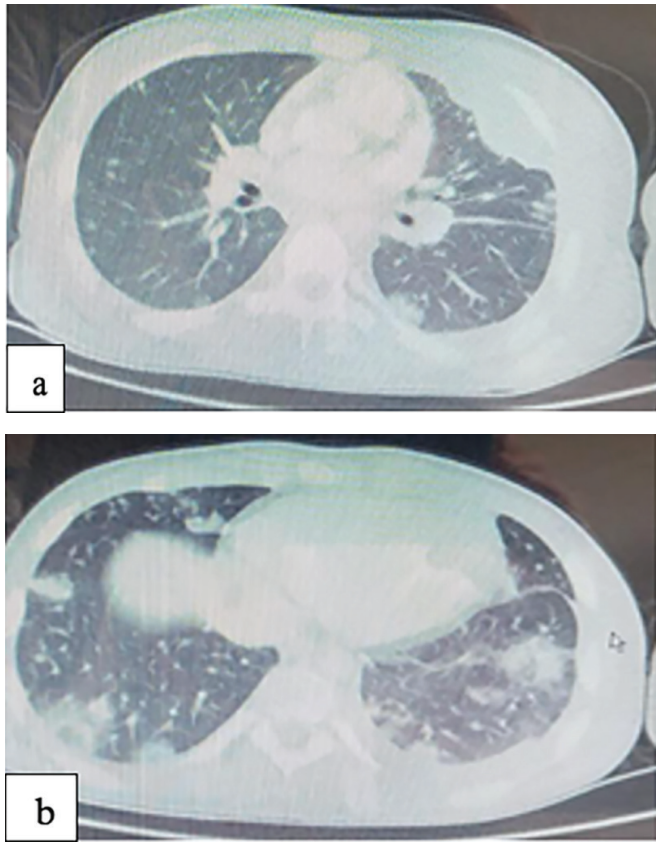

Figure 2. a-b) Thorax CT on 1st day
CT: Computed tomography

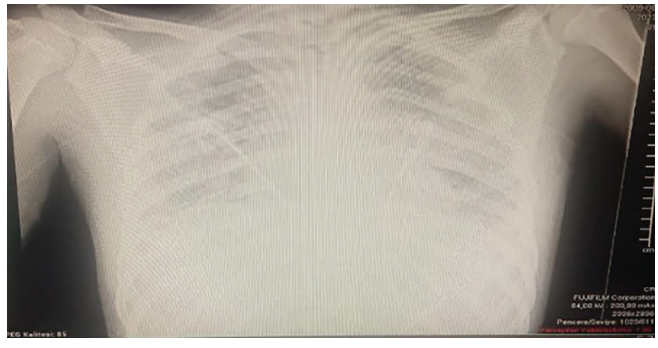

Figure 3. Chest X-ray on day 6, ARDS
ARDS: Acute respiratory distress syndrome

detected in fasting gastric aspirate. Pulmonary computed tomography angiography was normal. There was no growth in CSF culture. All blood cultures taken until the 9th day of hospitalization continued to grow MRSA. Purified protein derivative was anergic. Thoracic magnetic resonance imaging was consistent with infectious pathology rather than vasculitis and malignancy. Echocardiography was normal. From the 2nd day of hospitalization to the 8th day, the maximum temperature was 37.4 °C. MRSA was grown in the abscess culture taken from the lung.

Bone marrow aspiration was done. Myeloid series dominance, an increase in mature band formations and plasma cells, and a blast rate of less than 5% are observed. Therefore, malignancy was not considered.

MRSA grew in blood and abscess cultures. Since no clinical response was obtained on the 8th day of vancomycin and there was no significant improvement in acute phase reactants, vancomycin was discontinued and switched to linezolid. A 5-day body wipe with chlorhexidine was performed for decolonization. Lung biopsy was performed on the 11th day of hospitalization. On the 12th day of hospitalization, he was separated from the high-flow nasal cannula and placed on a nasal cannula (Figure 4). Monitoring continued, on room air, on the 16th day of hospitalization. The dihydro rhodamine test was normal; chronic granulomatous disease was excluded. Linezolid was discontinued on the 28th day, and he was discharged after a full recovery.

The patient's written informed consent was obtained for the publication of the case report concerning his family (clinical details and images).

DISCUSSION

It is thought that children's chest wall is more flexible and elastic, allowing kinetic energy to be transferred to the lung parenchyma more effectively in blunt trauma. Through a mechanism involving the transmission of strong compressive force to the lung tissue, the pseudocyst or pneumatocel forms (5,6). This mechanism results in a pulmonary laceration that disrupts the airway and causes air to seep into the pulmonary parenchyma. In blunt trauma, damage to the lung parenchyma may occur due to the disruption of the integrity of the bronchi, resulting in forms of contusion, hematoma, pseudocyst, pneumatocele, and cavitation (5-7). Serial compression-decompression ruptures the alveoli, leaving small air- or fluid-filled spaces; it expands until a pressure balance is established between the cavity and the surrounding parenchyma (5). Another theory is that if a bronchus is blocked or the glottis is closed, at the time of injury, the air cannot escape quickly enough, causing the parenchyma to rupture in a "burst" fashion, creating a gap (5). *S. aureus* should be considered in blunt thoracic trauma (7,8).

Our case, identified after investigating the differential diagnoses, was an example of this rare condition.

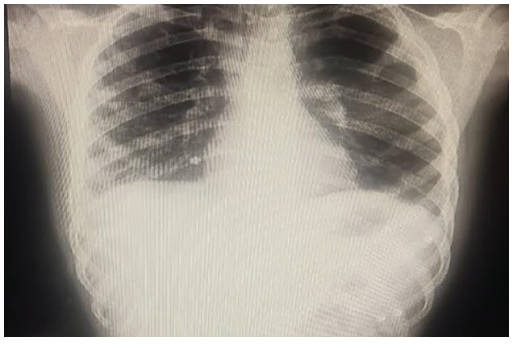

Figure 4. Chest X-ray on day 12

CONCLUSION

MRSA should come to mind when considering post-traumatic fever and severe pneumonia. An infected post-traumatic lung pseudocyst or necrotizing pneumonia should be considered in a patient presenting with chest pain and fever after blunt trauma. Trauma history should be investigated to elucidate the etiology of necrotizing pneumonia.

ETHICS

Informed Consent: The patient's written informed consent was obtained for the publication of the case report concerning his family (clinical details and images).

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: B.P., S.Ö.D., G.A., S.Y., S.A.T., D.B.A., M.Ç.A.Ç., P.C.E., A.D.I., Consept: B.P., S.Ö.D., G.A., D.B.A., A.D.I., Design: B.P., S.Ö.D., G.A., S.Y., S.A.T., P.C.E., Data Collection or Processing: B.P., S.Y., M.Ç.A.Ç., P.C.E., A.D.I., Analysis or Interpretation: B.P., S.Ö.D., G.A., D.B.A., Literature Search: B.P., S.A.T., M.Ç.A.Ç., Writing: B.P., S.Ö.D.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that this study received no financial support.

REFERENCES

1. Jaradat ZW, Ababneh QO, Sha'aban ST, Alkofahi AA, Assaleh D, Al Shara A. Methicillin resistant Staphylococcus aureus and public fomites: a review. Pathog Glob Health. 2020;114:426-50.

2. Liu C, Bayer A, Cosgrove SE, Daum RS, Fridkin SK, Gorwitz RJ, et al. Clinical practice guidelines by the Infectious Diseases Society of America for the treatment of methicillin-resistant Staphylococcus aureus infections in adults and children. Clin Infect Dis. 2011;52:e18-55. Erratum in: Clin Infect Dis. 2011;53:319.
3. Chen Y, Li L, Wang C, Zhang Y, Zhou Y. Necrotizing pneumonia in children: early recognition and management. J Clin Med. 2023;12:2256.
4. Masters IB, Isles A., Grimwood K. Necrotizing pneumonia: an emerging problem in children? Pneumonia. 2017;9:1-19.
5. Fagkrezos D, Giannila M, Maniatis P, Papailiou J, Triantopoulou C. Post-traumatic pulmonary pseudocyst with hemopneumothorax following blunt chest trauma: a case report. J Med Case Rep. 2012;6:356.
6. Phillips B, Shaw J, Turco L, McDonald D, Carey J, Balters M, et al. Traumatic pulmonary pseudocyst: an underreported entity. Injury. 2017;48:214-20.
7. Son SA, Lee SC, Cho JY. Successful management of traumatic giant pulmonary hematoma in poly-trauma patient. Trauma Case Rep. 2021;32:100433. Erratum in: Trauma Case Rep. 2023;45:100818.
8. Ashton RW, Morgenthaler TI, Prakash UB. Post-traumatic pulmonary pseudocyst in a 20-year-old man after a motor vehicle accident. Chest. 2004;126:953S.

Medical Journal of Bakırköy

Med J Bakirkoy 2026;22(1):115
DOI: 10.4274/BMJ.galenos.2026.e001

Erratum

Med J Bakirkoy 2025;21:62-69

DOI: 10.4274/BMJ.galenos.2024.2024.8-13

The article titled "Davulcu CD, Afacan MY. The impact of TRIMANO adjustable arm holder on proximal humerus fracture management: enhancing surgery duration, surgical efficiency, and patient outcomes. Med J Bakirkoy. 2025;21:62-69. Doi: 10.4274/BMJ.galenos.2024.2024.8-13" published in Medical Journal of Bakırköy has been corrected due to an error in the correspondence author information.

Published on page 62;

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