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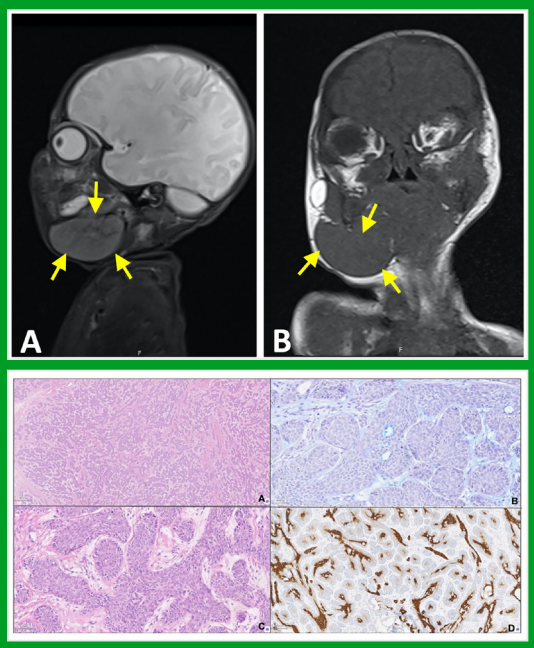




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## Original Articles

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# EDITORIAL

**Dear Readers;**

We are with you with a new issue in the second issue of 2025. An important indicator of starting scientific studies at an early age is student congresses and the papers presented here. In addition to the traditional medical school student congress we organized this year, we are happy to have the congress of our dentistry students and the papers presented there collected in a new issue. Our publication quality increases every day with the numerous articles sent to our journal.

In this issue, we chose the cover image from the article "Köprülü MS, et al. Trichoblastoma in a Newborn: A Case Report."

A rare case of Trichoblastoma is presented in this article. Trichoblastoma is a benign skin tumor originating from the hair germ, the precursor of the hair follicle. It is most commonly seen on the scalp and face. Trichoblastoma formation is quite rare in the pediatric population. A 10-day-old male newborn was admitted with a swelling in the right submandibular region that had been present since birth. Physical examination revealed a painless, firm, and mobile mass measuring approximately 3 cm in size in the right submandibular region. Magnetic resonance imaging was consistent with a well-defined mass with diffuse contrast enhancement. Tru-cut biopsy showed that the tumor consisted of epithelial and myoepithelial components. Total mass excision was performed and the final pathological report was trichoblastoma. Our editorial board found it appropriate to include the picture of this case on the cover as it reminds us to keep trichoblastoma in mind in newborns presenting with a neck mass.

Other featured articles are as follows:

"Enhancing Diagnostic Accuracy of Adnexal Masses: The Prognostic Value of Systemic Immune-İnflammatory Index in Conjunction with CA125" by Körpe et al.,

"The Impact of Preoperative Negative Overjet Amount on Postoperative Patient Satisfaction and Quality of Life in Orthognathic Surgery Patients with Skeletal Class III Malocclusion" by Akkoyun et al.,

"The Relationship of Tumor Marker Panel with Tumor Size and Histopathological Results in Borderline Ovarian Tumor" by Satır Özel et al.,

"The Role of 4D-CT in Hyperparathyroidism with Negative Scintigraphy: Identifying Causes of Diagnostic Challenges" by Keven et al.

This issue is again the product of a labor-intensive effort. I would like to thank my assistant editors, referees and publishing house that have contributed to the preparation of this issue, and to our valued readers have always supported us.

I wish you all the best…

Sincerely,

**Prof. Dr. Adem AKÇAKAYA**
**Editor in Chief**

Original Article

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Bezmialem Science 2025;13(2):88-93

# Enhancing Diagnostic Accuracy of Adnexal Masses: The Prognostic Value of Systemic Immune-inflammatory Index in Conjunction with CA125

## Adneksiyal Kitlelerin Tanısal Doğruluğunun Artırılması: CA125 ile Birlikte Sistemik İmmün-enflamatuvar İndeksin Prognostik Değeri

Büşra KÖRPE[1], Caner KÖSE[1], Samet Kutluay ERGÖRÜN[1], Vakkas KORKMAZ[2], Hüseyin Levent KESKİN[1], Yaprak ENGİN ÜSTÜN[3]

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## ABSTRACT

**Objective:** This retrospective study aimed to investigate the predictive role of the systemic immune-inflammatory index (SII) in distinguishing between benign and malignant adnexal masses in women.

**Methods:** A total of 268 female patients with adnexal masses who underwent surgical intervention were included. Patient data, including complete blood count and cancer antigen 125 (CA125) levels, were collected, and final pathological examinations were assessed. Patients with prior cancer diagnoses, non-epithelial ovarian cancer, and inflammatory, hematologic, or autoimmune diseases were excluded.

**Results:** The study included 177 women with benign and 91 women with malignant ovarian tumors. SII and CA125 showed significant differences between the two groups, with both markers found to be significantly higher in the malign group (p<0.001). The area under the curve for SII and CA125 in predicting malignancy were 0.779 and 0.814, respectively. Univariate and multivariate logistic regression analyses demonstrated that a higher preoperative CA125 level (>160) and elevated SII (>5.63) were associated with increased risks of having a malignant tumor (p<0.001).

## ÖZ

**Amaç:** Bu çalışmada, kadınlarda benign ve malign adneksiyal kitleleri ayırt etmede sistemik immün-enflamatuvar indeksin (SII) öngörücü rolünün araştırılması amaçlanmıştır.

**Yöntemler:** Adneksiyal kitle nedeniyle opere edilen, final patoloji sonuçlarına göre benign tümör veya epitelyal over kanseri tanısı alan 268 kadın çalışmaya dahil edildi. Hastaların tam kan sayımı ve kanser antijeni 125 (CA125) düzeyleri gibi verileri retrospektif olarak toplandı ve değerlendirildi. Bilinen kanser tanısı olan, non-epitelyal over kanseri olan, enflamatuvar, hematolojik veya otoimmün hastalığı olan hastalar çalışmadan çıkarıldı.

**Bulgular:** Çalışmaya, 177 benign ve 91 malign epitelyal over tümörü olan kadın dahil edildi. SII ve CA125, iki grup arasında anlamlı farklılık gösterdi ve her iki belirteç de malign grupta anlamlı şekilde daha yüksek bulundu (p<0,001). SII ve CA125'in maligniteyi öngörmedeki eğri altında kalan alanları sırasıyla 0,779 ve 0,814 idi. Univaryant ve multivaryant lojistik regresyon analizleri, yüksek preoperatif CA125 düzeyi (>160) ve yüksek SII (>5,63) ile malign tümörlere sahip olma riskinin arttığını gösterdi (p<0,001).

**Sonuç:** Bulgularımız, SII'nın CA125 ile birlikte, benign ve malign adneksiyal kitleleri ayırt etmek için umut vaat eden öngörücü

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**ABSTRACT**

**Conclusion:** Our findings indicate that the SII, in conjunction with CA125, holds promise as a predictive marker for distinguishing between benign and malignant adnexal masses. While CA125 remains a cornerstone biomarker, the integration of SII provides valuable information about the inflammatory and immune response within the tumor microenvironment, enhancing diagnostic accuracy.

**Keywords:** Adnexal mass, ovarian cancer, systemic immune-inflammatory index, predictive biomarker

**ÖZ**

bir belirteç olduğunu göstermektedir. CA125 ile birlikte SII'nın entegrasyonu, tümör mikro çevresindeki enflamatuvar ve immün yanıt hakkında değerli bilgiler sağlayarak tanısal doğruluğu artırır.

**Anahtar Kelimeler:** Adneksiyal kitle, over kanseri, sistemik immün-enflamutuvar indeks, öngörücü belirteç

## Introduction

Adnexal masses are common in women and are often detected during routine gynecological examinations or imaging studies (1). Most adnexal masses are benign, but a small percentage are malignant, and accurate diagnosis is essential for optimal patient management (2,3). However, traditional diagnostic methods such as imaging and tumor markers have limitations in their ability to distinguish between benign and malignant adnexal masses, and new biomarkers are needed to improve diagnostic accuracy (4,5).

The inflammatory and immune response within the tumor microenvironment plays a crucial role in cancer development and progression (6). Chronic inflammation has been implicated in various cancer types, and ovarian cancer is no exception (7). Tumor-associated neutrophils and platelets can release pro-inflammatory mediators, such as cytokines and chemokines, promoting angiogenesis, tumor growth, and metastasis (8). Conversely, lymphocytes are essential components of the immune system and play a pivotal role in tumor surveillance and suppression. An imbalance between these immune and inflammatory components can lead to an altered SII, reflecting the dynamic changes within the tumor microenvironment (9).

In recent years, systemic immune-inflammatory index (SII) has been suggested as a novel biomarker for predicting the prognosis of various types of cancer (10-12). SII is a composite index based on peripheral blood counts, which includes neutrophil, lymphocyte, and platelet counts. It reflects the systemic inflammatory response to the tumor and has been found to be associated with the prognosis of several types of cancer, including ovarian cancer (10-15).

Despite the potential diagnostic value of SII in predicting the likelihood of malignancy in adnexal masses, there is limited research on its predictive role. Therefore, this study aims to investigate the predictive role of SII in woman with adnexal masses from benign to malign. The primary objective of this study is to determine whether SII can be used as a diagnostic biomarker for distinguishing between benign and malignant adnexal masses in women.

## Methods

This retrospective study included 268 female patients who presented with adnexal masses and subsequently underwent surgical intervention at tertiary referral center and whose final pathological results were epithelial ovarian cancer. Data were collected from patient records and the hospital's electronic database. All procedures were performed in accordance with the Declaration of Helsinki and in compliance with relevant ethical guidelines.

Approval was obtained from the University of Health Sciences Türkiye, Ankara Etlik City Hospital Ethics Committee (decision number: AEŞH-EK1-2023-194, date: 17.05.2023).

Inclusion criteria were as follows: female patients aged 18 years and above, patients with adnexal masses confirmed through imaging studies (ultrasound, magnetic resonance imaging, or computed tomography scan), patients who underwent surgical exploration (laparoscopy or laparotomy) to determine the nature of the adnexal mass, patients with available complete blood count and cancer antigen 125 (CA125) data, including neutrophil (NEUT) count, lymphocyte count, and platelet count, within one week before the surgery. The final pathological examinations and diagnoses of adnexal masses were based on the International Federation of Obstetrics and Gynecology (FIGO) classification (16). Patients with a prior cancer diagnosis, non-epithelial ovarian cancer, inflammatory, hematologic, and autoimmune diseases were excluded from the study. Patients with incomplete medical records or missing laboratory data were excluded from the study also.

The SII was calculated for each patient using the following formula: SII = (Platelet count × NEUT count)/lymphocyte count. NEUT to lymphocyte ratio (NLR), platelet to lymphocyte (PLR) were calculated by dividing the total NEUT or platelet count by the total lymphocyte count.

### Statistical Analysis

Statistical analysis was performed using the SPSS version 26 program (SPSS, Chicago, Illinois, United States of America). The normality of the data was analyzed with histogram and with Skewness and Kurtosis values. Descriptive statistics were

presented as mean ± standard deviation. $X^2$ tests were used to compare categorical variables. Qualitative data were presented as number (n) and percentage (%). Receiver operating characteristic (ROC) curve analysis was conducted to determine the optimal cut-off value for SII in predicting malignancy. Area under the curve (AUC), sensitivity and specificity were calculated to evaluate the diagnostic performance of SII. Univariate analysis was performed after univariate analysis, a model for multivariate logistic regression analysis was formed, 95% confidence interval (CI) and a p-value of <0.05 were considered significant.

## Results

A total of 268 women were included in study. Women were divided into two groups according to the final pathological results as benign and malign ovarian tumors. The benign group included 177 women with benign results, and the malign group included 91 women with malign results. Of the women 56.7% (n=152) were postmenopausal.

Table 1 shows the comparison of the two groups. There were no differences in terms of age and body mass index between the groups (p>0.05). However, significant differences were observed in laboratory results, particularly in CA125, SII, PLR, and NLR levels. All values were found to be significantly higher in the malign group (Table 1). Figure 1 shows the comparison of the SII levels of the women with benign and malign tumors.

Table 2 presents the characteristics of malignant ovarian tumors. The most frequently observed histologic type of the malignant tumors was serous histology (47, 51.6%), followed by the endometrioid type (26, 28.6%). Most of the women with malign ovarian tumors were in Stage IB (31, 34.1%).

According to the ROC analysis, AUC of CA125, SII, PLR and NLR in predicting malign ovarian tumors were 0.814, 0.779, 0.694 and 0.655, respectively (Figure 2). Women were divided into two groups based on the optimal cut-off values determined by ROC curve. Table 3 shows the univariate and multivariate logistic regression analyses of the variables. Women with preoperative CA125 level > 160 (95% CI: 9.13-42.08, p<0.001) had a 19.6-fold increased risk and SII >5.63 (95% CI: 2.3-11.52, p<0.001) had a 5.15 increased risk of having malignant tumor (Table 3).

**Table 1.** Comparison of the groups

| | Benign group (n=177) | Malign group (n=91) | p-value |
|---|---|---|---|
| **Age (y)** | 49.29±9.95 | 50.75±9.49 | 0.250 |
| **BMI (kg/m²)** | 27.96±4.78 | 28.79±5.52 | 0.207 |
| **Gravidity (median, range)** | 3 (0-6) | 3 (0-7) | 0.059 |
| **Parity (median, range)** | 3 (0-6) | 2 (0-7) | 0.085 |
| **Ca125 (mean, range)** | 171.68 (7-1393) | 494.32 (58-5812) | **<0.001** |
| **SII (mean, SD)** | 5.45±2.69 | 10.27±6.22 | **<0.001** |
| **PLR (mean, SD)** | 137.37±59.39 | 171.13±51.1 | **<0.001** |
| **NLR (mean, SD)** | 2.06±1.03 | 3.08±2.56 | **<0.001** |
| **Postmenopausal (n%)** | 96 (54.2) | 56 (61.5) | 0.253 |

SII: Systemic immune inflammatory index, NLR: Neutrophil lymphocyte ratio, PLR: Platelet to lymphocyte, SD: Standard deviation, BMI: Body mass index

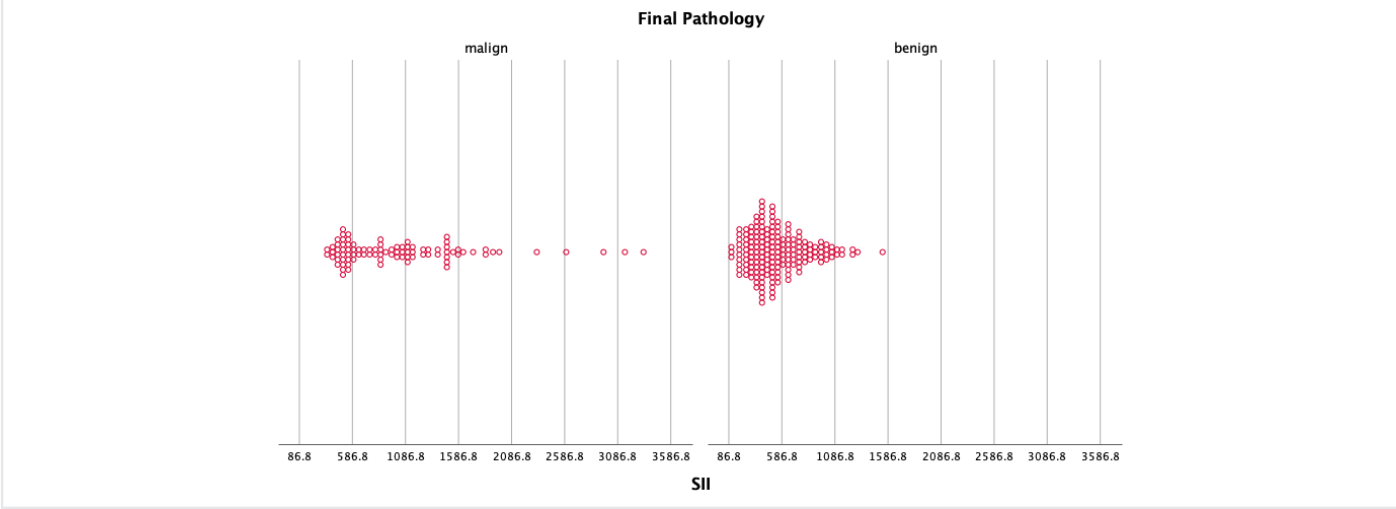


**Figure 1.** SII levels of patients with malign and benign ovarian tumors
*SII: Systemic immune inflammatory index*

**Table 2.** Characteristics of malign ovarian tumors

| | (n=91) |
|---|---|
| **Histology** | |
| Serous | 47 (51.6) |
| Endometrioid | 26 (28.6) |
| Mucinous | 8 (8.8) |
| Clear cell | 5 (5.5) |
| Mixed | 3 (3.3) |
| Undifferentiated | 2 (2.2) |
| **FIGO stage** | |
| IA | 26 (28.6) |
| IB | 31 (34.1) |
| IC1 | 11 (12.1) |
| IC2 | 9 (9.9) |
| IC3 | 7 (7.7) |
| IIA | 4 (4.4) |
| IIB | 3 (3.3) |

FIGO: International Federation of Obstetrics and Gynecology

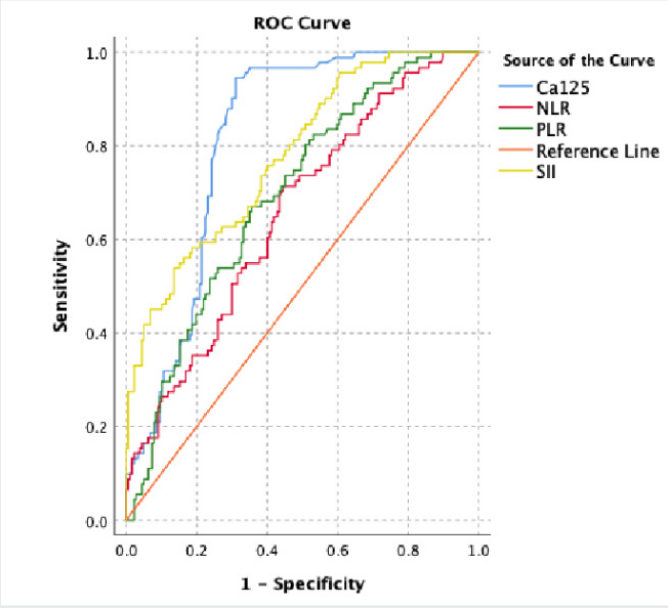


**Figure 2.** ROC analysis of CA125, SII, PLR and NLR for predicting the malign ovarian tumors

AUC=0.814, an optimal cut-off point of Ca125=160, sensitivity=80.2%, specificity=74.6%; AUC=0.779, an optimal cut-off point of SII=5.63, sensitivity=70.3%, specificity=63.1%; AUC=0.694, an optimal cut-off point of PLR=145.02, sensitivity=67%, specificity=62.6%; AUC=0.655, an optimal cut-off point of NLR=2.07, sensitivity=61.5%, specificity=60.3%

*ROC: Receiver operating characteristic, CA: Cancer antigen, SII: Systemic immune inflammatory index, NLR: Neutrophil lymphocyte ratio, PLR: Platelet to lymphocyte, AUC: Area under the curve*

## Discussion

Adnexal masses are a common clinical challenge, and their accurate diagnosis is crucial for appropriate patient management (17). While CA125 has been widely used as a biomarker for ovarian tumors, its limitations in distinguishing between benign and malignant adnexal masses have prompted the search for additional predictive markers (18). In recent years, the SII has emerged as a novel and promising biomarker for various types of cancer, including ovarian cancer (19,20). Our study aimed to investigate the predictive role of SII in distinguishing between benign and malignant adnexal masses in women. We found that SII, along with CA125, showed significant potential in aiding the differentiation between these two groups of ovarian tumors. While CA125 has traditionally been considered more valuable due to its well-established role, our results suggest that SII can complement CA125 and enhance diagnostic accuracy.

Our findings are consistent with previous studies that have reported elevated SII levels in various malignancies, including ovarian cancer (19,20). These findings suggest that SII may not only serve as a general indicator of systemic inflammation but can also be indicative of the underlying pathological processes associated with malignancy. In a study by Bizzarri et al. (21) which evaluated the prognostic impact of baseline inflammatory markers in early-stage ovarian cancer, NLR and SII were found to be associated with worse disease-free survival. Additionally, SII was found to be associated with worse overall survival (OS). The study demonstrated that high levels of SII and NLR were significantly linked to the risk of recurrence, and, when combined with PLR, were associated with the risk of death in a population of early-stage ovarian cancer patients.

In a meta-analysis investigating the prognostic value of inflammatory markers in patients with ovarian cancer, the study revealed that markers like NLR and PLR were associated with ovarian cancer survival (22). Another review conducted by Zhang et al. (23) also supported these findings, highlighting that NLR and PLR could serve as reliable predictors of overall and progression-free survival (PFS) in patients with ovarian cancer. Furthermore, Prodromidou et al. (24) conducted a thorough review of 18 studies involving 3453 ovarian cancer patients and observed significant deviations in PLR and NLR values compared to healthy controls. These markers were found to potentially indicate disease stage and response to chemotherapy. Despite their potential clinical relevance, it's important to acknowledge that the diagnostic accuracy of NLR and PLR remains limited. While they have shown moderate sensitivity and specificity, further research is needed to enhance their predictive capabilities for ovarian cancer patients.

Feng and Wang (25) investigated the correlation of the systemic immune-inflammatory response index (SIRI) with clinical data in patients with malignant ovarian tumors. The group of patients who died exhibited notably higher NEUT and SIRI levels compared to the surviving group. SIRI showed a positive correlation with serum CA125, CA15-3, and HE4. The study identified age, FIGO stage, SIRI, and therapeutic regimen

**Table 3.** Univariate and multivariate logistic regression analysis of the variables for malignant ovarian tumors

| Factor | | Univariate logistic regression Odds ratio (95% CI) | p-value* | Multivariate logistic regression Odds ratio (95% CI) | p-value * |
|---|---|---|---|---|---|
| CA125 | ≤160 (n=150) | 1 (reference) | | | |
| | >160 (n=118) | 11.89 (6.42-22.04) | **<0.001** | 19.6 (9.13-42.08) | **<0.001** |
| SII | ≤5.63 (n=136) | 1 (reference) | | | |
| | >5.63 (n=132) | 3.8 (2.2-6.53) | **<0.001** | 5.15 (2.3-11.52) | **<0.001** |
| PLR | ≤145.02 (n=139) | 1 (reference) | | | |
| | >145.02 (n=129) | 3.25 (1.91-5.54) | **<0.001** | 2.45 (1.09-5.54) | **0.03** |
| NLR | ≤2.07 (n=131) | 1 (reference) | | | |
| | >2.07 (n=137) | 2.27 (1.35-3.82) | **<0.001** | 0.683 (0.31-1.49) | 0.339 |

CA: Cancer antigen, SII: Systemic immune inflammation index, PLR: Platelet to lymphocyte ratio, NLR: Neutrophil to lymphocyte ratio, *: Logistic regression analysis, CI: Confidence interval

as independent prognostic factors for the 5-year survival of ovarian cancer patients. In another meta-analysis that examined the prognostic significance of NLR and PLR in ovarian cancer patients, the results indicated that elevated NLR and PLR were associated with poorer outcomes. Specifically, higher NLR and PLR values were found to have an adverse effect on both PFS and OS in patients with ovarian cancer (26).

All of these studies in the literature have examined the impact of inflammatory markers on the prognosis of ovarian cancer cases. However, this study aims to evaluate whether inflammatory markers can be used to differentiate benign ovarian masses from malignant ones. With this characteristic, it offers a different perspective from other studies.

### Study Limitations

Limitations of the study include retrospective design and single-center setting. Additionally, the relatively small sample size may impact the generalizability of the findings to larger populations. Prospective studies with larger cohorts and multi-center collaborations will be valuable to validate our results and establish the clinical utility of SII in adnexal mass evaluation.

## Conclusion

In conclusion, our study demonstrates the potential significance of SII alongside CA125 in differentiating between benign and malignant adnexal masses in women. Although CA125 remains a cornerstone biomarker, SII offers an additional layer of information about the inflammatory and immune response within the tumor microenvironment. Healthcare providers should consider incorporating SII into their diagnostic evaluations, especially when faced with challenging cases or inconclusive CA125 results. The integration of SII and CA125 could lead to improved diagnostic accuracy and better patient outcomes by enabling more appropriate and timely management of women with adnexal masses. Future prospective studies should aim to confirm the clinical utility of SII and establish standardized guidelines for its use in ovarian tumor diagnostics.

### Ethics

**Ethics Committee Approval:** Approval was obtained from the University of Health Sciences Türkiye, Ankara Etlik City Hospital Ethics Committee (decision number: AEŞH-EK1-2023-194, date: 17.05.2023).

**Informed Consent:** Retrospective study.

### Footnotes

### Authorship Contributions

Surgical and Medical Practices: C.K., B.K., S.K.E., V.K., H.L.K., Concept: C.K., B.K., V.K., Design: H.L.K., Y.E.Ü., Data Collection or Processing: C.K., B.K., S.K.E., Analysis or Interpretation: B.K., S.K.E., Y.E.Ü., Literature Search: C.K., B.K., S.K.E., Writing: C.K., B.K., Y.E.Ü.

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

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## References

1. Timmerman D, Testa AC, Bourne T, Ameye L, Jurkovic D, Van Holsbeke C, et al. Simple ultrasound-based rules for the diagnosis of ovarian cancer. Ultrasound Obstet Gynecol. 2008;31:681-90.
2. Prat J. Ovarian tumors: a review. Histopathology. 2018;72:3-21.
3. Gupta JK. Diagnosis and management of adnexal masses. Best Pract Res Clin Obstet Gynaecol. 2009;23:697-709.
4. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Gynecology. Practice Bulletin No. 174: Evaluation and Management of Adnexal Masses. Obstet Gynecol. 2016;128:210-26.
5. Zanetta G, Mariani E, Lissoni A, Ceruti P, Trio D, Strobelt N, et al. A prospective study of the role of ultrasound in the management of adnexal masses in pregnancy. BJOG. 2003;110:578-83.
6. Balkwill F, Mantovani A. Inflammation and cancer: back to Virchow? Lancet. 2001;357:539-45.

7. Quail DF, Joyce JA. Microenvironmental regulation of tumor progression and metastasis. Nat Med. 2013;19:1423-37.
8. Wu L, Saxena S, Awaji M, Singh RK. Tumor-associated neutrophils in cancer: going pro. Cancers (Basel). 2019;11:564.
9. Baghban R, Roshangar L, Jahanban-Esfahlan R, Seidi K, Ebrahimi-Kalan A, Jaymand M, et al. Tumor microenvironment complexity and therapeutic implications at a glance. Cell Commun Signal. 2020;18:59.
10. Liberto JM, Chen SY, Shih IM, Wang TH, Wang TL, Pisanic TR 2nd. Current and emerging methods for ovarian cancer screening and diagnostics: a comprehensive review. Cancers (Basel). 2022;14:2885.
11. Kose C, Korpe B, Korkmaz V, Ustun YE. The role of systemic immune inflammation index in predicting treatment success in tuboovarian abscesses. Arch Gynecol Obstet. 2023;308:1313-9.
12. Köse C, Körpe B, Kurdoğlu Z, Korkmaz H, Ustun YE, Korkmaz V. Predictive utility of systemic immune inflammation index (SII) in identifying endometrial carcinoma in premalignant endometrial lesions. Van Med J. 2023;30:418-25.
13. Wang J, Yin S, Chen K. Predictive value of the systemic immune-inflammation index for the efficacy of neoadjuvant chemotherapy and prognosis in patients with stage III ovarian cancer-a retrospective cohort study. Gland Surg. 2022;11:1639-46.
14. Mao H, Yang F. Prognostic significance of systemic immune-inflammation index in patients with ovarian cancer: a meta-analysis. Front Oncol. 2023;13:1193962.
15. Liu J, Li S, Zhang S, Liu Y, Ma L, Zhu J, et al. Systemic immune-inflammation index, neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio can predict clinical outcomes in patients with metastatic non-small-cell lung cancer treated with nivolumab. J Clin Lab Anal. 2019;33:e22964.
16. Prat J; FIGO Committee on Gynecologic Oncology. Staging classification for cancer of the ovary, fallopian tube, and peritoneum. Int J Gynaecol Obstet. 2014;124:1-5.
17. Bullock B, Larkin L, Turker L, Stampler K. Management of the adnexal mass: considerations for the family medicine physician Front Med (Lausanne). 2022;9:913549.
18. Charkhchi P, Cybulski C, Gronwald J, Wong FO, Narod SA, Akbari MR. CA125 and ovarian cancer: a comprehensive review. Cancers (Basel). 2020;12:3730.
19. Cong R, Kong F, Ma J, Li Q, Wu Q, Ma X. Combination of preoperative neutrophil-lymphocyte ratio, platelet-lymphocyte ratio and monocyte-lymphocyte ratio: a superior prognostic factor of endometrial cancer. BMC Cancer. 2020;20:464.
20. Raungkaewmanee S, Tangjitgamol S, Manusirivithaya S, Srijaipracharoen S, Thavaramara T. Platelet to lymphocyte ratio as a prognostic factor for epithelial ovarian cancer. J Gynecol Oncol. 2012;23:265-73.
21. Bizzarri N, D'Indinosante M, Marchetti C, Tudisco R, Turchiano F, Scambia G, et al. The prognostic role of systemic inflammatory markers in apparent early-stage ovarian cancer. Int J Clin Oncol. 2023;28:314-20.
22. Zhao Z, Zhao X, Lu J, Xue J, Liu P, Mao H. Prognostic roles of neutrophil to lymphocyte ratio and platelet to lymphocyte ratio in ovarian cancer: a meta-analysis of retrospective studies. Arch Gynecol Obstet. 2018;297:849-57.
23. Zhang CL, Jiang XC, Li Y, Pan X, Gao MQ, Chen Y, et al. Independent predictive value of blood inflammatory composite markers in ovarian cancer: recent clinical evidence and perspective focusing on NLR and PLR. J Ovarian Res. 2023;16:36.
24. Prodromidou A, Andreakos P, Kazakos C, Vlachos DE, Perrea D, Pergialiotis V. The diagnostic efficacy of platelet-to-lymphocyte ratio and neutrophil-to-lymphocyte ratio in ovarian cancer. Inflamm Res. 2017;66:467-75.
25. Feng J, Wang Q. Correlation of systemic immune-inflammatory response index with clinical data in patients with malignant ovarian tumor. Am J Transl Res. 2023;15:3309-17.
26. Zhu Y, Zhou S, Liu Y, Zhai L, Sun X. Prognostic value of systemic inflammatory markers in ovarian Cancer: a PRISMA-compliant meta-analysis and systematic review. BMC Cancer. 2018;18:443.

Original Article

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# The Effect of Hemodialysis Patients' Attitudes Towards Dietary Treatment on Dialysis Symptoms: A Randomized Controlled Clinical Study

## Hemodiyaliz Hastalarının Diyet Tedavisine Yönelik Tutumlarının Diyaliz Semptomlarına Etkisi: Randomize Kontrollü Klinik Bir Çalışma

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## ABSTRACT

**Objective:** This study was conducted to determine the effect of hemodialysis patients' attitudes towards diet therapy on dialysis symptoms.

**Methods:** The data of the randomized controlled study were collected from experimental (n=30) and control groups (n=30) at Gümüşhane Province Kelkit State Hospital between 1 November 2023 and 1 January 2024. Institutional and ethics committee permissions were obtained before the study. The experimental group patients were given training on diet therapy. "Patient information form", "hemodialysis patients' attitude scale towards diet therapy (HDTO)" and "dialysis symptom index (DSI)" were used to collect data. Data collection tools were applied before the study (pre-test), after the training was given (intermediate measurement) and one month later (post-test). The data were analyzed using the chi-square, repeated measures ANOVA test and independent groups t-test in the SPSS 25.0 package program.

**Results:** It was determined that the post-training measurements (intermediate measurement) of the total HDTO and sub-dimensions score averages of the hemodialysis patients in the experimental group were higher than the pre-training (pre-test) measurements; and the measurements made 1 month after the training (post-test) were lower than the measurements made immediately after the training (intermediate measurement)

## ÖZ

**Amaç:** Bu çalışma, hemodiyaliz hastalarının diyet tedavisine yönelik tutumlarının diyaliz semptomlarına etkisini belirlemek amacıyla gerçekleştirildi.

**Yöntemler:** Randomize kontrollü olan çalışmanın verileri, Gümüşhane İli Kelkit Devlet Hastanesi'nde 1 Kasım 2023 - 1 Ocak 2024 tarihleri arasında deney (n=30) ve kontrol gruplarındaki (n=30) hastalardan toplandı. Çalışma öncesinde kurum izni ve etik kurul izni alındı. Deney grubu hastalara diyet tedavisine yönelik eğitim verildi. Verilerin toplanmasında "hasta bilgi formu", "hemodiyaliz hastalarının diyet tedavisine yönelik tutum ölçeği (HDTÖ)" ve "diyaliz semptom indeksi (DSİ)" kullanıldı. Veri toplama araçları çalışma öncesi (ön-test), eğitim verildikten sonra (ara ölçüm) ve bir ay sonra (son-test) uygulandı. Veriler, SPSS 25.0 paket programında ki-kare, tekrarlayan ölçümlerde ANOVA testi ve bağımsız gruplar t-testi kullanılarak analiz edildi.

**Bulgular:** Deney grubu hemodiyaliz hastaların toplam HDTÖ ve alt boyutları puan ortalamalarının eğitim sonrası ölçümlerinin (ara ölçüm), eğitim öncesi (ön-test) ölçümlerden daha yüksek olduğu; eğitimin verilmesinden 1 ay sonra yapılan ölçümlerde ise (son-test) eğitimden hemen sonra yapılan ölçümlerden (ara ölçüm) düşük olduğu belirlendi ($p<0,05$). Yine, deney grubu hastaların DSİ puan ortalamalarının eğitim sonrası ölçümlerinin (ara ölçüm), eğitim öncesi (ön-test) ölçümlerden daha düşük olduğu ($p<0,05$);

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**ABSTRACT**

(p<0.05). Again, the post-training measurements (intermediate measurement) of the DSI score averages of the experimental group of patients were lower than the pre-training (pre-test) measurements (p<0.05); it was determined that the measurements made 1 month after the training were given (post-test) did not differ from the measurements made immediately after the training (intermediate measurement) (p>0.05).

**Conclusion:** In line with the findings, it was determined that the diet therapy training provided increased hemodialysis patients' attitudes towards diet therapy and reduced dialysis symptoms.

**Keywords:** Hemodialysis, diet treatment, symptom management

**ÖZ**

eğitimin verilmesinden 1 ay sonra yapılan ölçümlerin ise (son-test) eğitimden hemen sonra yapılan ölçümlerden (ara ölçüm) farklılaşmadığı belirlendi (p>0,05).

**Sonuç:** Elde edilen bulgular doğrultusunda, verilen diyet tedavisi eğitiminin hemodiyaliz hastalarının diyet tedavisine tutumlarını artırdığı ve diyaliz semptomlarını azalttığı tespit edildi.

**Anahtar Kelimeler:** Hemodiyaliz, diyet tedavisi, semptom yönetimi

## Introduction

Chronic kidney disease (CKD) is a progressive and chronic disease in which kidney functions (fluid electrolyte, metabolic, endocrine, etc.) are severely impaired and the glomerular filtration rate decreases as a result (1,2). CKD, the incidence of which is increasing day by day in the world and in Türkiye (3,4), is a fundamental public health problem due to its negative impact on quality of life, high morbidity and mortality rates, poor prognosis and high cost renal replacement therapy (RRT) (5,6). Although drug and medical nutrition therapy are sufficient in the initial stages of CKD treatment, RRT may become mandatory in advanced CKD stages where kidney functions are completely lost. RRTs are divided into three: hemodialysis (HD), peritoneal dialysis (PD) and transplantation (7,8). HD treatment is the most preferred method in patients with advanced end-stage renal disease (9). The main purpose of HD treatment is to correct fluid-electrolyte imbalance, prevent metabolic and extra-renal complications, improve quality of life and prolong life (10,11). HD treatment, in addition to its benefits, can also cause many undesirable symptoms (12,13). These symptoms are; hypotension/hypertension, respiratory distress, head-back-chest pain, muscle cramps, pruritus, nausea-vomiting, fatigue, fever, constipation, diarrhea, pruritus, edema, emotional problems and sexual dysfunction (14,15). The symptoms experienced can cause life-threatening complications and increased health costs in cases where patients do not comply with the treatment, and can negatively affect daily life activities and quality of life (16,17). HD treatment is a complex process, and the patients' compliance with diet, fluid intake, dialysis sessions and medication intake affects the success of the treatment (18). Among the many methods used to increase compliance with treatment in individuals undergoing HD treatment, diet treatment is particularly important in terms of its direct effect on blood values (19). Diet treatment may cause the disease to worsen, but it may also prevent complications that may occur in patients undergoing HD (20). At the same time, it contributes to the appropriate nutrition of patients during the disease process, to the improvement of their quality of life, and can increase survival rates (21). In this sense, patients' individual nutrition patterns should be determined and their food intake should be supported with appropriate dietary recommendations in terms of quality, quantity, and consumability. In addition, in order for the metabolic functions of individuals undergoing HD to be maintained in a healthy manner, the daily energy requirements should be met (17). Therefore, a well-programmed diet treatment prepared in cooperation with a dietician should be created for patients. Again, dialysis training, which constitutes an important part of the treatment, should be given by nurses in order to increase the knowledge level of patients undergoing HD and their compliance with treatment (22).

The education given to patients and the goals of the diet treatment should be appropriate according to the RRT applied and the patient's nutrition should be arranged in line with the goals (23). The aim of diet treatment in patients undergoing HD is to keep the possible symptoms of uremia and biochemical parameters that may cause fluid-electrolyte imbalance at an appropriate level, to protect the quality of life and renal functions and to stop the progression of renal damage (24,25). Again, among the goals of nutrition treatment are to correct anemia in patients, reduce inflammation, prevent the development of cardiovascular diseases, reduce symptoms such as nausea, vomiting, pruritus and pain and prevent malnutrition (26). Therefore, it is important for patients undergoing HD to comply with diet treatment (27).

Adherence to diet treatment in patients undergoing HD reduces complications and increases the effectiveness of the treatment (27). However, one of the most important roles and responsibilities of nurses who care for patients, in addition to their roles as caregivers, therapeutics, guides, coordinators, case managers and consultants, is their educational role (28). It is stated that education given by the nurse in line with a plan and program reduces patients' anxiety, increases their satisfaction, positively affects patients' adaptation to their illness, reduces healthcare costs, reduces morbidity and mortality, shortens the duration of hospital stay and increases patients' awareness levels (29). In addition, struggling with the complications of the disease affects individual and quality of life (30). In line with this information, a randomized controlled trial (RCT) was conducted to investigate the effect of the attitudes of patients undergoing HD who were given education towards diet treatment on dialysis symptoms.

## Methods

### Purpose of the Study

This study was conducted as a randomized RCT to investigate the effects of HD patients' attitudes towards diet treatment on dialysis symptoms.

### Research Questions:

Question 1: Does the attitudes of patients undergoing HD towards diet treatment have a positive effect on dialysis symptoms?

Question 2: Does the education given on diet treatment have a positive effect on HD patients' attitudes towards diet treatment and dialysis symptoms?

### Research Universe and Sample

The data of the study were conducted between November 1, 2023 and January 1, 2024 at Kelkit State Hospital in Gümüşhane Province.

HD is applied to patients with stage 4 and stage 5 CKD in the HD Unit of Kelkit State Hospital in Gümüşhane. In the dialysis unit, 36 patients are treated on outpatient HD for three sessions a week, 6 days a week (monday, wednesday, friday and tuesday, thursday, saturday) in four groups every day (two session groups between 08:00-12:00 and 12:00-16:00 during the day, two session groups between 16:00-20:00 and 20:00-24:00 in the evening) and nine patients in each group. Therefore, HD treatment can be applied to 72 patients in a week. Power analysis was performed after data were collected by taking 30 patients undergoing HD each into the experimental and control groups. As a result of the study obtained; The mean score of "attitude scale for the dietary therapy of hemodialysis patients (ASDTHP)" was determined as 36.16±11.94 in the control group and 57.03±5.50 in the experimental group, and the mean score of the "dialysis symptom index (DSI)" was determined as 91.96±30.64 in the control group and 49.13±23.00 in the experimental group. According to these values, in the power analysis performed with an alpha margin of error of 5%, the power of the study/test was found to be 100% for the ASDTHP result, the effect size was 2.24 (large effect), and the power of the test was found to be 99% for the DSI result, the effect size was 1.58 (large effect) (G*Power 3.1.9.2). The study was terminated by deciding that the sample size was sufficient (experiment=30; control=30). The patients to be included in the study were selected by lottery method and the data were collected by single-blind randomization method.

The inclusion criteria for the study were;

- Being at least 18 years old,
- Agreeing to participate in the study,
- Being able to communicate verbally and in writing,
- Undergoing at least two sessions of HD treatment per-week,
- Not having any mental or intellectual dysfunction,
- Undergoing HD treatment for at least three months (in order to be defined as a chronic HD program),

The exclusion criteria for the study were determined as; not accepting to participate in the study, undergoing PD, being diagnosed as having a psychiatric disorder diagnosed by a psychiatrist, and general condition being unstable (heart rate <100 mm/Hg or diastolic BP <60 mm/Hg). Ethical approval was obtained from the Research Ethics Committee of Gümüşhane University (protocol no: 2023/4, date: 29.08.2023).

### Data Collection Tools and Data Collection

Research data were collected by one of the researchers involved in the study based on literature knowledge using the patient information form, ASDTHP and DSI face-to-face interview technique. In order to ensure single-blind randomization and prevent bias, individual training was provided by the other researcher regarding the nutrition and diet treatment of the patients before starting the study. In addition, information about the study was provided before starting the study and written consent was obtained from the individuals and the patient information form was applied. Again, ASDTHP and DSI were applied a total of 3 times before the study (pre-test), immediately after the training (interim measurement) and 4 weeks after the training (post-test).

### Patient Information Form

The patient information form was developed by the researcher after reviewing the literature (31,32). The form consisted of a total of 11 questions regarding the gender, marital status, age, education level, family type, employment status, occupation, income perception level, duration of CKD, duration of HD and having an additional chronic disease.

### Attitude Scale for the Dietary Therapy of Hemodialysis Patients (ASDTHP)

It was developed by Onbe and Kanda (33) to determine the attitudes of patients towards diet treatment. The Turkish validity and reliability study of the scale consisting of a four-point Likert type and 16 items was conducted by Bahçecioğlu Turan et al. (34). Each item represents the answer "1-strongly agree, 2-agree, 3-disagree, 4-strongly disagree". The scale consists of 3 sub-dimensions: "propensity of behavior that is affected by cognition" (items 1-7), "propensity of behavior that is affected by the food culture" (items 8-13), "negative affect that modifies the diet" (items 14-16). The last three items on the scale are reversed. Higher scores obtained from the scale indicate better attitudes (34).

### Dialysis Symptom Index (DSI)

The scale was developed by Weisbord et al. (35) and adapted into Turkish by Önsöz and Usta Yeşilbalkan (36). It consists of a total of 30 items that evaluate the emotional and physical symptoms of dialysis patients and the severity of these symptoms. After patients answer questions about the symptoms they have experienced in the last week as "yes-no", their symptoms to which the answer is

yes are re-evaluated on a five-point Likert type ("5 points: Very much", "4 points: Quite a bit", "3 points: Somewhat", "2 points: A little bit", "1 point: Not at all"). The total score to be obtained from the scale varies between 0-150. A score of zero indicates that the patient has no symptoms.

### Statistical Analysis

Statistical analysis was performed using the IBM SPSS 25 package program. The skewness and kurtosis coefficients of the scores obtained from the scales being within the range of ±1.5 were considered evidence of the existence of a normal distribution (37). When Table 1 was examined, since the skewness and kurtosis coefficients for pre-test, interim and post-test scores in each scale were within the range of ±1.5, repeated measures analysis was performed using the ANOVA test, which was a parametric test for repeated measures. When comparing the experimental and control groups in terms of scale scores, the independent groups t-test was used if the scale scores showed a normal distribution (Table 1).

## Results

The introductory information of HD patients is examined in Table 2. The mean age of the experimental group was 64.00±12.08 years. It was determined that 56.7% of the participants in the experimental group were female, 83.3% were married, 33.3% had primary school or lower education, 76.7% lived in a nuclear family or alone, 93.3% were unemployed, 63.3% were housewives, 76.7% had income equal to their expenses, 40% had CKD for more than 11 years, 33.3% had undergone HD for 1-5 years or 6-10 years, and 66.7% did not have an additional chronic disease (Table 2). The mean age of the control group was determined as 58.77±13.81 years. It was determined that 56.7% of the participants in the control group were male, 56.7% were married, 73.3% had secondary education or higher, 80% lived in a nuclear family or alone, 86.7% were unemployed, 50% were retired, 53.3% had income equal to their expenses, 26.7% had CKD for less than 1 year and 6-10 years, 36.7% had undergone HD for less than 1 year, and 76.7% had an additional chronic disease (Table 2). As a result of the statistical analyses conducted on whether the introductory information differed according to the experimental and control groups, it was determined that marital status, occupation, income status, HD duration, and having an additional chronic disease differed significantly according to the groups ($p<0.05$). However, it was found that gender, education level, family type, employment status and CKD duration did not differ according to the groups ($p>0.05$) (Table 2). When the repeated measures ANOVA test results were examined regarding whether the pre-test, mid-test and post-test "ASDTHP" and "DSI" mean scores of the experimental and control groups showed significant differences; it was found that the mean scores of the "ASDTHP" propensity of behavior that is affected by cognition sub-dimension ($F=139.04$, $p=0.000$), the propensity of behavior that is affected by the food culture sub-dimension ($F=136.44$, $p=0.000$), the negative affect that modifies the diet sub-dimension ($F=105.48$, $p=0.000$), the total ASDTHP ($F=142.91$, $p=0.000$) and DSI ($F=19.55$, $p=0.000$) differed significantly according to the education process of the experimental group ($p<0.001$). According to the multiple comparison test results conducted to determine which group caused the difference in the experimental group; it was determined that the post-training measurements (interim measurement) of the ASDTHP propensity of behavior that is affected by cognition sub-dimension, propensity of behavior that is affected by the food culture sub-dimension, negative affect that modifies the diet sub-dimension and total ASDTHP mean scores were higher than the pre-training (pre-test) measurements; and the measurements taken 1 month after the training (post-test) were lower than the measurements taken immediately after the training (interim measurement) ($p<0.05$). Again, it was determined that the post-training measurements (interim measurement) of the DSI mean scores of the experimental group patients were lower than the pre-training (pre-test) measurements ($p<0.05$); and the measurements taken 1 month after the training (post-test) did not differ from the measurements taken immediately

**Table 1.** Skewness and kurtosis coefficients of the scores obtained from the scales

| Scale | SD | Intervention group (n=30) | | | | | | Control group (n=30) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pre-test | | Mid-test | | Post-test | | Pre-test | | Mid-test | | Post-test | |
| | | SC | KC | SC | KC | SC | KC | SC | KC | SC | KC | SC | KC |
| ASDTHP | Propensity of behavior that is affected by cognition SD | 0.650 | 0.096 | -0.457 | -0.767 | -0.358 | -0.337 | 0.064 | -0.718 | 0.086 | -0.731 | 0.291 | -0.022 |
| | Propensity of behavior that is affected by the food culture SD | 0.454 | -0.292 | -0.631 | 0.004 | -0.107 | -0.796 | -0.019 | -0.863 | 0.093 | -0.780 | 0.247 | -0.118 |
| | Negative affect that modifies the diet SD | 0.843 | -0.029 | -0.539 | -1.021 | -0.392 | -0.172 | 0.211 | -0.642 | 0.277 | -0.494 | 0.510 | -0.232 |
| | Total | 0.717 | 0.155 | -0.535 | -0.427 | -0.269 | -0.454 | 0.058 | -0.751 | 0.117 | -0.690 | 0.309 | -0.091 |
| DSI | | 0.026 | -1.205 | 0.591 | -1.067 | 1.098 | 1.488 | 0.355 | -1.336 | -0.425 | 0.277 | -0.580 | 0.483 |

SD: Sub-dimension, ASDTHP: Attitude scale for the dietary therapy of hemodialysis patients, DSI: Dialysis symptom index, SC: Skewness coefficient, KC: Kurtosis coefficient

**Table 2.** Descriptive information on hemodialysis patients (n=60)

| Descriptive information | | $\bar{X}$ ± SD | $\bar{X}$ ± SD | t | p* |
|---|---|---|---|---|---|
| Age | | 64.00±12.08 | 58.77±13.81 | 1.562 | 0.124 |
| | | Intervention group (n=30) | Control group (n=30) | Statistical analysis | |
| | | n (%)** | n (%)** | $x^2$ | p |
| **Gender** | Male | 13 (43.3) | 17 (56.7) | 0.600 | 0.439 |
| | Female | 17 (56.7) | 13 (43.3) | | |
| **Marital status** | Married | 25 (83.3) | 17 (56.7) | 3.889 | **0.049*** ** |
| | Single (widow/divorced) | 5 (16.7) | 13 (43.3) | | |
| **Education level** | Primary school and below | 10 (33.3) | 8 (26.7) | 0.079 | 0.778 |
| | Secondary school and above | 20 (66.7) | 22 (73.3) | | |
| **Family type** | Nuclear | 23 (76.7) | 24 (80.0) | 0.000 | 1.000 |
| | Extended | 7 (23.3) | 6 (20.0) | | |
| **Employment status** | Employed | 2 (6.7) | 4 (13.3) | 0.671 | 0.335 |
| | Not employed | 28 (93.3) | 26 (86.7) | | |
| **Occupation** | Retired | 6 (20.0) | 15 (50.0) | 6.134 | **0.041**** |
| | Housewife | 19 (63.3) | 13 (43.3) | | |
| | Self-employed | 5 (16.7) | 2 (6.7) | | |
| **Income status** | Income less than expenses | 3 (10.0) | 12 (40.0) | 7.288 | **0.030**** |
| | Income equal to expenses | 23 (76.7) | 16 (53.3) | | |
| | Income more than expenses | 4 (13.3) | 2 (6.7) | | |
| **Duration of CKD** | >1 year | 2 (6.7) | 8 (26.7) | 5.124 | 0.163 |
| | 1-5 years | 6 (20.0) | 7 (23.3) | | |
| | 6-10 years | 10 (33.3) | 8 (26.7) | | |
| | <11 years | 12 (40.0) | 7 (23.3) | | |
| **Duration of HD** | >1 year | 2 (6.7) | 11 (36.7) | 11.870 | **0.007**** |
| | 1-5 years | 10 (33.3) | 9 (30.0) | | |
| | 6-10 years | 10 (33.3) | 9 (30.0) | | |
| | <11 years | 8 (26.7) | 1 (3.3) | | |
| **Additional chronic disease** | Yes | 10 (33.3) | 23 (76.7) | 9.697 | **0.002*** ** |
| | No | 20 (66.7) | 7 (23.3) | | |

*: Independent groups t-test, **: Column percentage**; ***: Pearson chi-square and continuity correction, ****: Chi-square test and Fisher-Freeman-Halton test, CKD: Chronic kidney disease, HD: Hemodialysis, SD: Standard deviation

**Table 3.** Intra- and inter-group analysis of the time-dependent changes in the mean scores of ASDTHP and DSI of the experimental and control groups (n=60)

| | Test | Intervention group (n=30) | | | Control group (n=30) | | | F;P | Intergroup analysis | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{x}$ | SD | | $\bar{x}$ | SD | | | t | p |
| **Propensity of behavior that is affected by cognition sub-dimension** | 1. Pre-test | 14.66 | 4.58 | | 16.06 | 5.31 | | | -1.093[d] | 0.279 |
| | 2. Mid-test | 24.90 | 2.48 | | 15.90 | 5.26 | | 73.80; 0.000[b] | 8.474[d] | 0.000 |
| | 3. Post-test | 22.90 | 3.63 | | 14.20 | 4.58 | | | 8.141[d] | 0.000 |
| | **Intragroup F;P** | 139.04; 0.000[a] | | | 4.05; 0.049[b] | | | | | |
| | **Significant difference[c]** | 1-2 | 1-3 | 2-3 | 1-2 | 1-3 | 2-3 | | | |

**Table 3.** Continued

| | Test | Intervention group (n=30) | | | Control group (n=30) | | | F;P | Intergroup analysis | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\bar{x}$ | SD | | $\bar{x}$ | SD | | | t | p |
| Propensity of behavior that is affected by the food culture sub-dimension | 1. Pre-test | 12.63 | 3.70 | | 13.80 | 4.45 | | | -1.103[d] | 0.275 |
| | 2. Mid-test | 21.26 | 2.16 | | 13.46 | 4.44 | | 75.15; 0.000[b] | 8.638[d] | 0.000 |
| | 3. Post-test | 19.50 | 2.95 | | 12.20 | 4.05 | | | 7.968[d] | 0.000 |
| | Intragroup F;P | 136.44; 0.000[a] | | | 3.84; 0.055[b] | | | | | |
| | Significant difference[c] | 1-2 | 1-3 | 2-3 | - | - | - | | | |
| Negative affect that modifies the diet sub-dimension | 1. Pre-test | 5.76 | 2.41 | | 6.93 | 2.40 | | | -1.874[d] | 0.066 |
| | 2. Mid-test | 10.86 | 1.10 | | 6.80 | 2.32 | | 73.91; 0.000[b] | 8.651[d] | 0.000 |
| | 3. Post-test | 9.86 | 1.71 | | 5.86 | 2.20 | | | 7.832[d] | 0.000 |
| | Intragroup F;P | 105.48; 0.000[a] | | | 6.40; 0.014[b] | | | | | |
| | Significant difference[c] | 1-2 | 1-3 | 2-3 | 1-2 | 1-3 | 2-3 | | | |
| Total ASDTHP | 1. Pre-test | 33.06 | 10.35 | | 36.80 | 12.08 | | | -1.285[d] | 0.204 |
| | 2. Mid-test | 57.03 | 5.50 | | 36.16 | 11.94 | | 79.08; 0.000[b] | 8.688[d] | 0.000 |
| | 3. Post-test | 52.26 | 8.1 | | 32.26 | 10.65 | | | 8.176[d] | 0.000 |
| | Intragroup F;P | 142.91; 0.000[a] | | | 4.50; 0.039[b] | | | | | |
| | Significant difference[c] | 1-2 | 1-3 | 2-3 | 1-2 | 1-3 | 2-3 | | | |
| DSI | 1. Pre-test | 81.66 | 35.92 | | 81.36 | 43.61 | | | 0.029[d] | 0.977 |
| | 2. Mid-test | 49.13 | 23.00 | | 91.96 | 30.64 | | 23.87; 0.000[b] | -6.122[d] | 0.000 |
| | 3. Post-test | 48.33 | 20.30 | | 96.03 | 19.62 | | | -7.312[d] | 0.000 |
| | Intragroup F;P | 19.55; 0.000[a] | | | 6.46; 0.008[b] | | | | | |
| | Significant difference[c] | 1-2 | 1-3 | 2-3 | 1-2 | 1-3 | 2-3 | | | |

[a]: The assumption of sphericity was met, [b]: Greenhouse-Geisser, [c]: Bonferroni test was used for multiple comparisons, [d]: Independent samples t-test, ASDTHP: Attitude scale for the dietary therapy of hemodialysis patients, DSI: Dialysis symptom index, SD: Standard deviation

after the training (interim measurement) (p>0.05) (Table 3). When the repeated measures ANOVA test results were examined regarding whether the pre-test, interim measurement and post-test ASDTHP and DSI score averages of the experimental and control group HD patients showed significant differences; it was found that the control group's mean scores for behavioral tendency affected by cognition subdimension of ASDTHP (F=4.05, p=0.049), negative affect that modifies the diet subdimension (F=6.40, p=0.014), total ASDTHP (F=4.50, p=0.039) and DSI (F=6.46, p=0.008) scores differed significantly according to time (p<0.05). However, it was determined that the mean scores of propensity of behavior that is affected by the food culture subdimension of ASDTHP did not differ according to time (p>0.05). According to the result of the multiple comparison test performed to determine which group the difference originated from in the control group; it was found that the mean scores of the negative affect that modifies the diet subdimension of the ASDTHP were not different from the pre-test measurements (p>0.05); and the mean scores of the post-test were lower than the mean scores of the interim measurements (p<0.05). There was no difference between the total ASDTHP interim measurement and the pre-test measurement, and between the post-test and interim measurements (p>0.05); and the mean scores of the post-test were lower than the mean scores of the pre-test (p<0.05). Again, it was found that the mean scores of the DSI interim measurement of the control group patients were higher than the mean scores of the pre-test (p<0.05); and there was no difference between the mean scores of the post-test and interim measurements (p>0.05) (Table 3).

In Table 3, as a result of the independent groups t-test conducted to determine whether the pre-test, mid-term and post-test ASDTHP and DSI mean scores of the patients undergoing HD differed according to the groups; it was found that the total ASDTHP and all its sub-dimensions and the DSI mid-term and post-test measurement scores differed significantly according to the groups (p<0.001). However, there was no difference between the pre-test total ASDTHP and all its sub-dimensions and the DSI measurement scores (p>0.05) (Table 3).

## Discussion

This study examined the effects of education given to patients undergoing HD on their attitudes towards diet treatment and dialysis symptoms.

It is reported in the literature that the prognosis of patients undergoing HD worsens and CKD-related mortality rates increase as a result of their failure to comply with diet treatment or recommended diet models (38). It is known that individuals who comply with treatment have better HD adequacy (31). In this study, it was determined that diet treatment education given to individuals undergoing HD positively increased patients' attitudes towards diet treatment, but its effect began to decrease 1 month after the education was given. In the literature studies reviewed, it was determined that diet treatment education given to individuals undergoing HD increased patients' attitudes towards diet treatment, similar to the findings in our study (32,39-43). In another study reviewed, it was determined that diet treatment applied to patients undergoing HD increased individuals' compliance with treatment (44). Another study showed that education given to patients on nutrition improved their health behaviors and outcomes and increased their participation in individualized interventions for patients (45). It has been reported that propensity of behavior that is affected by cognition, propensity of behavior that is affected by the food culture, and negative affect that modifies the diet affect diet treatment in individuals undergoing HD. In some studies examining the effects of cognitive behaviors on diet, it has been determined that there are improvements in cognition levels with diet education programs for patients (33,46). In other studies examining the effects of food cultures on diet, it has been determined that eating habits and food cultures affect the sodium, potassium, calcium and fluid consumption of patients (47,48). Again, in another study where education aimed to create behavioral change, it was reported that with the education given for diet treatment, diseases were prevented or treated and health was protected by determining the nutritional status of patients (49). In a study examining the effects of behaviors that negatively affected patients' diets, it was determined that poor nutritional management of patients and lack of knowledge about nutrition were behaviors that negatively affected the diet (22). In another study examined, it was concluded that nurses' understanding of cognition and affect that affect patients' attitudes in diet treatment education for HD patients could lead to effective behavioral changes in patients (50). In this study, it was found that education increased the propensity of behavior that is affected by cognition, propensity of behavior that is affected by the food culture, and decreased negative affect that modifies the diet.

It is reported in the literature that patients undergoing HD who comply with dietary instructions have a higher chance of reaching their health goals, while patients who do not comply with the diet experience a series of health complications and symptoms (8). In addition, it is known that the symptoms experienced by individuals undergoing HD are also affected by the diet treatment they receive (43,51). In a reviewed study, it was reported that education given during the treatment and care process positively affected the diet and the quality of life of the patients, and that patients were able to effectively manage the symptoms they experienced (52). In another study, it was found that face-to-face education increased the diet knowledge of the patients and improved clinical and laboratory parameters (19,39). In an RCT, it was found that repeated education increased the compliance of the patients in the experimental group to diet treatment and fluid restriction and improved their clinical parameters (43). In a study conducted by Taşkın Duman (53), it was reported that video-assisted education provided to patients undergoing HD reduced the symptom burden of the patients. In a study conducted by Tutur (54), it was determined that education and counseling provided to patients undergoing HD via tele-nursing increased the level of dietary knowledge and reduced the symptoms experienced. In this study, in parallel with the studies examined, it was determined that the symptoms seen in patients undergoing HD decreased after the education given. In addition, it was determined that the effect of the education continued even 1 month after the education was given.

## Conclusion

In this study, it was found that education on diet therapy given to patients undergoing HD increased their attitudes towards diet therapy and reduced dialysis symptoms. According to the findings obtained from the study, it is recommended that individuals undergoing HD receive regular diet education. In addition, it is recommended that nurses working in HD units should be informed about dialysis and that diet therapy education should be provided in cooperation with dietitians, and that patients should be included in the patient care process by considering their socio-demographic and socio-cultural levels. In addition, due to the limited number of studies conducted in the field of HD, it is thought that there is a need for high-sample follow-up studies and randomized controlled experimental studies.

### Ethics

**Ethics Committee Approval:** Ethical approval was obtained from the Research Ethics Committee of Gümüşhane University (protocol no: 2023/4, date: 29.08.2023). In addition, necessary permissions were obtained from the Gümüşhane Provincial Health Directorate (dated 18.10.2023 and numbered E. 227139421) for the hospital where the data would be collected.

**Informed Consent:** In addition, information about the study was provided before starting the study and written consent was obtained from the individuals and the patient information form was applied.

### Footnotes

### Authorship Contributions

Surgical and Medical Practices: D.A.C., H.D., Concept: D.A.C., Design: H.D., Data Collection or Processing: D.A.C., Analysis or Interpretation: H.D., Literature Search: D.A.C., Writing: D.A.C., H.D.

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## References

1. Köylü, H. Glomerül fitrasyon hızı. Köylü H, editör. 4. Baskı. Ankara: Ankara Nobel Tıp Kitabevleri; 2020.s.323-30.
2. Zengin N, Ören B. Hemodiyaliz hastalarının tuzdan kısıtlı diyete uyumlarının incelenmesi. Nefroloji Hemşireliği Dergisi. 2015;10:39-49.
3. Jafari H, Ebrahimi A, Aghaei A, Khatony A. The relationship between care burden and quality of life in caregivers of hemodialysis patients. BMC Nephrol. 2018;19:321.
4. Aydın Z, Sevim Y, Döner B, Gürsu M, Karadağ S, Uzun S, et al. Anthropometric measurements in hemodialysis patients. Turk Neph Dial Transpl. 2015;24:61-7.
5. Beerappa H, Chandrababu R. Adherence to dietary and fluid restrictions among patients undergoing hemodialysis: an observational study. Clinical Epidemiology and Global Health. 2019;7:127-30.
6. Varol E, Karaca Sivrikaya S. Quality of life in chronic renal failure and nursing. J DU Health Sci Inst. 2018;8:89-96.
7. Süleymanlar G. Böbrek anatomisi ve fizyolojisi. İçinde: Yeniçerioğlu Y, Güngör Ö, Arıcı M, editörler. Temel nefroloji: İstanbul; 2019.s.3-23.
8. Lim JH, Chinna K, Khosla P, Karupaiah T, Daud ZAM. Understanding how nutrition literacy links to dietary adherence in patients undergoing maintenance hemodialysis: a theoretical exploration using partial least squares structural equation modeling. Int J Environ Res Public Health. 2020;17:7479.
9. Albayrak Orçin F, Usta Yeşilbakan Ö. Hemodiyaliz tedavisi alan kronik böbrek yetmezliği hastalarının yaşam deneyimlerinin incelenmesi. Adıyaman Üniversitesi Sağlık Bilimleri Dergisi. 2020;6:1-12.
10. Eroğlu H, Metin ZG. Hemodiyaliz hastalarında semptom yönetiminde tamamlayıcı ve interaktif yaklaşımlar: sistematik bir derleme. Hacettepe Üniversitesi Hemşirelik Dergisi. 2021;14:17-25.
11. Alemdar H, Çınar Pakyüz S. Hemodiyaliz hastalarında öz bakım gücünün yaşam kalitesine etkisinin değerlendirilmesi. Nefroloji Hemşireliği Dergisi. 2015;2:19-30.
12. Ahsen A. Acute complications of hemodialysis. Kocatepe Medical Journal. 2011;12:54-60.
13. Akpolat T, Utaş C. Hemodiyalizde sık karşılaşılan sorunlar. [Erişim tarihi: 22 Mart 2023]. Erişim adresi: http://www.tsn.org.tr/folders/file/hemodiyaliz_hastasinda_karsilasilan_sorunlar.pdf.
14. Raja SM, Seyoum Y. Intradialytic complications among patients on twice-weekly maintenance hemodialysis: an experience from a hemodialysis center in Eritrea. BMC Nephrol. 2020;21:163.
15. Hintistan S, Deniz A. Evaluation of symptoms in patients undergoing hemodialysis. Bezmialem Science. 2018;6:112-8.
16. Kraus MA, Fluck RJ, Weinhandl ED, Kansal S, Copland M, Komenda P, et al. Intensive hemodialysis and health-related quality of life. Am J Kidney Dis. 2016;68(Suppl 1):33-42.
17. Kara B. Hemodiyaliz hastalarında tedaviye uyum: çok yönlü bir yaklaşım. Gülhane Tıp Dergisi. 2007;9:132-6.
18. Tayaz E, Koç A. Hemodiyaliz tedavisi alan kronik böbrek yetmezliği hastalarında semptom yönetimi ve hemşirelik. Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi. 2020;23:147-56.
19. Doğan S, Bardak Perçinci N. The effect of nutrition education on some biochemical parameters and diet compliance in hemodialysis patients. Turkish Journal of Health Research. 2021;2:16-25.
20. Ezici V, Aksoy M, Öztürk A, Önder C, Ada M. Diyaliz hastalarında çeşitli besinlerdeki tuz alımına bağlı olarak interdiyalitik kilo alımının incelenmesi. XV. Öğrenci Sempozyumu Çalışma Grubu Raporları.14-16 Mayıs 2013. Ankara. http://tip.baskent.edu.tr/egitim/mezuniyetoncesi/calismagrp/grsmpzsnm15/15.S26.pdf.
21. Kızıltan G. Medical nutrition therapy in end-stage renal failure. Bes Diy Derg. 2018;46(Suppl):48-56.
22. Yakar B, Demir M, Canbolat Ö. The effect of nutritional knowledge levels of hemodialysis patients on nutritional status. Konuralp Medical Journal. 2019;11:384-91.
23. Olcay Eminsoy Ş. Medical nutrition of adult patients receiving renal replacement therapy: a case report. Bes Diy Derg. 2018;46(Suppl):94-9.
24. Gama-Axelsson T, Heimbürger O, Stenvinkel P, Bárány P, Lindholm B, Qureshi AR. Serum albumin as predictor of nutritional status in patients with ESRD. Clin J Am Soc Nephrol. 2012;7:1446-53.
25. Yağcı Y. Periton diyalizi hastalarının beslenme durumlarının belirlenmesi (tez). İstanbul: Haliç Üniv. 2015
26. Elmas A, Saral EE, Tuğrul A, Şengül E, Bülbül F. The relationship between the level of nutritional eduction and clinical and laboratory findings in hemodialysis patients. Kocaeli Med J. 2012;3:23-6.
27. Kang SS, Chang JW, Park Y. Nutritional status predicts 10-year mortality in patients with end-stage renal disease on hemodialysis. Nutrients. 2017;9:399.
28. Aydemir Gedük E. Hemşirelik mesleğinin gelişen rolleri. Sağlık Bilgileri ve Mesleki Dergisi. 2018;5:253-8.
29. Hoving C, Visser A, Mullen PD, van den Borne B. A history of patient education by health professionals in Europe and North America: from authority to shared decision making education. Patient Educ Couns. 2010;78:275-81.
30. Mollaoğlu M. Disability, Activities of daily living and self-efficacy in dialysis patients. TAF Prev Med Bull. 2011;10:181-6.
31. Bülbül E, Demiroglu S. The relationship between health literacy and adherence to treatment in patients receiving hemodialysis treatment. Karya J Health Sci. 2023;4:1-5.
32. Başar E, Mollaoğlu M. The effect of a hemodialysis patient education program on fluid control and dietary compliance. Hemodial Int. 2019;23:392-401.
33. Onbe H, Kanda K. Development and testing of the attitude scale for the dietary therapy of hemodialysis patients. Jpn J Nurs Sci. 2018;15:39-49.
34. Bahçecioğlu Turan G, Yilmaz Karabulutlu E, Özer Z. Attitude scale for the dietary therapy of hemodialysis patients: Turkish validity and reliability study. Int Urol Nephrol. 2023;55:769-76.

35. Weisbord SD, Fried LF, Arnold RM, Rotondi AJ, Fine MJ, Levenson DJ, et al. Development of a symptom assessment instrument for chronic hemodialysis patients: the dialysis symptom index. J Pain Symptom Manage. 2004;27:226-40.
36. Önsöz HB, Usta Yeşilbalkan Ö. Reliability and validity of the Turkish version of the dialysis symptom index in chronic hemodialysis patients. Turk Neph Dial Transpl. 2013;22:60-7.
37. Tabachnick BG, Fidell LS. Using multivariate statistics. 6th ed. Pearson Education; 2013;6:1277-96.
38. Toku TN. Yetişkin hemodiyaliz hastalarının beslenme durumlarının kısıtlı diyete uyumlarının ve yaşam kalitelerinin diyaliz tedavisi alma yıllarına göre değerlendirilmesi (tez). Edirne: Trakya Üniv. 2022.
39. Torabikhah M, Farsi Z, Sajadi SA. Comparing the effects of mHealth app use and face-to-face training on the clinical and laboratory parameters of dietary and fluid intake adherence in hemodialysis patients: a randomized clinical trial. BMC Nephrol. 2023;24:194.
40. Sarıaslan A. Precede proceed modeline temellendirilmiş eğitim programının hemodiyaliz hastalarının tedaviye uyumuna, sağlıklı yaşam biçimi davranışlarına ve yaşam kalitesine etkisinin değerlendirilmesi (tez). Erzurum: Atatürk Üniv. 2022.
41. Wenfang S, Kang S. Effect of systemic nursing intervention on calcium and phosphorus metabolism and pruritus in hemodialysis patients. Boletin De Malariologia Y Salud Ambienta. 2020;60:55-60.
42. Nadri A, Khanoussi A, Hssaine Y, Chettati M, Fadili W, Laouad I. Effect of a hemodialysis patient education on fluid control and dietary. Nefrol Ther. 2020;16:353-8.
43. Başer E. Hemodiyaliz hastalarında eğitim programının sıvı kontrolü ve diyete uyum üzerindeki etkisi (tez). Sivas: Cumhuriyet Üniv. 2018.
44. Alikari V, Tsironi M, Matziou V, Tzavella F, Stathoulis J, Babatsikou F, et al. The impact of education on knowledge, adherence and quality of life among patients on haemodialysis. Qual Life Res. 2019;28:73-83.
45. Chung MK, Kim DH, Park JI, Lee S, Park HC, Kim K, et al. Adaptive nutrition ıntervention stabilizes serum phosphorus levels in hemodialysis patients: a multicenter decentralized clinical trial using real-world data. J Renal Nutr. 2023;34:47-57.
46. Chow J, Dalton B. Yeni, 12 haftalık, ulusal düzeydeki motivasyon ve eğitim programı hemodiyaliz hastalarında serum fosfat üzerinde hiçbir etki yoktur. Avustralasya Böbrek Derneği Dergisi. 2012;8:82-6.
47. Garagarza C, Valente A, Caetano C, Ramos I, Sebastião J, Pinto M, et al. Mediterranean diet: a dietary pattern related to nutritional benefits for hemodialysis patients. J Ren Nutr. 2023;33:472-81.
48. Lim HS, Kim HS, Kim JK, Park M, Choi SJ. Nutritional status and dietary management according to hemodialysis duration. Clin Nutr Res. 2019;8:28-35.
49. Taberna DJ, Navas-Carretero S, Martinez JA. Current nutritional status assessment tools for metabolic care and clinical nutrition. Curr Opin Clin Nutr Metab Care. 2019;22:323-8.
50. Topbaş E, Bingöl G. Psikososyal boyutu ile diyaliz tedavisi ve uyum sürecine yönelik hemşirelik girişimleri. Nefroloji Hemşireliği Dergisi. 2017;1:36-42.
51. Kalantar-Zadeh K, Bellizzi V, Piccoli GB, Shi Y, Lim SK, Riaz S, et al. Caring for patients with advanced chronic kidney disease: dietary options and conservative care ınstead of maintenance dialysis. J Ren Nutr. 2023;33:508-19.
52. Keskin Yıldırım A, Özpulat,F. Kronik böbrek yetmezliği tanısıyla hemodiyaliz tedavisi uygulanan hastaların yaşadıkları güçlükler. Sağlık ve Toplum. 2019;29:32-43.
53. Taşkın Duman H. Hemodiyaliz tedavisi uygulanan hastalara yapılan video eğitiminin semptom yükü, konfor düzeyi ve yaşam kalitesine etkisi (tez). İzmir: Ege Üniversitesi. 2021.
54. Tutur İ. Hemodiyaliz hastalarına tele-hemşirelik yoluyla verilen eğitim ve danışmanlığın hastalık yönetimine, yaşam kalitesine ve öz bakım davranışına etkisi (tez). Hatay: Hatay Mustafa Kemal Üniversitesi. 2023.

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# Impact of Compassion Fatigue on Care Behaviors in Intensive Care Nurses

## Yoğun Bakım Hemşirelerinde Merhamet Yorgunluğunun Bakım Davranışlarına Etkisi

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### ABSTRACT

**Objective:** The aim of the study was to examine the effect of compassion fatigue on care behaviors in intensive care unit (ICU) nurses.

**Methods:** The research was a cross-sectional type. It was conducted with 98 nurses working in adult ICUs of a university hospital. Nurses who had been working in the ICU for at least six months, were not diagnosed with a psychological disease, and agreed to participate in the study were included in the study. Data were collected to the Introductory characteristics form, Compassion Fatigue-Short Scale (CF-SS) and the Care Behaviors Scale-24 (CBS-24).

**Results:** The average age of the nurses was 31.23±5.81 years and 66.3% were women. The average working year of the nurses was 7.12±4.98, the average weekly working hours was 45.22±4.69, and the average number of patients they cared for in a day was 3.21±1.32. The total score of CF-SS of the participating in the study was 63.36±25.77 and the total score of CBS-24 was 5.19±0.55. A negative and weakly significant relationship was found between nurses' CBS-24 and CF-SS scales total scores ($p<0.05$). In addition, a statistically significant difference was found between the genders of the nurses and the mean score of CBS-24 ($p<0.05$). It was determined that female nurses had higher levels of perception of care behaviors than men.

### ÖZ

**Amaç:** Bu araştırmada, yoğun bakım ünitesi (YBÜ) hemşirelerinde görülen merhamet yorgunluğunun hemşirelik bakım davranışına etkisini belirlemek amaçlandı.

**Yöntemler:** Tanımlayıcı tipteki bu araştırma, bir üniversite hastanesinin erişkin YBÜ'lerinde çalışan 98 hemşire ile gerçekleştirildi. Araştırmaya en az altı aydır YBÜ'de görev yapan, psikolojik hastalık tanısı olmayan ve araştırmaya katılmayı kabul eden hemşireler dahil edildi. Araştırma verileri, tanıtıcı özellikler formu, Merhamet Yorgunluğu Kısa Ölçeği (MY-KÖ) ve Bakım Davranışları Ölçeği-24 (BDÖ-24) ile toplandı.

**Bulgular:** Hemşirelerin yaş ortalamaları 31,23±5,81 yıl olup %66,3'ü kadındı. Hemşirelerin çalışma yılı ortalaması 7,12±4,98, haftalık çalışma saati ortalaması 45,22±4,69 ve bir günde bakım verdiği ortalama hasta sayısı 3,21±1,32 idi. Hemşirelerin MY-KÖ toplam puanı 63,36±25,77, BDÖ-24 toplam puanı ise 5,19±0,55 idi. Hemşirelerin BDÖ-24 ölçek toplam puanları ile MY-KÖ toplam puan ortalamaları arasında negatif yönlü zayıf anlamlı bir ilişki saptandı ($p<0,05$). Hemşirelerin cinsiyetleri ile BDÖ-24 puan ortalamaları arasında istatistiksel olarak anlamlı fark bulundu ($p<0,05$). Kadın hemşirelerin erkeklere göre bakım davranışlarını algılama düzeylerinin daha yüksek olduğu saptandı.

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**ABSTRACT**

**Conclusion:** In this study, it was found that ICU nurses experienced moderate compassion fatigue and their level of perception of care behaviors was high. The compassion fatigue experienced by ICU nurses has a negative effect on their care behaviors.

**Keywords:** Care, care behavior, compassion fatigue, intensive care nurse, nursing

**ÖZ**

**Sonuç:** YBÜ hemşirelerinin orta düzeyde merhamet yorgunluğu yaşadığı ve bakım davranışlarını algılama düzeylerinin yüksek olduğu tespit edildi. Araştırmada öne çıkan önemli bir bulgu da, YBÜ hemşirelerinin yaşadıkları merhamet yorgunluğunun bakım davranışlarını olumsuz yönde etkilemesiydi.

**Anahtar Kelimeler:** Bakım, bakım davranışı, merhamet yorgunluğu, yoğun bakım hemşiresi, hemşirelik

## Introduction

Compassion is a sense of developing empathy for incidents experienced by other people and helping these people (1). Compassion fatigue is defined as inability to maintain empathy due to mental, physical and spiritual burnout (2,3). Joinson (4) introduced compassion fatigue for the first time in his study conducted with emergency service nurses. He expressed compassion fatigue as burnout of caregivers due to the internalization of stress experienced by patients to whom nurses gave care (4).

Intensive care units (ICU) are settings where patients require close follow-up and those with complex and life threatening issues receive treatment and care services via high technology equipment (5,6). The coronavirus disease 2019 (COVID-19) pandemic which has affected the world in recent years has once again revealed the need for ICUs. Intensive care nurse is the nurse responsible for diagnosing patients with complex and life-threatening problems, monitoring patients continuously, applying quality and advanced intensive care and treatment interventions, establishing therapeutic relationships with patients and their relatives, and implementing preventive, curative and rehabilitative interventions (7). In nurses who are employed in specific areas like ICUs, most factors such as being subjected to patients with complex and life threatening issues for a long time, experiencing traumatic memories and losses frequently, making ethical decisions, observing patients suffer for a long time, having communication problems with patients and their relatives, facing stressors in the workplace environment, having inefficient coping and problem solving skills and experiencing anxiety, stress and inadequate social support form a basis for compassion fatigue (8-11). Nurses who are employed in ICUs experience a moderate-high level of compassion fatigue (9,10,12-15). A study conducted to determine the prevalence of compassion fatigue among ICU nurses found that 60.1% of the nurses had high a risk for compassion fatigue (16).

"Care" plays a key role in nursing profession which is based on humans. The major quality separating nurses from other health occupational groups is their caregiver role (17,18). In nurses which is an occupational group giving uninterrupted care to patients, emergence of compassion fatigue may lead to problems such as indifference to the patient, higher possibility of making a mistake due to low concentration, inability to make a correct decision and inability to give necessary care to the patient (1,11). These problems that arise from compassion fatigue are directly correlated with decreased job satisfaction in nurses, decreased patient satisfaction and patient safety (12). The aforementioned problems that may be brought by compassion fatigue to nurses who are responsible for providing healthcare in a more quality and reliable way may lead to a decrease in performance and job quality and consequently in the quality of patient care (1,11). Determining the impact of compassion fatigue on care behaviors especially in nurses employed in units like ICUs where care is essential is significant in terms of burnout, professional development, patient safety, patient satisfaction and job satisfaction. Therefore, the current study sought to determine the impact of compassion fatigue on nursing care behaviors in ICU nurses.

## Methods

### Type of the Study

The study was planned the cross sectional study to determine the impact of compassion fatigue on nursing care behaviors in ICU nurses and reported it in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology cross sectional reporting directives (19). The study was conducted with nurses employed in ICUs in a hospital between 15 April and 15 June 2022.

### Target Population and Sample of the Study

The target population of the study comprised all nurses (n=150) employed in adult ICUs in the hospital where the study was conducted. Without sampling, the researchers aimed to reach all nurses employed in the ICUs between the aforementioned dates. The researchers carried out the study with 98 nurses who had been employed in hospital ICU for at least six months, had no specific psychological disorder and agreed to take part in the study. Rate of participation in the study was 65.3%.

### Collection of the Study Data

The researchers collected the study data using the Introductory Characteristics Form, Compassion Fatigue-Short Scale (CF-SS) and the Care Behaviors Scale-24 (CBS-24).

**Introductory Characteristics Form:** The form had seven questions aimed at determining introductory characteristics of the nurses such as sociodemographic information about the participants, unit worked, years of employment, weekly working hours and average number of patients they gave care to (5,6,8).

**Compassion Fatigue-Short Scale (CF-SS):** Adams et al. (20) developed the scale. Dinç and Ekinci (21) adapted the scale into Turkish and conducted its validity and reliability study. The scale was a self-report assessment tool requiring the participants to specify the degree that each scale item reflected their experiences. The 10 point likert scale ranged from seldomly/never (1) to very often (10). The scale had two subscales as secondary trauma and occupational burnout. Items "c, e, h, j, l" in the scale measured secondary trauma and items "a, b, d, f, g, i, k, m" measured occupational burnout. The total Cronbach's alpha coefficient of the scale was 0.876. The lowest and highest possible scores obtainable from the scale were 13 and 130, respectively. As the scores obtained from the scale increased, the level of compassion fatigue experienced by the individuals increased (21). The present study found the Cronbach's alpha coefficient to be 0.89.

**Care Behaviors Scale-24 (CBS-24):** Wolf et al. (22) developed the scale for nurses to assess themselves in nursing care. Wu et al. (23) updated and shortened the scale. The likert scale had four subscales (assurance, knowledge and skill, respect and commitment) and 24 items. Kurşun and Kanan (24) conducted the Turkish validity and reliability study of the scale in 2012. The total Cronbach's alpha value of the scale was 0.96.

In calculation of the total scale score, a scale ranging from "1 to 6" (1= never, 2= almost never, 3= sometimes, 4= usually, 5= mostly, 6= always) was obtained by summing the scores of 24 items and then dividing them into 24. In assessment of each subscale, a subscale score ranging from 1 to 6 was obtained by summing the scores of items in the subscales and dividing the score obtained into item number. As the total scale score and subscale scores increased, the level of nurses to perceive the quality of care behaviors increased (24). The present study found the Cronbach's alpha coefficient to be 0.95.

The researchers collected the study data via face-to-face interviews within the scope of COVID-19 measures.

### Ethical Committee

In order to conduct the research, written permission was obtained from Mersin University Hospital and ethics committee approval was obtained from Tarsus University Clinical Research Ethics Committee (approval no: 2022/27, date: 04.04.2022). Prior to the study, the researchers obtained informed consent form and written permission from the participants to take part in the study. The researchers conducted the study in accordance with the Helsinki Declaration.

### Statistical Analysis

Research data were analyzed in computer environment. They presented the data via descriptive statistics such as number, percentage, mean and standard deviation. They evaluated the normal distribution of the data via the Shapiro-Wilk test. In analysis of the data, the researchers used the Mann-Whitney U test and Kruskal-Wallis test. The researchers used the Spearman's Rho Correlation Coefficient to examine the correlations between the variables. If the r value in the correlation was <0.20, it indicated no/very weak correlation. If the r value was between 0.20 and 0.39, it indicated a weak correlation. If the r value was between 0.40 and 0.59, it indicated a moderate correlation. If the r value was between 0.60 and 0.79, it indicated a high correlation. If the r value was between 0.80 and 1.00, it indicated a very high correlation (25). For the comparisons, the researchers set the statistical significance value at $p<0.05$.

## Results

The mean age of the nurses was 31.23±5.81 years and 66.3% were women. Of them 81.6% were undergraduate graduates, 26.5% of them were working in the surgical ICU. The average working year of the nurses was 7.12±4.98, the average weekly working hour was 45.22±4.69, and the number of patients they cared for per day was 3.21±1.32 (Table 1).

Nurses' total score on CF-SS was 63.36±25.77, occupational burnout sub-dimension score on CF-SS was 40.59±16.93, and secondary trauma subscales score was 22.77±10.82. ICU nurses' CBS-24 total score was 5.19±0.55, CBS-24 assurance subscales score was 5.25±0.62, knowledge-skill subscales score was 5.38±0.54, respectful subscales score was 5.10±0.63, and commitment subscales score was 5.02±0.62 (Table 2).

A negative and weakly significant relationship was found between nurses' CBS-24 scale total scores and subscales and CF-SS total and occupational burnout subscales mean scores ($p<0.05$). A negative and weakly significant relationship was found between CF-SS secondary trauma subscales and CBS-24 knowledge-skill subscales ($p=0.022$) (Table 3).

**Table 1.** Descriptive characteristics of nurses (n=98)

| Characteristics | x ± SD | Min.-max. |
|---|---|---|
| Age | 31.23±5.81 | 23-48 |
| Working year | 7.12±4.98 | 1-26 |
| Weekly working hours | 45.22±4.69 | 40-60 |
| Number of patients provided care/day | 3.21±1.32 | 2-11 |
| | n | % |
| **Gender** | | |
| Female | 65 | 66.3 |
| Male | 33 | 33.7 |
| **Educational status** | | |
| Associate's degree | 10 | 10.2 |
| Bachelor's degree | 80 | 81.6 |
| Postgraduate | 8 | 8.2 |
| **Unit of assignment** | | |
| Surgical | 26 | 26.5 |
| Coronary | 16 | 16.3 |
| Medical | 20 | 20.4 |
| Reanimation | 18 | 18.4 |
| Emergency | 10 | 10.2 |
| Cardiovascular surgery | 8 | 8.2 |

x: Mean, SD: Standard deviation, Min.-max.: Minimum-maximum

While there was no significant difference between the introductory characteristics of nurses in terms of age, education status, ICU, working year, weekly working hours, average number of patients they cared for per day, and total scores of CF-SS and CBS-24 (p>0.05), there was a statistically significant difference between their gender and CBS-24 score averages (p=0.017) (Table 4).

**Table 2.** Compassion fatigue short scale and caring behaviors scale-24 total and subscale mean scores (n=98)

| Scales and subscale mean scores | x ± SD | Min.-max. |
|---|---|---|
| **Compassion fatigue short scale total score** | 63.36±25.77 | 16-130 |
| Occupational burnout | 40.59±16.93 | 8-90 |
| Secondary trauma | 22.77±10.82 | 5-50 |
| **Caring behaviors scale-24 total score** | 5.19±0.55 | 3.63-6 |
| Assurance | 5.25±0.62 | 3.50-6 |
| Knowledge and skill | 5.38±0.54 | 3.40-6 |
| Respect | 5.10±0.63 | 3.67-6 |
| Commitment | 5.02±0.62 | 3.40-6 |

x: Mean, SD: Standart deviation, Min.-max.: Minimum-maximum

**Table 3.** The relationship between the nurses' compassion fatigue short scale and the caring behaviors scale-24 total and subscale mean scores (n=98)

| Scales | Compassion fatigue short scale | | Occupational burnout | | Secondary trauma | |
|---|---|---|---|---|---|---|
| | p | r | p | r | p | r |
| **Caring behaviors scale-24** | 0.005 | -0.280 | 0.001 | -0.319 | 0.097 | -0.169 |
| **Assurance** | 0.032 | -0.216 | 0.008 | -0.267 | 0.338 | -0.098 |
| **Knowledge and Skill** | 0.004 | -0.289 | 0.004 | -0.292 | 0.022 | -0.231 |
| **Respect** | 0.005 | -0.280 | 0.001 | -0.320 | 0.106 | -0.165 |
| **Commitment** | 0.011 | -0.255 | 0.004 | -0.286 | 0.115 | -0.160 |

r: Spearman correlation analysis

**Table 4.** Comparison of nurses' descriptive characteristics and compassion fatigue short scale and caring behaviors scale-24 scores (n=98)

| Characteristics<br>Gender | Compassion Fatigue Short Scale<br>[Q2(Q1-Q3)] or r | Test and p-value | Caring Behaviors Scale-24<br>[Q2(Q1-Q3)] or r | Test and p-value |
|---|---|---|---|---|
| Female | 60 (47-83) | U=936.00 | 5.29 (5-5.79) | U=754.00 |
| Male | 60 (31-81) | p=0.305 | 5.04 (4.64-5.37) | p=0.017 |
| **Educational status** | | | | |
| Associate degree | 66 (37-100) | KW=0.869 | 5.02 (4.75-5.60) | KW=0.599 |
| Bachelor's degree | 60 (44-83) | p=0.648 | 5.18 (4.84-5.73) | p=0.741 |
| Postgraduate | 53 (46-73) | | 5.20 (5.01-5.80) | |
| **Unit of assignment** | | | | |
| Surgical | 59 (46-84) | KW=2.777 | 5.12 (4.90-5.59) | KW=5.360 |
| Coronary | 59 (41-88) | p=0.734 | 5.22 (5.01-5.40) | |
| Medical | 62 (45-85) | | 4.91 (4.48-5.68) | p=0.374 |
| Reanimation | 54 (36-71) | | 5.37 (4.98-5.87) | |
| Emergency | 65 (49-82) | | 5.45 (4.62-5.76) | |
| Cardiovascular surgery | 71 (44-92) | | 5.27 (5.01-5.67) | |
| Age | r=-0.034 | p=0.743 | r=-0.004 | p=0.971 |
| Working year | r=-0.056 | p=0.582 | r=0.127 | p=0.214 |
| Weekly working hours | r=0.163 | p=0.110 | r=-0.038 | p=0.708 |
| Number of patients Provided care/day | r=0.152 | p=0.136 | r=-0.194 | p=0.055 |

U: Mann-Whitney U test, KW= Kruskal-Wallis test, r= Spearman correlation analysis, Q2= Median, Q1=25. Percent, Q3: 75. Percent

## Discussion

The study which sought to determine the impact of compassion fatigue on care behaviors in ICU nurses giving care to critically ill patients found that the nurses had a moderate level of compassion fatigue and a higher perception of care quality. Also previous studies reported that ICU nurses had a moderate and high level of compassion fatigue, which was in agreement with the results of the current study (9,10,12-15,26). However, studies examining the impact of compassion fatigue on care behaviors in ICUs are not adequate in number (12,27). As the nurses' age, years of employment, working hours and number of patients they gave care to increased, their compassion fatigue increased (10,13). In addition, the nurses with a lower level of education experienced compassion fatigue at a higher level (11). Although the nurses worked in a busy unit like ICU, they had a lower level of compassion fatigue in the present study. It was probably because they had lower mean age, had relatively fewer years of employment and most of them had undergraduate education. Compassion fatigue might have also been caused by giving care to more patients compared to the recommended number of patients (two patients should receive care in tertiary ICU) (28).

The current study found that the ICU nurses had a higher perception of care quality. A study conducted by Efil et al. (29) with ICU nurses in Turkey similarly found that nurses had a higher perception of care quality (5.4±0.6). Based on these results, it is possible to state that the ICU nurses fulfilled their professional roles and responsibilities related to nursing care at an optimal level.

Although the current study found that the ICU nurses had a higher perception of care quality, as compassion fatigue increased, care perception quality of the nurses decreased. A study conducted by Dığın et al. (30) with surgical nurses obtained similar results. In contradistinction to the present study, a study conducted by Alharbi et al. (12) examined the impact of compassion fatigue on indicators sensitive to nursing care (pressure injuries, medication errors and patient falling), however, they found no significant correlation. It was probably because the number of indicators sensitive to nursing care was inadequate (12,30).

Compassion fatigue leads to a variety of physical and psychological problems in individuals and consequently causes nurses to face problems such as making a mistake, being unable to make the correct decision and being unable to give necessary care to patients due to indifference to patients and lower concentration (1,11). In addition, compassion fatigue has a negative impact on communication and serenity of healthcare professionals in the workplace environment (31). The present study similarly found a weakly significant correlation between the compassion fatigue scale occupational burnout subscale scores and the total care behavior and subscale scores of the nurses in a negative direction. It is possible to state that as occupational burnout in individuals increases, the state of perceiving care quality, using knowledge and skills in care applications and having assurance, commitment and respect may decrease, even if it is at a minumum level. A systematic compilation conducted by Kaçan and Örsal (32) reported that ICU nurses had a moderate-high level of burnout. A high level of burnout in a group will inevitably affect care behaviors (32). A study conducted by Hezer (33) reported a significant correlation between the total care behaviors scale score and burnout in a negative direction (33). In addition, some studies have reported that there is a significant correlation between burnout level and compassion fatigue in a positive direction (34,35). These studies demonstrate that burnout and compassion fatigue may cause a decrease in care quality perception of nurses. This may threaten patient safety in units like ICU where patients are dependent on nursing care, decrease the quality of care and increase possible complications. In this sense, it is significant to identify compassion fatigue and burnout in nurses and create relevant support mechanisms for patient safety and quality of care.

The present study found no statistically significant difference between the nurses' age, educational status, ICU worked, years of employment, weekly working hours, average number of patients they gave care to daily and total CF-SS and CBS-24 scores ($p>0.05$). However, the study found a statistically significant difference between the nurses' gender and mean CBS-24 scores ($p=0.017$) and determined that the male nurses had lower mean CBS-24 scores than the female nurses. Care behavior is an element which has socially been attributed to women for many years. One of the most important roles of nurses, caregiving has been identified with traditionalized female role (36). Although nursing profession had long been a woman's profession, the inclusion of men in the profession after a legal amendment conducted in 2007 began to resolve gender discrimination in nursing profession in our country (36). Even if nurses from both genders work with the same devotion in patient care, a study conducted by Saraç and Özyurda (37) expressed a negative opinion about male nurses, which was "being inadequate in caregiving and patient follow-up due to limiting nursing applications to receiving vital signs and treating" (37). A study conducted by Alharbi et al. (12) with nurses employed in ICU reported that male nurses experienced a higher level of stress and burnout than female nurses (12). The literature suggests that a higher level of stress and burnout may affect care behaviors in a negative direction (33). These factors might have been related with lower mean CBS-24 scores in the male nurses.

### Study Limitations

The study was conducted in only one hospital and not all adult intensive care nurses could be reached. This is the limitation of the study. Multicenter and multinational studies are needed to generalize the results.

## Conclusion

On the basis of the study results, the intensive care nurses experienced a moderate level of compassion fatigue and a higher perception of care behaviors. Compassion fatigue experienced by the intensive care nurses had a negative impact on their care behaviors. In order to decrease compassion fatigue perceived by intensive care nurses who have a higher risk of experiencing

compassion fatigue and consequently increase the quality of care behaviors, increase motivation and job satisfaction and decrease possible burnout in nurses, it is necessary to develop coping mechanisms, increase work motivations and make arrangements in the healthcare system.

**Ethics**

**Ethics Committee Approval:** In order to conduct the research, written permission was obtained from Mersin University Hospital and ethics committee approval was obtained from Tarsus University Clinical Research Ethics Committee (approval no: 2022/27, date: 04.04.2022).

**Informed Consent:** Prior to the study, the researchers obtained informed consent form and written permission from the participants to take part in the study.

**Footnotes**

**Authorship Contributions**

Concept: S.G.Y., G.B., G.A.U., Design: S.G.Y., G.B., G.A.U., Data Collection or Processing: H.D., H.F.K., Analysis or Interpretation: S.G.Y., G.B., G.A.U., Literature Search: S.G.Y., G.B., G.A.U., Writing: S.G.Y., G.B., G.A.U.

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## References


1. Polat FN, Erdem R. The relationship between the level of compassion fatigue and quality of professional life: The case of medical professionals. Journal of Süleyman Demirel University Institute of Social Sciences. 2017;1:291-312.
2. Peters E. Compassion fatigue in nursing: A concept analysis. Nurs Forum. 2018;53:466-80.
3. Pehlivan T, Güner P. Merhamet yorgunluğu: Bilinenler, bilinmeyenler. J Psychiatric Nurs. 2018;9:129-34.
4. Joinson C. Coping with compassion fatigue. Nursing. 1992;22:116-20.
5. Öndaş Aybar D, Parlar Kılıç S. The effect on their stress levels of ethical problems faced by ıntensive care nurses working in a University Hospital. Düzce Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi. 2020;10:29-35.
6. Özcan Arslan F, Ören B. Burnout syndrome ın nurses working ın ıntensive care units: The Case Of Adana Province. Aydın Sağlık Dergisi. 2020;6:298-313.
7. T.C. Official Gazette. Regulation amending the regulation on nursing (Issue: 27910). Accessed 12.10.2022. https://www. resmigazete.gov.tr/eskiler/2011/04/20110419-5.htm.
8. Kırçı T, Kızıler E. The ınvisible face of the iceberg: Compassion fatigue in nurses. Türkiye Sağlık Bilimleri ve Araştırmaları Dergisi. 2021;4:11-21.
9. Al Barmawi MA, Subih M, Salameh O, Sayyah Yousef Sayyah N, Shoqirat N, Abdel-Azeez Eid Abu Jebbeh R. Coping strategies as moderating factors to compassion fatigue among critical care nurses. Brain Behav. 2019;9:e01264.
10. Alharbi J, Jackson D, Usher K. Compassion fatigue in critical care nurses. An integrative review of the literature. Saudi Med J. 2019;40:1087-97.
11. Karaca Ş. The effect of mercury fatıgue on patient safety in nurses workıng in ıntensıve care unit. (Master of Thesis, İstinye University Institute of Health Sciences). 2019.
12. Alharbi J, Jackson D, Usher K. Personal characteristics, coping strategies, and resilience impact on compassion fatigue in critical care nurses: A cross-sectional study. Nurs Health Sci. 2020;22:20-7.
13. Jakimowicz S, Perry L, Lewis J. Compassion satisfaction and fatigue: A cross-sectional survey of Australian intensive care nurses. Aust Crit Care. 2018;31:396-405.
14. Khan A, Khan M, Malik N. Compassıon fatigue amongst health care providers. Pak Armed Forces Med J. 2015;65:286-9.
15. Kim S. Compassion fatigue in liver and kidney transplant nurse coordinators: A descriptive research study. Prog Transplant. 2013;23:329-35.
16. Dikmen Y, Aydın Y, Basaran H, Filiz NY, Denat Y, Arslan GG. Prevalence of compassion fatigue in emergency and intensive care nurses in Turkey. Oxidation Communications. 2016;39:3190-8.
17. Kol E, Boz İA. Literature review on caring behaviors in ıntensive care nursing. J Intensive Care Nurs. 2020;24:32-8.
18. Erenoğlu R, Can R, Tambağ H. Nursing care behaviors and factors related to care behaviors; Maternity Hospital. Sağlık ve Toplum. 2019;29:79-88.
19. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening there porting of observational studies in epidemiology (strobe) statement: Guidelines for reporting observational studies. Int J Surg. 2014;12:1495-9.
20. Adams RE, Boscarino JA, Figley CR. Compassion fatigue and psychological distress among social workers: a validation study. Am J Orthopsychiatry. 2006;76:103-8.
21. Dinç S, Ekinci M. Turkish adaptation, validity and reliability of compassion fatigue short scale. Current Approaches in Psychiatry. 2019;11(Suppl 1):192-202.
22. Wolf ZR, Giardino ER, Osborne PA, Ambrose MS. Dimensions of nurse caring. Image J Nurs Sch. 1994;26:107-11.
23. Wu Y, Larrabee JH, Putman HP. Caring Behaviors Inventory: a reduction of the 42-item instrument. Nurs Res. 2006;55:18-25.
24. Kurşun Ş, Kanan N. Validity and reliability study of the Turkish version of Caring Behaviors Inventory-24. Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi. 2012;15:229-35.
25. Evans JD. Straight forward statistics for the behavioral sciences. Brooks/Cole Publishing, CA, Pacific Grove; 1996.
26. Katran HB, Gür S, Arpag N, Çavuşlu M. Compassion fatigue in ıntensive care nurses in the covıd-19 pandemic. J Intensive Care Nurs. 2021;25:42-50.
27. Anglade D. Patient safety culture, compassion fatigue, compassion satisfaction: Impact on nurse-sensitive patient outcomes (Doctoral dissertation, University of Miami). 2014.

28. Ministry of Health of Turkey. Adult Intensive Care Equipment, Service, Minimum and Personnel Standards. Accesed 12.12.2022. https://www.resmigazete.gov.tr/eskiler/2020/08/20200821-7-1.pdf.
29. Efil S, Turen S, Yıldız Ayvaz M, Bulbul E, Yenı T. Burnout levels and care behaviours in intensive care nurses: A cross-sectional, multicentre study. Intensive Crit Care Nursç 2022;71:103246.
30. Dığın F, Kızılcık Özkan Z, Şahin A. Determining the relationship between compassion fatigue of surgical nurses and care behaviors. Online Turkish Journal of Health Sciences. 2022;7:272-7.
31. Ertümer AG, Elif K. The effect of compassion fatigue level of health professionals on patient safety. Hacettepe Journal of Health Administration. 2019;25:139-54.
32. Kaçan CY, Örsal Ö. The factors effecting burnout at ıntensive care unit Nurses: A systematic review. J Intensive Care Nurs. 2018;22:25-36.
33. Hezer M. Hemşirelerin iş doyumu ve tükenmişlik düzeyleri ile hemşirelik bakım kalitesinin değerlendirilmesi. (Master of Arts Thesis, Biruni University Institute of Health Sciences).2019.
34. Topçu N. Hemşirelerde merhamet yorgunluğunun tükenmişliğe etkisinde empatinin araci rolü. Master Thesis. Sakarya University Business Administration Institute. 2020.
35. Slocum-Gori S, Hemsworth D, Chan WW, Carson A, Kazanjian A. Understanding compassion satisfaction, compassion fatigue and burnout: A survey of the hospice palliative care workforce. Palliat Med. 2013;27:172-8.
36. Başaran F, Köşgeroğlu N. Reflections of gender inequality on nursing profession. Gümüşhane University Journal of Health Sciences. 2020;9:293-9.
37. Saraç E, Özyurda F. Health employees' and health managers' opinions regarding male nurses and related factors. Journal of Anatolia Nursing and Health Sciences. 2020;23: 369-77.

Original Article

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# The Impact of Preoperative Negative Overjet Amount on Postoperative Patient Satisfaction and Quality of Life in Orthognathic Surgery Patients with Skeletal Class III Malocclusion

## İskeletsel Sınıf III Maloklüzyona Sahip Ortognatik Cerrahi Hastalarında Ameliyat Öncesi Negatif Overjet Miktarının Ameliyat Sonrası Hasta Memnuniyeti ve Yaşam Kalitesi Üzerindeki Etkisi

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## ABSTRACT

**Objective:** Orthognathic surgery is a procedure performed to correct dentofacial deformities. Patient satisfaction depends on the success of the surgery, the patient's expectations, and psychological factors. The aim of the study was to evaluate the aesthetic and functional satisfaction of patients with class III skeletal malocclusion who underwent orthognathic surgery by using the orthognathic quality of life questionnaire (OQLQ) and the effect of the change in preoperative negative overjet amount on quality of life.

**Methods:** Patients with class III dentofacial deformities who underwent orthognathic surgery at Bezmialem Vakıf University Faculty of Dentistry in 2022-2023 were included in the study. The patients were requested to complete the OQLQ online. The negative overjet amount of the patients was measured on three-dimensional models in the virtual surgical planning software (NemoFab). The intersection length of the most anterior points of the incisal edges of the maxillary and mandibular incisal teeth was measured. The correlation between the survey scores and the measurements was evaluated statistically.

## ÖZ

**Amaç:** Ortognatik cerrahi, dentofasiyal deformitelerin düzeltilmesi amacıyla yapılan bir cerrahi işlemdir ve hasta memnuniyeti ameliyatın başarısına, hastanın beklentilerine ve psikolojik faktörlere bağlıdır. Çalışmanın amacı, ortognatik cerrahi operasyonu geçirmiş sınıf III iskeletsel maloklüzyona sahip hastaların estetik ve fonksiyonel memnuniyetlerinin ortognatik yaşam kalitesi anketi (OQLQ) ile değerlendirilerek preoperatif negatif overjet miktarındaki değişimin yaşam kalitesi üzerine etkisinin gösterilmesidir.

**Yöntemler:** Çalışmaya Bezmialem Vakıf Üniversitesi Diş Hekimliği Fakültesi'nde 2022-2023 yıllarında ortognatik cerrahi operasyonu geçirmiş ve ameliyat sonrası en az 6 ay geçmiş sınıf III dentofasiyal deformiteye sahip hastalar dahil edildi. Bu hastalardan online olarak OQLQ anketini doldurmaları istendi. Hastaların negatif overjet miktarı ölçümleri sanal cerrahi planlama yazılımında (NemoFab) üç boyutlu modeller üzerinde yapıldı. Maksiller ve mandibular insizal dişlerin kesici kenarlarının en anterior noktalarının kesişim uzunluğu ölçüldü. Anket sorularına verilen skorlar ile ölçümler arasındaki korelasyon istatistiki olarak değerlendirildi.

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## ABSTRACT

**Results:** Sixty three patients (39 female, 24 male) were included in the study. The mean age was 25.7 years, and the mean negative overjet was 6.47 mm (minimum 1.15 mm, maximum 16 mm). Only in the 14th survey question "I am ashamed of the appearance of my face", was a statistically significant correlation observed (p=-0.259). No statistically significant correlation was found between the severity of the patient's deformity and patient satisfaction, concern about the social aspects of the deformity, oral function, or awareness of facial deformity (p>0.05).

**Conclusion:** It was found that the amount of preoperative negative overjet was positively correlated with the feeling of embarrassment about the facial appearance after surgery. The results indicated that patients reported lower scores in oral function and facial aesthetics following the surgery, emphasizing the importance of orthognathic surgery for both functional improvement and aesthetic enhancement. Based on the findings, it can be concluded that the impact of orthognathic surgery on patients' quality of life increases in direct relation to the severity of malocclusion.


**Keywords:** Orthognathic surgery, quality of life, negative overjet, class III skeletal malocclusion


## ÖZ

**Bulgular:** Çalışmaya 63 (39 kadın, 24 erkek) hasta dahil edilmiştir. Ortalama yaş 25,7 yıl, ortalama negatif overjet miktarı 6,47 mm'dir (minimum 1,15 mm, maksimum 16 mm). Yalnızca 14. anket sorusu olan "yüzümün görünümünden utanırım" ifadesinde istatistiksel olarak anlamlı bir ilişki olduğu görülmüştür (p=-0,259). Hastanın mevcut deformite şiddeti ile hasta memnuniyeti, deformitenin sosyal yönüyle ilgili endişe, oral fonksiyon ve fasiyal deformite farkındalığı açısından istatistiksel olarak anlamlı bir ilişki gözlenmemiştir (p>0,05).

**Sonuç:** Çalışmadan elde edilen bilgilere göre preoperatif negatif overjet miktarının fazla olmasının, ameliyat sonrası yüz görünümünden utanma duygusu ile pozitif korelasyon gösterdiği bulunmuştur. Cerrahi sonrası hastaların oral fonksiyon ve fasiyal estetik alanlarda kabul edilebilir cevaplar vermiş olmaları ortognatik cerrahinin işlevsellik açısından ve estetik açıdan önemli bir tedavi olduğunu desteklemektedir. Çalışmanın sonuçlarına göre ortognatik cerrahi ameliyatların hastalar üzerine etkilerinin, maloklüzyonun şiddeti ile doğru orantılı olduğu söylenebilir.


**Anahtar Kelimeler:** Ortognatik cerrahi, yaşam kalitesi, negative overjet, sınıf III iskeletsel maloklüzyon

## Introduction

Orthognathic surgery is a surgical procedure frequently used to treat dentofacial deformities and related dental disorders, aiming to restore oral functions and achieve facial harmony, thereby effectively improving individuals' quality of life (1). Patients with dentofacial deformities who require orthognathic surgery typically seek treatment due to concerns about their appearance, psychosocial reasons, and functional abnormalities such as difficulties in eating, speaking, and breathing. Such deformities severely impact the patient's quality of life (2). Orthognathic surgery improves facial structure and appearance, increasing social acceptance and enhancing psychological well-being (3,4). Dissatisfaction with one's facial appearance can have a negative impact on a person's quality of life. Therefore, it is crucial to assess a patient's motivation and any unrealistic expectations they may have before undergoing surgery. This is essential for the success of the treatment. In the healthcare field, there is growing recognition of the importance of evaluating patient satisfaction and quality of life as key indicators of treatment success (4). Most research has focused on objective assessments, with only a few studies exploring patients' perspectives and subjective evaluations (3). It is important to use reliable and sensitive assessment tools to understand how dentofacial deformities and their treatments affect an individual's quality of life (5). The concept of "quality of life" was defined by the World Health Organization in 1993 as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns. It is a subjective concept that cannot be assessed by others (6). Various different surveys have been used to evaluate patient satisfaction after surgery (7). To determine the impact of dentofacial deformity on quality of life, Cunningham et al. (8) developed the "orthognathic quality of life questionnaire (OQLQ)" in 2000, which is frequently used today to assess quality of life and aesthetic expectations after orthognathic surgery (9). The questionnaire was validated again by Cunningham et al. (8,10) in 2002. The translation and validation of the questionnaire into Turkish were carried out by Turna et al. (11) in 2022. The OQLQ consists of 22 questions divided into 4 subgroups. These subgroups are as follows: concerns related to the social aspects of the deformity (questions 15-22), facial aesthetics (questions 1, 7, 10, 11, 14), oral function (questions 2-6), and awareness of the facial deformity (questions 8, 9, 12, 13). Patients are asked to rate these questions on a scale of 0-4 based on their personal thoughts according to the following explanations:

- 0 points: This statement does not apply to you or does not bother you at all.

- 1 point: It bothers you a little.

- 2 and 3 points: Marked by the patient as a situation between 1 and 4.

- 4 points: It bothers you a lot.

The OQLQ scoring is evaluated based on the total score to assess the patient's postoperative satisfaction and quality of life. A high score indicates a low quality of life, while a low score indicates a high quality of life. Adult skeletal class III malocclusion is one of the most severe and difficult maxillofacial deformities to correct, and the amount of negative overjet is an important reference indicating the severity of class III malocclusion. As the severity of the deformity increases, the patient's complaints and postoperative satisfaction may vary (12). This study aimed to evaluate the aesthetic and functional satisfaction of patients with skeletal class III malocclusion who underwent orthognathic

surgery using the OQLQ to demonstrate the effect of changes in the preoperative negative overjet amount on patient satisfaction.

## Methods

This study was approved by the Ethics Committee of Bezmialem Vakıf University (approval number: E-54022451-050.04-153865, date: 10.06.2024). This was a retrospective study which included patients aged 18-40 who underwent bimaxillary orthognathic surgery for class III dentofacial deformity at the Department of Oral and Maxillofacial Surgery, Bezmialem Vakıf University Faculty of Dentistry and had at least 6 months post-surgery. All patients underwent le fort I osteotomy and sagittal split ramus osteotomy using the same surgical technique and team. Patients who had single jaw surgery or underwent genioplasty in addition to bimaxillary orthognathic surgery were excluded from the study. Patients without virtual surgical planning records via NemoFab software were also excluded. Written informed consent was obtained from all patients before the study. The Turkish version of the 5-point Likert scale OQLQ was used in the study (11).

### Predictor Variable

The primary predictor variable was a negative overjet amount of the skeletal class III patients. Preoperative negative overjet amounts were measured on three-dimensional models of the upper and lower jaws prepared and recorded in the NemoFab software (Nemotec, Spain, v.20.10.0) for virtual surgical planning. Measurements were made from the buccal surface of the incisal edges of the maxillary central incisors to the lingual surface of the incisal edges of the mandibular central incisors and recorded individually for each patient.

### Main Outcome

The main outcome of the study was questionary scores of the patients. An online survey was prepared, and a link to the survey was sent to the patients, asking them to respond based on how orthognathic surgery affected their quality of life. The scores from the questionnaires were recorded individually for each patient. The scores for the postoperative questionnaire were then analyzed for correlation with the preoperative negative overjet measurements.

### Statistical Analysis

All statistical analyses were performed using SPSS software (IBM Corp, USA, version 26.0). Descriptive statistics, including mean, standard deviation, median, minimum, and maximum values, were calculated. The normality of the data distribution was evaluated using the Shapiro-Wilk test. The relationship between the OQLQ scores and the preoperative negative overjet measurements (mm) was analyzed using Pearson correlation if the data were normally distributed. Spearman's correlation test was used for data that was not normally distributed. A significance level of 0.05 was considered statistically significant.

## Results

Sixty three patients were included in this study and their demographic and clinical characteristics were analyzed in detail (Table 1). Of the participants 24 were male (38%) and 39 were female (62%), and the average age was 25.7 years. Among the patients included in the study, the youngest patient was 19 years old, and the oldest patient was 42 years old. While the average negative overjet amount was determined as 6.47 mm, the lowest negative overjet amount was recorded as 1.15 mm, and the highest negative overjet amount was recorded as 16 mm (Table 1). After the surgery, all patients were within the normal (1-3 mm) overjet range.

It was observed that there was a statistically significant correlation between negative overjet amount and the 14$^{th}$ survey question,

**Table 1.** Descriptive statistics

| | Mean | SD | | Mean | SD |
|---|---|---|---|---|---|
| Age (year) | 25.75 | 5.495 | Question 14 | 0.44 | 0.894 |
| Negative overjet amount (mm) | 6.4743 | 3.32386 | Question 15 | 0.30 | 0.754 |
| Question 1 | 0.46 | 0.930 | Question 16 | 0.21 | 0.544 |
| Question 2 | 0.59 | 0.978 | Question 17 | 0.37 | 0.848 |
| Question 3 | 0.49 | 0.965 | Question 18 | 0.37 | 0.789 |
| Question 4 | 0.41 | 0.796 | Question 19 | 0.37 | 0.903 |
| Question 5 | 0.24 | 0.665 | Question 20 | 0.49 | 1.061 |
| Question 6 | 0.76 | 1.073 | Question 21 | 0.40 | 0.890 |
| Question 7 | 0.35 | 0.765 | Question 22 | 0.52 | 1.120 |
| Question 8 | 0.63 | 0.972 | Social aspect | 3.02 | 5.425 |
| Question9 | 0.68 | 0.895 | Facial aesthetics | 2.90 | 4.306 |
| Question 10 | 0.79 | 1.207 | Oral function | 2.49 | 3.340 |
| Question 11 | 0.86 | 1.229 | Facial awareness | 3.73 | 3.647 |
| Question 12 | 1.16 | 1.273 | Total score | 12.14 | 14.127 |
| Question 13 | 1.25 | 1.391 | | | |

SD: Standard deviation

"I am ashamed of the appearance of my face" (Spearman's rho: -0.259, p=0.041) (Tables 2, 3). When the survey data were examined in detail, it was observed that there was no statistically significant correlation between the patient's current deformity severity and general patient satisfaction score, concern about the social aspect of the deformity, oral function, or facial deformity awareness (p>0.05). In the analysis of the total score for the facial awareness group, no significant correlation with the severity of negative overjet was detected.

## Discussion

Dentofacial deformities are deviations from the ideal facial proportions and occlusion. One of the most dramatic and serious malocclusions is class III malocclusions (12). It is observed that patients with class III malocclusion experience increased social acceptance and self-confidence, as well as a decrease in anxiety caused by facial appearance, after surgery to fulfill an ideal function and improve aesthetic appearance (13). Many surveys have been used to evaluate patients' quality of life and satisfaction

**Table 2.** Non-parametric correlations

| Spearman's rho | | Negative overjet amount | | | Negative overjet amount overjet |
|---|---|---|---|---|---|
| Question 1 | Correlation coefficient | -0.197 | Question16 | Correlation coefficient | 0.021 |
| | Sig. (2-tailed) | 0.122 | | Sig. (2-tailed) | 0.871 |
| | N | 63 | | N | 63 |
| Question 2 | Correlation coefficient | -0.061 | Question 17 | Correlation coefficient | -0.056 |
| | Sig. (2-tailed) | 0.636 | | Sig. (2-tailed) | 0.665 |
| | N | 63 | | N | 63 |
| Question 3 | Correlation coefficient | -0.140 | Question 18 | Correlation coefficient | 0.021 |
| | Sig. (2-tailed) | 0.275 | | Sig. (2-tailed) | 0.870 |
| | N | 63 | | N | 63 |
| Question 4 | Correlation coefficient | -0.235 | Question 19 | Correlation coefficient | -0.139 |
| | Sig. (2-tailed) | 0.063 | | Sig. (2-tailed) | 0.279 |
| | N | 63 | | N | 63 |
| Question 5 | Correlation coefficient | -0.014 | Question 20 | Correlation coefficient | -0.063 |
| | Sig. (2-tailed) | 0.912 | | Sig. (2-tailed) | 0.625 |
| | N | 63 | | N | 63 |
| Question 7 | Correlation coefficient | -0.192 | Question 21 | Correlation coefficient | -0.013 |
| | Sig. (2-tailed) | 0.132 | | Sig. (2-tailed) | 0.922 |
| | N | 63 | | N | 63 |
| Question 8 | Correlation coefficient | -0.059 | Question 22 | Correlation coefficient | 0.143 |
| | Sig. (2-tailed) | 0.645 | | Sig. (2-tailed) | 0.265 |
| | N | 63 | | N | 63 |
| Question 9 | Correlation coefficient | -0.117 | Social aspect | Correlation coefficient | 0.052 |
| | Sig. (2-tailed) | 0.361 | | Sig. (2-tailed) | 0.686 |
| | N | 63 | | N | 63 |
| Question 10 | Correlation coefficient | 0.024 | Facial aesthetics | Correlation coefficient | -0.103 |
| | Sig. (2-tailed) | 0.850 | | Sig. (2-tailed) | 0.423 |
| | N | 63 | | N | 63 |
| Question 14 | Correlation coefficient | -0.259* | Oral function | Correlation coefficient | -0.094 |
| | N | 63 | | Sig. (2-tailed) | 0.462 |
| | Sig. (2-tailed) | 0.041 | | N | 63 |
| Question 15 | Correlation coefficient | -0.003 | Total score | Correlation coefficient | -0.050 |
| | Sig. (2-tailed) | 0.983 | | Sig. (2-tailed) | 0.697 |
| | N | 63 | | N | 63 |

*: Correlation is significant at the 0.05 level (2-tailed).

**Table 3.** Parametric correlations

| | | Negative overjet amount |
|---|---|---|
| Question 6 | Pearson correlation | 0.007 |
| | Sig. (2-tailed) | 0.956 |
| | N | 63 |
| Question 11 | Pearson correlation | -0.098 |
| | Sig. (2-tailed) | 0.446 |
| | N | 63 |
| Question 12 | Pearson correlation | -0.032 |
| | Sig. (2-tailed) | 0.805 |
| | N | 63 |
| Question 13 | Pearson correlation | -0.104 |
| | Sig. (2-tailed) | 0.416 |
| | N | 63 |
| | Pearson correlation | -0.125 |
| | Sig. (2-tailed) | 0.328 |
| | N | 63 |

Sig: Significant

after orthognathic surgery. The "OQLQ" scale, developed by Cunningham et al. (8) in 2000 to meet the quality of life and aesthetic expectations after orthognathic surgery and validated in 2002 (10), is currently being used today. In a study conducted by Rezaei et al. (14) the preoperative and postoperative evaluations of class III patients were assessed, as in our study, using the OQLQ in four main categories: social aspects of deformity, facial aesthetics, oral function, and awareness of facial deformity. The results showed that orthognathic surgery in class III patients improved their quality of life, satisfaction in various aspects, self-confidence, and oral functions, while no difference was found between the groups in terms of the social aspect, which evaluated others' opinions about the patient. Kilinc and Ertaş (15) also did not find a significant difference in this aspect in their study (15).

In this study, the correlation between the scores of the Turkish-translated and modified OQLQ, which we used to measure overall postoperative patient satisfaction in patients with class III malocclusion, and the patient's preoperative negative overjet amounts (mm) was evaluated to examine the effect of preoperative negative overjet amounts on patient satisfaction and quality of life. Malocclusions can have significant impacts on facial aesthetics and function, which may negatively affect the overall quality of life of patients. However, orthognathic surgery can correct these effects and provide significant improvements in patients' aesthetic appearance, social acceptance, functional abilities, and psychological well-being. In this study, no complications were observed during the operation in any of the patients, and the overjet amount in the final occlusion was measured to be on average between 1-3 mm. The OQLQ used in this study, along with other similar questionnaires, has been identified as an effective tool for measuring postoperative satisfaction and quality of life (16). The results showed no significant correlation between preoperative negative overjet amounts and OQLQ scores. This suggests that patients' overall quality of life improves after orthognathic surgery, regardless of the severity of their deformities. The only statistically significant correlation was found between the amount of preoperative negative overjet and the scores given to the statement, "I am ashamed of my facial appearance". This finding suggests that an increase in the severity of the deformity may negatively impact a patient's perception of their facial aesthetics.

Many studies have shown that the quality of life of patients improves in terms of oral function and facial aesthetics after orthognathic surgery. This increase indicates that orthognathic surgery has a positive effect on chewing and facial appearance. The current findings generally show that the OQLQ of patients with class III malocclusion increases after orthognathic surgery. Posnick and Wallace (18) reported that orthognathic surgery was associated with a high level of patient satisfaction. Pahkala and Kellokoski (19) also reported that orthognathic surgery reduced the symptoms of temporomandibular disorders and pain, improved facial aesthetics, and enhanced chewing function. Additionally, most patients were satisfied with the treatment outcome. Esperao et al. (20) demonstrated that orthognathic surgery positively impacted quality of life. Rezaei et al. (14) evaluated the impact of orthodontic intervention on mental health and body image and showed that orthodontic treatment significantly improved a person's mental health and multidimensional attitudes towards body image.

Joachim et al. (21) largely associated satisfaction after orthognathic surgery with improvements in facial aesthetics, while they linked most dissatisfaction after orthognathic surgery to the appearance of the nose, mouth opening, and temporomandibular joint complaints. However, in their study involving 55 patients with class III malocclusion, they reported no significant correlation between the measurements of overjet and overbite and the degrees of aesthetic, social, and functional satisfaction. They stated that they analyzed the connection between preoperative overjet and overbite measures and the postoperative patient responses, however, they did not provide information regarding the preoperative negative overjet amounts, nor did they mention how the measurements were conducted.

In the study conducted by Rezaei et al. (14), the preoperative and postoperative evaluations of class III patients were assessed, as in our study, using the OQLQ in four main categories: social aspects, facial aesthetics, oral function, and facial awareness (14). The results showed that orthognathic surgery in skeletal class III patients improved their quality of life, satisfaction in various aspects, self-confidence, and oral functions, while no difference was found between the groups in terms of the social aspect, which evaluates others' opinions about the patient. In that study, it was noted that the lowest average score in facial aesthetics, which indicated patients' shyness and satisfaction with their facial appearance, was recorded preoperatively, while the highest average score was recorded postoperatively. Kilinc and Ertaş (15) also did not find a significant difference in this aspect in their study.

### Study Limitation

One of the limitations of this study was the fact that the questionnaire was completed online, which might reduce comprehensibility compared to face-to-face completion. The study aimed to evaluate how the orthognathic surgery affected the patients' quality of life from different perspectives in relation to the amount of preoperative negative overjet, with the goal of determining whether the severity of the deformity had an impact on satisfaction after orthognathic surgery. Since this is a retrospective study, preoperative scores are not available. Therefore, preoperative and postoperative score changes could not be compared.

## Conclusion

The results of the study show that the quality of life of patients with class III malocclusion can be improved with orthognathic surgery and that orthognathic surgery has a positive effect on patient satisfaction. It was observed that the severity of the patient's preoperative deformity did not have a direct effect on postoperative patient satisfaction, concerns about the social aspects of the deformity, awareness of facial deformity, and oral function. However, the scores given to the facial appearance embarrassment question in the facial aesthetics group increased with the increasing amount of negative overjet. Future research that supports these findings and further explores the differences between preoperative and postoperative scores can significantly enhance clinical practices and treatment methods in this field.

### Ethics

**Ethics Committee Approval:** This study was approved by the Ethics Committee of Bezmialem Vakıf University (approval number: E-54022451-050.04-153865, date: 10.06.2024).

**Informed Consent:** Written informed consent was obtained from all patients before the study.

### Footnotes

### Authorship Contributions

Surgical and Medical Practices: E.F.A., T.P., D.D., Concept: E.F.A., T.P., D.D., Design: E.F.A., T.P., D.D., Data Collection or Processing: G.K., A.Ç., Analysis or Interpretation: E.F.A., G.K., A.Ç., Writing: E.F.A., G.K., D.D., A.Ç.

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

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## References

1. Reyneke JP. Essentials of orthognathic surgery. Quintessence Chicago; 2003.
2. Baker NJ, David S, Barnard DW, Birnie DJ, Robinson SN. Occlusal outcome in patients undergoing orthognathic surgery with internal fixation. Br J Oral Maxillofac Surg. 1999;37:90-3.
3. Lazaridou-Terzoudi T, Kiyak HA, Moore R, Athanasiou AE, Melsen B. Long-term assessment of psychologic outcomes of orthognathic surgery. J Oral Maxillofac Surg. 2003;61:545-52.
4. Alves e Silva AC, Carvalho RA, Santos Tde S, Rocha NS, Gomes AC, de Oliveira e Silva ED. Evaluation of life quality of patients submitted to orthognathic surgery. Dental Press J Orthod. 2013;18:107-14.
5. Ağırnaslıgil MÖ, Amuk NG. Pre and post operative evaluation of self-esteem, sensitivity to criticism and social appearance anxiety of orthognathic surgery patients with skeletal Class III malocclusion. Selçuk Dent J. 2017;5:50-8.
6. Zamboni R, de Moura FRR, Brew MC, Rivaldo EG, Braz MA, Grossmann E, et al. Impacts of Orthognathic Surgery on Patient Satisfaction, Overall Quality of Life, and Oral Health-Related Quality of Life: A Systematic Literature Review. Int J Dent. 2019;2019:2864216.
7. Alanko OM, Svedström-Oristo AL, Tuomisto MT. Patients' perceptions of orthognathic treatment, well-being, and psychological or psychiatric status: a systematic review. Acta Odontol Scand. 2010;68:249-60.
8. Cunningham SJ, Garratt AM, Hunt NP. Development of a condition-specific quality of life measure for patients with dentofacial deformity: I. Reliability of the instrument. Community Dent Oral Epidemiol. 2000;28:195-201.
9. Ağırnaslıgil MÖ, Amuk NG. Patient Psychology and Satisfaction about Orthognathic Surgery Treatment. Journal of Health Sciences. 2018;27:80-6.
10. Cunningham SJ, Garratt AM, Hunt NP. Development of a condition-specific quality of life measure for patients with dentofacial deformity: II. Validity and responsiveness testing. Community Dent Oral Epidemiol. 2002;30:81-90.
11. Turna D, Benlidayı ME, Güney AÜ, Sertdemir Y. Validity and reliability of the Turkish version of the orthognathic quality of life questionnaire in patients with dentofacial deformity. Med Oral Patol Oral Cir Bucal. 2022;27:351-6.
12. Jeyaraj P, Juneja P. A Case of Extreme Skeletal Class III Malocclusion Beyond the Envelope of Discrepancy, Managed Effectively by a Modified Ortho-Surgical Protocol. J Maxillofac Oral Surg. 2021;20:201-18.
13. Paul NR, Baker SR, Gibson BJ. Decision Making from the Experience of Orthognathic Surgery Patients: A Grounded Theory Approach. JDR Clin Trans Res. 2022;7:256-66.
14. Rezaei F, Masalehi H, Golshah A, Imani MM. Oral health related quality of life of patients with class III skeletal malocclusion before and after orthognathic surgery. BMC Oral Health. 2019;19:289.
15. Kilinc A, Ertas U. An Assessment of the Quality of Life of Patients With Class III Deformities Treated With Orthognathic Surgery. J Oral Maxillofac Surg. 2015;73:1394.
16. Lin CH, Chin WC, Huang YS, Chen YR, Tan PWW, Chen JYJ, et al. S Short-term and long-term psychological impact and quality of life of patients undergoing orthognathic surgery. Biomed J. 2022;45:549-56.

17. Nicodemo D, Pereira MD, Ferreira LM. Effect of orthognathic surgery for class III correction on quality of life as measured by SF-36. Int J Oral Maxillofac Surg. 2008;37:131-4.
18. Posnick JC, Wallace J. Complex orthognathic surgery: assessment of patient satisfaction. J Oral Maxillofac Surg. 2008;66:934-42.
19. Pahkala RH, Kellokoski JK. Surgical-orthodontic treatment and patients' functional and psychosocial well-being. Am J Orthod Dentofacial Orthop. 2007;132:158-64.
20. Esperão PT, de Oliveira BH, de Oliveira Almeida MA, Kiyak HA, Miguel JA. Oral health-related quality of life in orthognathic surgery patients. Am J Orthod Dentofacial Orthop. 2010;137:790-5.
21. Joachim MV, Richter DE, Mohana A, Labeeb M, Abdelraziq M, Abu El-Naaj I. Quality of Life After Class III Repair Orthognathic Surgery: Five-Year Retrospective Study. J Craniofac Surg. 2021;32:2588-91.

Original Article

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# Evaluation of Maxillary Sinus Pathology, Concha Bullosa and Ostium Obstruction in Cleft Lip and Palate Using Cone-beam Computed Tomography

## Dudak ve Damak Yarığında Maksiller Sinüs Patolojisi, Konka Bülloza ve Ostium Tıkanıklığının Konik Işınlı Bilgisayarlı Tomografi Kullanılarak Değerlendirilmesi

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## ABSTRACT

**Objective:** Cleft lip and palate (CLP) is one of the most common congenital anomalies in the craniofacial region. Many malformations involving the midface may occur in patients with CLP. This study aimed to evaluate the effect of a cleft on maxillary sinus pathology (MSP), concha bullosa and ostium obstruction using cone beam computed tomography (CBCT).

**Methods:** A total of 90 patients out of which 30 were categorized as unilateral CLP (UCLP), 30 were categorized as bilateral CLP and 30 were categorized as control, were included in this retrospective study. The effects of cleft presence to MSP, concha bullosa and ostium obstruction were determined using CBCT images.

**Results:** A total of 180 right and left sides of the study population were divided into two groups as 90 cleft and 90 normal sides. There was no statistically significant relationship between the presence of cleft and the parameters examined in UCLP patients. For all patients, in the presence of a cleft, the incidences of MSP (83.3%, p<0.001) and ostium obstruction (17.8%, p=0.011) were statistically significant. However, the presence of a cleft did not have a statistically significant effect on the concha bullosa. The presence of a cleft increased MSP 4.2 times and ostium obstruction 3.7 times.

## ÖZ

**Amaç:** Dudak ve damak yarığı (DDY), kraniyofasiyal bölgede en sık görülen konjenital anomalilerden biridir. DDY'li hastalarda orta yüzü ilgilendiren birçok malformasyon ortaya çıkabilir. Bu çalışmada, yarıkların maksiller sinüs patolojisi (MSP), konka bülloza ve ostium tıkanıklığı üzerine etkisinin konik ışınlı bilgisayarlı tomografi (KIBT) kullanılarak değerlendirilmesi amaçlandı.

**Yöntemler:** Bu retrospektif çalışmaya 30'u unilateral DDY (UDDY), 30'u bilateral DDY ve 30'u kontrol olmak üzere toplam 90 hasta dahil edildi. Yarık varlığının MSP, konka bülloza ve ostium tıkanıklığına etkisi KIBT görüntüleri kullanılarak belirlendi.

**Bulgular:** Çalışma popülasyonunun toplam 180 sağ ve sol tarafı 90 yarık ve 90 normal taraf olmak üzere iki gruba ayrıldı. UDDY hastalarında yarık varlığı ile incelenen parametreler arasında istatistiksel olarak anlamlı bir ilişki bulunamadı. Tüm hastalarda yarık varlığında MSP (%83,3, p<0,001) ve ostium tıkanıklığı (%17,8, p=0,011) görülme sıklığı istatistiksel olarak anlamlıydı. Ancak yarık varlığının konka bülloza üzerinde istatistiksel olarak anlamlı bir etkisi olmadı. Yarık varlığı MSP'yi 4,2 kat, ostium tıkanıklığını ise 3,7 kat artırdı.

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**ABSTRACT**

**Conclusion:** While the presence of a cleft increased the risk of MSP and ostium obstruction, it was not associated with the presence of a concha bullosa.

**Keywords:** Cleft lip and palate, concha bullosa, cone beam computed tomography, maxillary sinus, ostium

**ÖZ**

**Sonuç:** Yarık varlığı MSP ve ostium tıkanıklığı riskini artırırken konka bülloza varlığı ile ilişkili değildi.

**Anahtar Kelimeler:** Dudak ve damak yarığı, konka bülloza, konik ışınlı bilgisayarlı tomografi, maksiller sinüs, ostium

## Introduction

Cleft lip and palate (CLP), one of the most common congenital anomalies in the maxillofacial area (1,2) is caused by the fusion disorder of the primary palate at the beginning of the fetal period (3). Patients with CLP experience many problems related to hearing, speech, nutrition, dentition, upper respiratory tract and facial morphology. Since the maxillary sinus is one of the main structures of the mid-face, it is an expected result that the maxillary sinuses are morphologically affected (3,4). Also, unilateral CLP (UCLP) can affect the external facial soft tissues, dental arches, maxilla, and morphology of the nasal airways (5-7).

The etiology of sinusitis in patients with CLP is not entirely understood. Factors such as external nasal deformity, rhinosinusitis, nasal concha variations and septum deviation are common in these patients (8,9). These factors can cause airway resistance, mouth breathing and consequently maxillary sinusitis (10). Patients with UCLP have a characteristic nasal deformity characterized by structural asymmetry and bending of the septum. It is important for practitioners to understand the anatomy of the maxillary sinuses, especially in patients with UCLP who may exist the above-mentioned disorders.

There are previous studies in the literature investigating the pathologies and variations related to the maxillary sinus and nasal cavity region in patients with CLP (8,9,11-15), but additional information is needed regarding these regions in patients with CLP. The objective of this study is to investigate the relationship between the presence of a cleft, maxillary sinus pathology (MSP), concha bullosa, and, unlike previous studies, ostium obstruction using cone beam computed tomography (CBCT) images.

## Methods

### Study Population

This study was approved with the number: 145, date: 14.06.2024 by the Çukurova University's Non-Invasive Clinical Research Ethics Committee, and was prepared in accordance with the Declaration of Helsinki, revised in 2013. CBCT images of UCLP, bilateral CLP (BCLP) and control patients were included in this retrospective, observational and case-control study. Firstly, since the number of BCLP patients was minimal, 15 male and 15 female BCLP patients were randomly selected from the patient archive. UCLP and control groups were then sorted by gender and matched similarly in terms of age (±1). If a patient had more than one match of the same gender and age, a random selection was made among them. Randomization was performed using the random module in the Python programming language. Random selection was based on achieving unbiased and balanced representation of gender and age across the BCLP, UCLP, and control groups, minimizing selection bias. The CBCT scans of the patients with CLP were routinely obtained for postoperative evaluation of the repaired clefts at least nine months after the last operation. CBCT images of the control group were available in the archieve of dentomaxillofacial radiology department and they were performed for different dental indications. As low as diagnostically acceptable being indication-oriented and patient-specific (ALADAIP) principle and the current European SEDENTEX CT guidelines were considered to perform the CBCTs. All patients or their parents applying to the related department filled out an informed consent form as a standard procedure because it could be used in scientific studies. The exclusion criteria were following: Inflammatory maxillary sinus diseases excluding mucositis and sinusitis, craniofacial syndrome, craniofacial patologies, trauma or skeletal/dental surgery history and bone dysplasias. The desired results from the study were to determine the distribution and effect of cleft presence related to MSP, concha bullosa and ostium obstruction.

### Imaging Procedure

Radiological assessments were analyzed by two maxillofacial radiologists (HDY and BTÜ). All CBCT images were acquired by a Planmeca Promax® 3D Mid (Helsinki, Finland) device in standard resolution mode (90 Kv, 10 mA, 27 s). DICOM format data were transferred to Planmeca Romexis 3.8.1.R software (Helsinki, Finland) and all images were evaluated in coronal, axial and sagittal sections. Any mucosal thickening (MT) more than two mm in the maxillary sinus was considered as "pathological". MSP, concha bullosa, and ostium obstruction were recorded as "present/absent" (Figure 1). All of the radiological assessments were evaluated independently by two observers at two-week intervals. One concha bullosa and one ostium obstruction evaluation differed among the observers, and as a result, a consensus was reached after discussion.

### Statistical Analysis

For this study, based on an effect size of 0.3 (Cohen's w), a significance level of 0.05, and a power of 0.95, the required sample size was determined to be 144. Considering a potential 25% data loss, the final sample size was increased to 180. This calculation was performed using the G*Power 3.1 software. The examined parameters were shown in tables as frequency and percentage. Chi-square test was performed to determine

relationships between defined categorical variables, and Odds ratios were calculated to determine the effect of presence of cleft on different variables. Whether there was a difference between the cleft and non-cleft sides of UCLP patients in terms of the parameters examined was evaluated with the McNemar test. IBM SPSS 20.0 software (Armonk, NY) was used for statistical analysis *(*p<0.05).

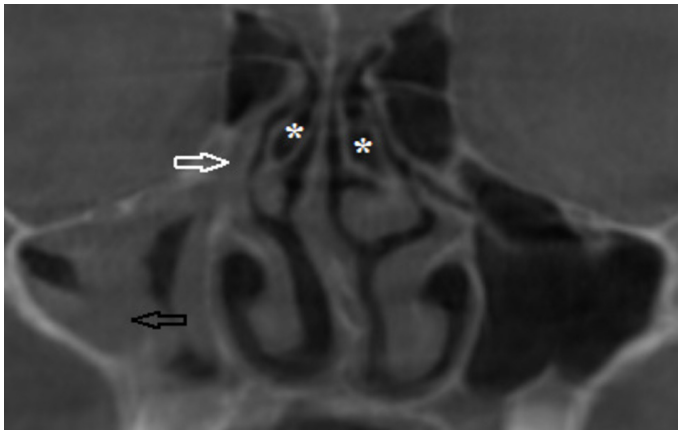

**Figure 1.** Parameters examined on cone beam computed tomography image

*Black arrow: Maxillary sinus pathology, *: Concha bullosa, White arrow: Ostium obstruction*

## Results

A total of 180 sides of 90 patients (45 female, 45 male) including 30 UCLP patients [mean age: 12.9±1.8; minimum (min.): 8, maximum (max.): 15], 30 BCLP patients (mean age: 12.8±1.6; min.: 8, max.: 15) and 30 controls (mean age: 12.8±1.8; min.: 8, max.: 15) were examined. The groups were categorized as; presence of cleft (30 cleft sides of 30 UCLP patients and 60 cleft sides of 30 BCLP patients) and absence of cleft (30 normal sides of 30 UCLP patients and 60 normal sides of 30 control patients). For all patients, in the presence of a cleft, the prevalence of the MSP (83.3%) and ostium obstruction (17.8%) were statistically significantly higher compared to the absence of a cleft (54.4% and 5.6%, respectively). The presence of a cleft increased MSP 4.2 times and ostium obstruction 3.7 times. There was no statistically significant relationship between the presence of a cleft and the concha bullosa (Table 1).

There was no significant difference in the parameters examined in the cleft and non-cleft sides of UCLP patients (Table 2).

## Discussion

Computed tomography (CT) is considered the gold standard for imaging paranasal sinuses (16,17). However, CBCT has a lower radiation dose, higher resolution, and shorter scan time compared to CT (18-20). It is also a reliable and accurate tool in

**Table 1.** Distribution of the cleft according to the parameters examined in all patients

| | Presence of cleft (n=90) | Absence of cleft (n=90) | Total (n=180) | p-value | Odds ratio (CI) |
|---|---|---|---|---|---|
| MSP | 75 (83.3) | 49 (54.4) | 124 (68.9) | <0.001* | 4.2 (2.1-8.4) |
| CB | 63 (70) | 56 (62.2) | 119 (66.1) | 0.270 | 1.4 (0.8-2.6) |
| OO | 16 (17.8) | 5 (5.6) | 21 (11.7) | 0.011* | 3.7 (1.3-10.5) |

MSP: Maxillary sinus pathology, CI: Confidence interval, *p<0.05

**Table 2.** Distribution of parameters examined in cleft and non-cleft sides of UCLP patients

| | | MSP-cleft side | | | |
|---|---|---|---|---|---|
| | | Absence | Presence | Total | p-value |
| MSP | Absence | 3 (37.5) | 5 (62.5) | 8 (100) | 0.727 |
| Non-cleft side | Presence | 3 (13.6) | 19 (86.4) | 22 (100) | |
| | Total | 6 (20) | 24 (80) | 30 (100) | |
| | | CB-cleft side | | | |
| | | Absence | Presence | Total | p-value |
| CB | Absence | 3 (33.3) | 6 (66.7) | 9 (100) | 0.754 |
| Non-cleft side | Presence | 4 (19) | 17 (81) | 21 (100) | |
| | Total | 7 (23.3) | 23 (76.7) | 30 (100) | |
| | | OO-cleft side | | | |
| | | Absence | Presence | Total | p-value |
| OO | Absence | 23 (85.2) | 4 (14.8) | 27 (100) | 0.687 |
| Non-cleft side | Presence | 2 (66.7) | 1 (33.3) | 3 (100) | |
| | Total | 25 (83.3) | 5 (16.7) | 30 (100) | |

UCLP: Unilateral cleft lip and palat

determining the relationship between anatomical structures and adjacent tissues in the maxillofacial region (21). The aim of this current study was to evaluate the possible relationship between MSP, concha bullosa and ostium obstruction with the presence of a cleft using CBCT.

In certain pediatric patients where conventional X-ray techniques fail to provide a definitive diagnosis, it may be essential to employ an advanced imaging modality like CBCT. Children are more vulnerable to ionizing radiation risks due to the rapid growth of their tissues (22). CBCT imaging must be conducted adhering to the ALADAIP principle and should be employed when the benefit to pediatric patients outweighs the potential risks. In this research, none of the CBCT referrals were specifically related to the study. The CBCTs of the study population were already available in the archieve of dentomaxillofacial radiology department.

When the literature was examined, Citron et al. (11), Kula et al. (12) and Pacnahad et al. (13) reported higher MT in the maxillary sinuses of CLP patients compared to control groups. 180 sides of 90 patients were evaluated in the current study. As a result, two groups of 90 cleft and 90 non-cleft sides were performed. The prevalence of MSP (83.3%) in the presence of a cleft was statistically significantly higher than absence of a cleft (54.4%). Suzuki et al. (8) reported that 32.0% of CLP patients and 21.0% of all sides had a minimum 10.0% soft tissue density shadow at least one of the maxillary sinuses. Ishikawa et al. (9) evaluated patients with CLP, and reported that there was no difference between the cleft groups and control group in terms of rhinosinusitis. Cagici et al. (23) determined that the thickening amount should be a minimum of 2 mm in order to detect sinus MT. In addition, they accepted the thickness above this border as pathological thickening. In present study, the amount of pathological MT was accepted as 2 mm and above. There were studies reporting the prevalence of maxillary sinus MT as 12%, 46.2% and 60.5% (16,24,25). Similar to these prevalences, the prevalence of MSP in the absence of cleft was 54.4% in the current study. In the presence of a cleft, this rate (83.3%) was significantly higher than the absence of a cleft and cleft presence increased the risk of MSP 4.2 times. In addition, there was no significant difference in the prevalence of MSP between the cleft and non-cleft sides in UCLP patients similar to Citron et al. (11) and Kula et al. (12) findings. In the study of Suzuki et al. (8) unlike these results, sinusitis was more severe on the non-cleft side than the cleft side.

Concha bullosa is generally asymptomatic; but may be symptomatic depending on the infection, size, drainage or ventilation failure (26). There were studies that reported the prevalence of concha bullosa as 41.7%, 53.7% and 67.5% in the normal population (25-27). Similar to these prevalences, the prevalence of concha bullosa in the absence of a cleft was 62.2% in the current study. Although the prevalence of concha bullosa was higher in the presence of cleft, there was no statistically significant relationship between the presence of cleft and the prevalence of concha bullosa. In parallel with these results, in Dedeoglu et al.'s (14) and Göksel and Özcan's (15) study, there was no significant difference in the prevalence of concha bullosa in the CLP and control groups.

In the present study, the effect of cleft presence on ostium obstruction was investigated, independent of volume and positioning. It is known that patients with osteomeatal complex obstruction are more prone to sinus diseases (28). The maxillary sinus ostium is located in the posterior superior part of the medial wall and opens into the middle meatus via the ethmoid infundibulum and flows into its posterior part (29). Therefore, any obstruction in the ostium can disrupt the ventilation of the maxillary sinus by interrupting drainage and therefore pathological areas may be accumulated in the maxillary sinus. In the present study, it was observed that the prevalence of obstructed ostium was significantly higher in the presence of a cleft (17.8%) compared to the absence of a cleft (5.6%), and the presence of a cleft increased ostium obstruction by 3.7 times. Although the prevalence of ostium obstruction on the cleft side was higher in patients with UCLP than on the non-cleft side, there was no statistically significant difference. Best of our knowledge, it was the first study to evaluate ostium obstruction in patients with CLP. In the future, more comprehensive studies are needed to examine the relationships between ostium obstruction and ostium location, maxillary sinus volume, and MSP in CLP patients. Further studies can be planned to determine the risk factors of pathologies, especially in the paranasal regions.

### Study Limitations

The most important limitation of this study was that patients were selected by ignoring that viral or allergic infections might increase in certain seasons. Another limitation was that, due to the retrospective nature of this study, it was not possible to perform a clinical evaluation of the patients' paranasal sinuses or osteomeatal complex, nor to determine whether the incidence of sinusitis was associated with various interventions applied for CLP treatment. In addition, the different findings in the studies must be considered with the understanding that they may result from different definitions of both MSP and ostium obstruction during the methodological design (8,11-13,30).

## Conclusion

The results of the present study showed that although the prevalence of MSP, concha bullosa and ostium obstruction on the cleft side was higher in patients with UCLP, there was no statistically significant difference between the cleft and non-cleft sides (Table 2). When all groups were evaluated (Table 1), it was found that the presence of a cleft increased the presence of MSP 4.2 times and ostium obstruction 3.7 times. As a result; within limitations, it has been shown that the presence of a cleft can be a risk factor for MSP and ostium obstruction.

### Ethics

**Ethics Committee Approval:** This study was approved with the number: 145, date: 14.06.2024 by the Çukurova University's Non-invasive Clinical Research Ethics Committee, and was prepared in accordance with the Declaration of Helsinki, revised in 2013.

**Informed Consent:** All patients or their parents applying to the related department filled out an informed consent form as a standard procedure because it could be used in scientific studies.

**Footnotes**

**Authorship Contributions**

Concept: H.D.Y., B.T.Ü., B.E., Design: H.D.Y., B.E., Data Collection or Processing: H.D.Y., B.T.Ü., Analysis or Interpretation: H.D.Y., B.E., Literature Search: H.D.Y., B.T.Ü., Writing: H.D.Y., B.T.Ü., B.E.

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

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## References

1. Celikoglu M, Halicioglu K, Buyuk SK, Sekerci AE, Ucar FI. Condylar and ramal vertical asymmetry in adolescent patients with cleft lip and palate evaluated with cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2013;144:691-7.
2. Shapira Y, Lubit E, Kuftinec MM, Borell G. The distribution of clefts of the primary and secondary palates by sex, type, and location. Angle Orthod. 1999;69:523-8.
3. Lawson W, Patel ZM, Lin FY. The development and pathologic processes that influence maxillary sinus pneumatization. Anat Rec (Hoboken). 2008;291:1554-63.
4. Lund VJ, Kennedy DW. Staging for rhinosinusitis. Otolaryngol Head Neck Surg. 1997;117:35-40.
5. Kyrkanides S, Bellohusen R, Subtelny JD. Skeletal asymmetries of the nasomaxillary complex in noncleft and postsurgical unilateral cleft lip and palate individuals. Cleft Palate Craniofac J. 1995;32:428-33.
6. Suri S, Utreja A, Khandelwal N, Mago SK. Craniofacial computerized tomography analysis of the midface of patients with repaired complete unilateral cleft lip and palate. Am J Orthod Dentofacial Orthop. 2008;134:418-29.
7. Agarwal R. Anthropometric evaluation of complete unilateral cleft lip nose with cone beam CT in early childhood. J Plast Reconstr Aesthet Surg. 2011;64:181-2.
8. Suzuki H, Yamaguchi T, Furukawa M. Rhinologic computed tomographic evaluation in patients with cleft lip and palate. Arch Otolaryngol Head Neck Surg. 1999;125:1000-4.
9. Ishikawa Y, Kawano M, Honjo I, Amitani R. The cause of nasal sinusitis in patients with cleft palate. Arch Otolaryngol Head Neck Surg. 1989;115:442-6.
10. Turvey TA, Hall DJ, Warren DW. Alterations in nasal airway resistance following superior repositioning of the maxilla. Am J Orthod. 1984;85:109-14.
11. Citron I, Lee C, Calabrese CE, Padwa BL. Schneiderian membrane thickness is increased in patients with cleft lip and palate. Cleft Palate Craniofac J. 2020;57:296-301.
12. Kula K, Hale LN, Ghoneima A, Tholpady S, Starbuck JM. Cone-Beam computed tomography analysis of mucosal thickening in unilateral cleft lip and palate maxillary sinuses. Cleft Palate Craniofac J. 2016;53:640-8.
13. Paknahad M, Pourzal A, Mahjoori-Ghasrodashti M, Khojastepour L. Evaluation of maxillary sinus characteristics in patients with cleft lip and palate using cone beam computed tomography. Cleft Palate Craniofac J. 2022;59:589-94.
14. Dedeoglu N, Altun O, Kucuk EB, Altindis S, Hatunogl E. Evaluation of the anatomical variation in the nasal cavity and paranasal sinuses of patients with cleft lip and palate using cone beam computed tomography. Bratisl Lek Listy. 2016;117:691-6.
15. Göksel S, Özcan İ. A CBCT study for anatomic variations of osteomeatal complex in patients with cleft lip and palate. Cleft Palate Craniofac J. 2023;60:13-20.
16. Shanbhag S, Karnik P, Shirke P, Shanbhag V. Association between periapical lesions and maxillary sinus mucosal thickening: a retrospective cone-beam computed tomographic study. J Endod. 2013;39:853-7.
17. Maestre-Ferrín L, Galán-Gil S, Carrillo-García C, Peñarrocha-Diago M. Radiographic findings in the maxillary sinus: comparison of panoramic radiography with computed tomography. Int J Oral Maxillofac Implants. 2011;26:341-6.
18. Lu Y, Liu Z, Zhang L, Zhou X, Zheng Q, Duan X, et al. Associations between maxillary sinus mucosal thickening and apical periodontitis using cone-beam computed tomography scanning: a retrospective study. J Endod. 2012;38:1069-74.
19. Holberg C, Steinhäuser S, Geis P, Rudzki-Janson I. Cone-beam computed tomography in orthodontics: benefits and limitations. J Orofac Orthop. 2005;66:434-44.
20. Aps JK. Cone beam computed tomography in paediatric dentistry: overview of recent literature. Eur Arch Paediatr Dent. 2013;14:131-40.
21. İlgüy M, Dölekoğlu S, Fişekçioğlu E, Ersan N, İlgüy D. Evaluation of pneumatization in the articular eminence and roof of the glenoid fossa with cone-beam computed tomography. Balkan Med J. 2015;32:64-8.
22. Ludlow JB, Ivanovic M. Comparative dosimetry of dental CBCT devices and 64-slice CT for oral and maxillofacial radiology. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008;106:106-14.
23. Cagici CA, Yilmazer C, Hurcan C, Ozer C, Ozer F. Appropriate interslice gap for screening coronal paranasal sinus tomography for mucosal thickening. Eur Arch Otorhinolaryngol. 2009;266:519-25.
24. Vallo J, Suominen-Taipale L, Huumonen S, Soikkonen K, Norblad A. Prevalence of mucosal abnormalities of the maxillary sinus and their relationship to dental disease in panoramic radiography: results from the Health 2000 Health Examination Survey. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;109:80-7.
25. Tassoker M. What are the risk factors for maxillary sinus pathologies? A CBCT study. Oral Radiol. 2020;36:80-4.
26. Koo SK, Kim JD, Moon JS, Jung SH, Lee SH. The incidence of concha bullosa, unusual anatomic variation and its relationship to nasal septal deviation: A retrospective radiologic study. Auris Nasus Larynx. 2017;44:561-70.

27. Smith KD, Edwards PC, Saini TS, Norton NS. The prevalence of concha bullosa and nasal septal deviation and their relationship to maxillary sinusitis by volumetric tomography. Int J Dent. 2010;2010:404982.
28. Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities: CT analysis for endoscopic sinus surgery. Laryngoscope. 1991;101:56-64.
29. Zinreich SJ, Mattox DE, Kennedy DW, Chisholm HL, Diffley DM, Rosenbaum AE. Concha bullosa: CT evaluation. J Comput Assist Tomogr. 1988;12:778-84.
30. Kato S, Omori Y, Kanayama M, Hirota A, Ferri M, Apaza Alccayhuaman KA, et al. Sinus mucosa thickness changes and ostium involvement after maxillary sinus floor elevation in sinus with septa. A Cone Beam Computed Tomography Study. Dent J (Basel). 2021;9:82.

Original Article

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# The Relationship of Tumor Marker Panel with Tumor Size and Histopathological Results in Borderline Ovarian Tumor

## Borderline Over Tümöründe, Tümör Belirteç Paneli ile Tümör Boyutu ve Histopatolojik Sonuçların İlişkisi

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## ABSTRACT

**Objective:** This retrospective, cross-sectional, and single-center study aimed to explore the correlation between preoperative tumor marker panel levels, tumor size, and histopathological features in borderline ovarian tumors (BOTs).

**Methods:** Sixty-seven patients, with confirmed pathologic results indicating BOTs, were included. The patients were categorized into two groups based on the type of surgery performed (comprehensive surgery and fertility-sparing surgery). The evaluation encompassed parameters such as tumor size, tumor laterality, histopathological tumor type, and other clinicopathological features.

**Results:** Preoperatively, 32 patients (47.7%) exhibited high cancer antigen (CA) -125, 13 patients (19.4%) high CA 19-9, 3 patients (4.4%) high CA 15-3, 7 patients (10.4%) high carcinoembryonic antigen (CEA), and 2 patients (2.9%) high alpha-fetoprotein (AFP) levels. A statistically significant correlation was observed between tumor size and elevated CEA values (p=0.010). However, no significant correlations were found between tumor size and CA-125, CA 19-9, CA 15-3, and AFP levels. Histopathological types showed a significant correlation with mean tumor diameter; serous, mucinous, and seromucinous (mixed) types had mean tumor diameters of 10.14±4.58 cm, 19.35±9.23 cm, and 10.67±6.17 cm, respectively (p=0.001).

## ÖZ

**Amaç:** Bu retrospektif, kesitsel ve tek merkezli çalışmanın amacı borderline over tümörlerinde (BOT) preoperatif tümör belirteç paneli düzeyleri ile tümör boyutu ve histopatolojik özellikler arasındaki ilişkiyi araştırmaktır.

**Yöntemler:** Patoloji sonuçları BOT lehine doğrulanan 67 hasta çalışmamıza dahil edildi. Hastalar kapsamlı cerrahi ve fertilite koruyucu cerrahi uygulananlar olarak iki gruba ayrıldı. Tüm hastalar tümör boyutu, tümör lateralitesi, tümörün histopatolojik tipi ve diğer klinikopatolojik özellikler açısından değerlendirildi.

**Bulgular:** Ameliyat öncesi hastaların 32'sinde (%47,7) yüksek kanser antijen (CA) -125, 13'ünde (%19,4) yüksek CA 19-9, 3'ünde (%4,4) yüksek CA 15-3, 7'sinde (%10,4) yüksek karsinoembriyonik antijen (CEA) ve 2'sinde (%2,9) yüksek alfa-fetoprotein (AFP) düzeyleri mevcuttu. Tümör boyutu ile yüksek CEA değerleri arasındaki ilişki istatistiksel olarak anlamlıydı (CEA değerleri <4 cm, 4,1-10 cm ve >10 cm tümör boyutları için sırasıyla 4,95±4,48, 2,27±3,07 ve 5,17±16,45, p=0,010). Tümör boyutu ile CA-125, CA 19-9, CA 15-3 ve AFP düzeyleri arasında anlamlı bir ilişki bulunmadı. Histopatolojik tipler ile ortalama tümör çapı arasında istatistiksel olarak anlamlı bir korelasyon saptandı ve ortalama tümör çapı (cm) seröz, müsinöz ve seromüsinöz

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**ABSTRACT**

**Conclusion:** Elevated tumor marker levels, especially CEA, may indicate larger tumor sizes, with mucinous BOTs being more associated with larger diameters. However, preoperative increases in tumor marker levels do not reliably predict histopathological typing for clinicians.

**Keywords:** Borderline ovarian tumors, tumor size, tumor markers

**ÖZ**

(mikst) tipler için sırasıyla 10,14±4,58, 19,35±9,23 ve 10,67±6,17 bulundu (p=0,001).

**Sonuç:** Özellikle CEA için yüksek tümör belirteç seviyeleri, daha büyük tümör boyutuna işaret edebilir. Büyük tümör çapı daha çok müsinöz tip borderline over tümörleri ile ilişkilidir. Ancak ameliyat öncesi tümör belirteçlerinden herhangi birinin düzeyindeki artış histopatolojik tiplemeyi öngörmede klinisyenler için sağlıklı bir yol sağlamamaktadır.

**Anahtar Kelimeler:** Borderline over tümörleri, tümör boyutu, tümör belirteçleri

## Introduction

Ovarian cancer ranks fifth in cancer-related deaths among women, surpassing other cancers of the female reproductive system in mortality (1). Borderline ovarian tumors (BOTs) account for 10-20% of all epithelial ovarian cancers (2) and share similar risk factors with invasive epithelial ovarian cancers (3). Unlike invasive cancers, BOTs lack stromal invasion, though approximately 10% may exhibit microinvasion areas (4). Patients with BOTs may be asymptomatic or present with symptoms such as pelvic pain, distension, dyspareunia, or the discovery of an adnexal mass during routine pelvic examinations. Tumor size in BOTs, like other ovarian tumors, can vary. BOTs lack a specific sonographic appearance, and measurements of tumor markers are nonspecific (5). While a high cancer antigen (CA) -125 level in serum may raise suspicion of ovarian cancer, it is not a reliable indicator for detecting BOTs. Elevated CA19-9 and carcinoembryonic antigen (CEA) levels are typically observed in stage 1b and higher stages (6). The association between BOTs and elevated levels of CA15-3 and alpha-fetoprotein (AFP) lacks substantial evidence from large-scale studies.

The majority of borderline ovarian tumor cases are of serous or mucinous histology. Rarely, endometrioid, clear-cell, mixed (seromucinous), or transitional cell (Brenner) borderline tumors are identified (7). Surgical intervention stands as the primary treatment for BOTs. In young women, the treatment goal is complete tumor removal. For patients who have completed their fertility, the recommended optimal treatment involves total abdominal hysterectomy, bilateral salpingo-oophorectomy, and omentectomy. Complete staging may necessitate pelvic and paraaortic lymph node dissection and omentectomy. Fertility-sparing surgery is an option for suitable patients.

This study aims to investigate the correlation between preoperative levels of a tumor marker panel, tumor size, and histopathological features in BOTs. It involves measuring the levels of a panel of serum tumor markers, including CA-125, CA 15-3, CA 19-9, CEA, and AFP.

## Methods

BOTs are characterized by nuclear atypia, epithelial stratification, formation of microscopic papillary projections, cellular pleomorphism, and increased mitotic activity without stromal invasion (12). This study retrospectively examined pathology results from patients treated at the Obstetrics and Gynecology department of a tertiary hospital between 01.01.2011 and 01.04.2022. A total of 67 patients diagnosed as having BOTs, including a tumor marker panel comprising CA-125, CA 19-9, CA 15-3, CEA, and AFP, were included in the study. Patient anamnesis provided information on age, obstetrical history, menopause status, complaints at the time of admission, and smoking.

Normal upper limits for tumor marker values were established as 35 U/mL for CA-125, 34 U/mL for CA 19-9, 26.2 U/mL for CA 15-3, 5 ng/mL for CEA, and 7 ng/mL for AFP. Patients with elevated preoperative serum CA 15-3 levels underwent mammography or breast sonography to rule out related breast diseases.

Patients were categorized based on the surgical procedures performed, either comprehensive or fertility-sparing surgery. Comprehensive surgical staging included peritoneal washing, total abdominal hysterectomy, bilateral salpingo-oophorectomy, infracolic omentectomy, bilateral pelvic and paraaortic lymph node dissection, and appendectomy. Fertility-preserving surgery was defined as operations in which the uterus and at least one ovary were preserved.

All patients underwent evaluation for tumor size, tumor laterality, histopathological type, and other clinicopathological features. Tumor size was determined based on the largest diameter reported in the pathological examination, with tumors classified into three groups as <4 cm, 4.1-10 cm, and >10 cm. Staging followed the 2014 International Federation of Gynecology and Obstetrics classification (1).

To ensure the study's integrity, patients with concurrent conditions (e.g., endometrioma, pelvic inflammatory disease) that might lead to elevated CA 125 levels were also excluded.

Ethical permission was obtained from İstanbul Medeniyet University Göztepe Prof. Dr. Süleyman Yalçın City Hospital, Ethics Committee for ethical compliance (approval no: 2022/0354, date: 01.06.2022).

Given the retrospective nature of the study and the analysis of anonymized data, the ethics committee waived the requirement for informed consent.

### Statistical Analysis

The study employed a range of statistical tests, including the Kruskal-Wallis test, chi-square analysis, ANOVA test, Fisher's exact test, and Mann-Whitney U test. The predetermined cut-off value for statistical significance was set at $p<0.05$.

## Results

Sixty-seven cases were identified, and their demographic characteristics are presented in Table 1. The mean age at diagnosis for the 67 patients included in the study was 43 (range: 18-86). Preoperatively, 32 patients (47.7%) exhibited elevated CA-125 levels, 13 (19.4%) had elevated CA 19-9 levels, 3 (4.4%) showed elevated CA 15-3 levels, 7 (10.4%) had elevated CEA levels, and 2 (2.9%) had elevated AFP levels. Bilateral tumors were observed in 7 patients. The diagnosed borderline tumors comprised 32 (47.8%) serous, 23 (34.3%) mucinous, 9 (13.4%) seromucinous (mixed), 2 endometrioid, and 1 Brenner tumor. Tumor size was less than 4 cm in 8 patients (11.9%), between 4.1-10 cm in 21 patients (31.3%), and more than 10 cm in 38 patients (56.7%). No recurrence was detected in the follow-up until September 2022.

The lymph node involvement rate was 1.5% (1/67), and positive peritoneal washing cytology was observed in 5 patients (7.4%). Micropapillary invasion was present in 8 patients (11.9%), and only 1 patient (1.5%) had borderline interpretation on omental histopathologic examination. The distribution of surgical stage and histological subtype of BOTs is given in Table 2 and there is no significant difference between the groups.

The mean preoperative tumor marker levels concerning tumor size are outlined in Table 3. A significant correlation was found between tumor size and high CEA values ($p=0.010$), with CEA values for tumor sizes <4 cm, 4.1-10 cm, and >10 cm being 4.95±4.48, 2.27±3.07, and 5.17±16.45, respectively. However, no significant correlation was found between tumor size and CA-125, CA 19-9, CA 15-3, and AFP levels.

Table 4 illustrates a significant correlation between histopathological types and mean tumor diameter (cm) (10.14±4.58, 19.35±9.23, and 10.67±6.17 for serous, mucinous, and seromucinous types, respectively; $p=0.001$).

The mean preoperative tumor marker values concerning histopathology are summarized in Table 5. No significant correlation was found between preoperative CA-125, CA 19-9, CA 15-3, CEA, and AFP values and histopathological types. Although not statistically significant, CA-125 levels were approximately 2 times higher in serous compared to mucinous borderline tumors, and CEA levels were approximately 4 times higher in mucinous compared to serous borderline tumors. Four extreme values (>1000 U/mL) for the CA19-9 variable were excluded from the analysis.

**Table 1.** Demographic data

| | Average ± SD or number (percentage) |
|---|---|
| **Age** | 43.01±15.71 |
| **Pregnancy history** | |
| Pregnant | 2.52±2.67 |
| Parity | 2.15±2.43 |
| **Obstetrics history** | |
| SVD | 1.72±2.51 |
| CS | 0.43±0.76 |
| D&C | 0.37±0.80 |
| **Menopause status** | |
| Premenopausal | 46 (68.7) |
| Postmenopausal | 21 (31.3) |
| **Presenting complaint** | |
| Asymptomatic | 21 (31.3) |
| Pelvic pain | 30 (44.8) |
| Abdominal distention | 9 (13.4) |
| Abnormal uterine bleeding | 5 (7.5) |
| Nausea and vomiting | 2 (3.0) |
| **Type of surgery** | |
| Comprehensive | 38 (56.7) |
| Fertility-sparing | 29 (43.3) |
| **FIGO staging** | |
| Unstaged | 12 (17.9) |
| 1a | 41 (61.1) |
| 1b | 6 (9.0) |
| 1c | 5 (7.4) |
| 2b | 2 (3.0) |
| 3b | 1 (1.5) |
| **Tumor laterality** | |
| Right | 32 (47.8) |
| Left | 28 (41.8) |
| Bilateral | 7 (10.4) |
| **Tumor size (cm)** | |
| <4 | 8 (11.9) |
| 4.1-10 | 21 (31.3) |
| >10 | 38 (56.7) |
| **Histopathology** | |
| Serous | 32 (47.8) |
| Mucinous | 23 (34.3) |
| Mixed (seromucinous) | 9 (13.4) |
| Endometrioid | 2 (3.0) |
| Brenner | 1 (1.5) |
| **Preoperative CBC parameters** | |
| Hemoglobin | 12.13±1.50 |
| Hematocrit | 36.97±4.11 |
| Platelet | 275.64±70.89 |
| White blood cell | 7.27±2.47 |
| C-reactive protein | 1.79±2.92 |

SD: Standard deviation, SVD: Spontaneous vaginal delivery, CS: Cesarean section, D&C: Dilatation and currettage, CBC: Complete blood count, FIGO: International Federation of Gynecology and Obstetrics

**Table 2.** Distrubution of surgical stage and histological subtype of borderline ovarian tumors

| | | Histology* | | | p-value |
|---|---|---|---|---|---|
| FIGO staging | Number of patient | Serous (n=32) | Ucinous (n=23) | Mixed (seromucinous) (n=9) | |
| IA | 41 | 19 (46.3%) | 18 (43.9%) | 4 (9.8%) | 0.361 |
| IB and higher | 13 | 8 (61.5%) | 2 (15.4%) | 3 (23.1%) | |
| Unstaged | 10 | 5 (50.0%) | 3 (30.0%) | 2 (20.0%) | |

*Endometrioid type was detected in 2 patients and Brenner tumor was detected in 1 patient. These patients were excluded from the analysis, FIGO: International Federation of Gynecology and Obstetrics

**Table 3.** The mean preoperative tumor markers levels with regard to tumor size

| | Tumor size (cm) | | | |
|---|---|---|---|---|
| Tumor markers | <4 (n=8) | 4.1-10 (n=21) | >10 (n=38) | p-value |
| CA-125 (U/mL) | 95.35±133.71 | 58.81±77.47 | 103.37±194.96 | 0.651 |
| CA 19-9 (U/mL)* | 36.04±50.60 | 23.04±50.06 | 25.25±27.64 | 0.334 |
| CA 15-3 (U/mL) | 17.49±11.21 | 13.46±5.65 | 13.56±5.84 | 0.800 |
| CEA (ng/mL) | 4.95±4.48 | 2.27±3.07 | 5.17±16.45 | 0.010 |
| AFP (ng/mL) | 3.99±2.91 | 2.87±2.20 | 2.60±1.17 | 0.599 |

*Four extreme values (>1000 U/mL) for the CA19-9 variable were excluded from the analysis, CA: Cancer antigen, CEA: Carcinoembryonic antigen, AFP: Alpha-fetoprotein

**Table 4.** The mean and subcategorized tumor size with regard to histopathology

| | Histopathology | | | |
|---|---|---|---|---|
| | Serous (n=32) | Mucinous (n=23) | Mixed (seromucinous) (n=9) | p-value |
| **Tumor size (cm, mean)** | 10.14±4.58 | 19.35±9.23 | 10.67±6.17 | **0,001** |
| **Tumor size (cm)** | | | | 0.058 |
| <4 | 2 (33.3%) | 2 (33.3%) | 2 (33.3%) | |
| 4.1-10 | 14 (66.7%) | 3 (14.3%) | 4 (19.0%) | |
| >10 | 16 (43.2%) | 18 (48.6%) | 3 (%8,1) | |
| **Tumor laterality** | | | | 0.319 |
| Unilateral | 28 (49.1%) | 22 (38.6%) | 7 (12,3) | |
| Bilateral | 4 (57.1%) | 1 (14.3%) | 2 (28.6%) | |

**Table 5.** The mean preoperative tumor marker levels with regard to histopathology

| | Histology | | | |
|---|---|---|---|---|
| Tumor markers | Serous (n=32)* | Mucinous (n=23)** | Mixed (seromucinous) (n=9) | p-value |
| CA-125 (U/mL) | 126.72±199.55 | 60.7±123.16 | 34.38±31.99 | 0.069 |
| CA 19-9 (U/mL) | 18.80±22.26 | 36.89±53.71 | 10.96±6.96 | 0.270 |
| CA 15-3 (U/mL) | 14.24±5.68 | 12.5±6.85 | 14.91±4.5 | 0.235 |
| CEA (ng/mL) | 1.97±2.13 | 8.36±21.22 | 2.48±1.75 | 0.264 |
| AFP (ng/mL) | 2.73±1.82 | 2.78±1.41 | 3.58±2.83 | 0.830 |

Four extreme values (>1000 U/mL) for the CA19-9 variable were excluded from the analysis, CA: Cancer antigen, CEA: Carcinoembryonic antigen, AFP: Alpha-fetoprotein

## Discussion

Tumor markers are substances found in tissues, blood, bone marrow, or other body fluids that may serve as indicators of cancer within the relevant system. For ovarian cancer, numerous markers are known and under study, including CA-125, CA 19-9, CA 15-3, CEA, AFP, hCG, lactate dehydrogenase, vascular endothelial growth factor, human epididymis protein 4, inhibin, sFas, kallikrein, hK10, mesothelin, macrophage colony-stimulating factor, osteopontin, and soluble EGF receptor. Among these, CA-125 is the most well-known and widely used in clinical practice, especially in the diagnosis, treatment, and follow-up of epithelial ovarian cancers. Protocols often recommend assessing serum CA-125 at diagnosis and during the follow-up of borderline tumors (8).

BOTs are staged using the International Federation of Gynecology and Obstetrics (FIGO) staging system (9). Most patients with BOTs are diagnosed at FIGO stage 1. Disease spread beyond the pelvis is rare at the time of diagnosis, with abdominal spread being an exception (10). Serum CA-125 antigen levels are higher in cases of serous BOTs and correlate with tumor size and FIGO stage, particularly in serous BOTs. However, a normal level of serum CA-125 antigen does not rule out a BOT (11). In this study, the preoperative serum CA-125 level was elevated in 62% of patients with serous BOTs, and it was also elevated in 50% of patients with tumor sizes both less than 4 cm and greater than 10 cm. Conversely, it was elevated in 42.9% of patients with tumor sizes between 4.1-10 cm. Previous research with 123 patients showed higher preoperative CA-125 levels in those with advanced stage disease compared to those with stage 1 disease (12). In the present study, serum CA-125 levels were elevated in 7.5% of stage 1 patients, while the rate increased to 21.4% in patients with stage 1b and above.

In a study involving 60 patients, none of the tumor markers, including CA-125, CA 15-3, CA 19-9, and CEA, showed a linear correlation with tumor size. However, when grouping the tumor size as <4 cm, 4.1-10 cm, and >10 cm, the mean values of CA-125 and CA 19-9 were found to increase significantly with larger tumor sizes (13). In contrast, in our study among tumor markers, which included CA-125, CA 15-3, CA 19-9, CEA, and AFP, a statistically significant correlation was observed only between the preoperative elevation of CEA values and the increase in tumor size.

The CEA is commonly used as a tumor marker in gastrointestinal system malignancies in contemporary medical practice. A study investigating tumor markers in mucinous ovarian tumors found CEA to be a reliable marker for differentiating between benign, borderline, and malignant tumors (14). In our study, among patients with elevated CEA level, 80% had mucinous histological types, while 20% had a mixed type (seromucinous) BOT.

In another study involving 44 patients with mucinous type BOTs, the preoperative serum CA19-9 level was more frequently elevated than CA-125 and CEA levels. (14). Similarly, in our study, CA19-9 was the most commonly elevated tumor marker in 23 patients (39.1%) with mucinous BOTs.

The comprehensive staging procedure for patients who do not desire future pregnancy includes total hysterectomy and bilateral salpingo-oophorectomy, peritoneal washing, omentectomy, and pelvic and para-aortic lymph node dissection. In contrast, more conservative surgery may be considered for patients who wish to preserve fertility. Epidemiological data indicate that approximately one-third of patients with BOTs are younger than 40 years (5). A significant proportion of young patients express the desire to preserve at least one ovary to maintain fertility or avoid menopausal symptoms (15). It's crucial to inform these patients that available data suggest a higher recurrence rate after conservative treatment (10% to 20%) compared to radical surgery (approximately 5%) (16,17). Notably, this higher recurrence rate has not translated into a higher mortality rate, as demonstrated in the largest series to date, the German ROBOT study. (18). In our study, 31.3% of the 67 included patients were nulliparous, with 65.5% of the 29 patients who underwent fertility-sparing surgery belonging to this group.

From a clinical perspective, we believe, based on the results of this study and existing literature, that preoperative discrimination using CA-125 levels is particularly challenging, especially between patients with stage 1 ovarian cancer and those with serous and/or advanced-stage BOTs. Elevated tumor marker levels, especially for CEA, may indicate a larger tumor size. A larger tumor diameter is more associated with mucinous BOTs. However, the preoperative elevation of any tumor markers does not offer a reliable method for clinicians to predict histopathological typing. Larger studies involving a greater number of patients are needed to address these complexities comprehensively.

### Study Limitations

The study's retrospective design and the small sample size constitute its limitations.

## Conclusion

In conclusion, elevated tumor marker levels, particularly for CEA, may indicate a larger tumor size. A larger tumor diameter is more associated with mucinous BOTs. However, the preoperative rise in the level of any tumor markers does not offer a reliable method for clinicians to predict histopathological typing.

### Ethics

**Ethics Committee Approval:** Ethical permission was obtained from İstanbul Medeniyet University Göztepe Prof. Dr. Süleyman Yalçın City Hospital, Ethics Committee for ethical compliance (approval no: 2022/0354, date: 01.06.2022).

**Informed Consent:** Retrospective study.

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**Footnotes**

**Authorship Contributions**

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

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## References

1. Ovarian Cancer Statistics | How Common is Ovarian Cancer [Internet]. (cited 2022 Sep 21). Available from: https://www.cancer.org/cancer/ovarian-cancer/about/key-statistics.html
2. Tropé CG, Kaern J, Davidson B. Borderline ovarian tumours. Best Pract Res Clin Obstet Gynaecol. 2012;26:325-36.
3. Huusom LD, Frederiksen K, Høgdall EVS, Glud E, Christensen L, Høgdall CK, et al. Association of reproductive factors, oral contraceptive use and selected lifestyle factors with the risk of ovarian borderline tumors: a Danish case-control study. Cancer Causes Control. 2006;17:821-9.
4. Buttin BM, Herzog TJ, Powell MA, Rader JS, Mutch DG. Epithelial ovarian tumors of low malignant potential: the role of microinvasion. Obstet Gynecol. 2002;99:11-7.
5. Harter P, Gershenson D, Lhomme C, Lecuru F, Ledermann J, Provencher DM, et al. Gynecologic Cancer InterGroup (GCIG) consensus review for ovarian tumors of low malignant potential (borderline ovarian tumors*).* Int J Gynecol Cancer. 2014;24:S5-8.
6. Hoffman BL, Schorge JO, Halvorson LM, Hamid CA, Corton MM, Schaffer JI. Epithelial Ovarian Cancer. In: Williams Gynecology [Internet]. 4th ed. New York, NY*:* McGraw-Hill Education*;* 2020 (cited 2022 Sep 24]) Available from: accessmedicine.mhmedical.com/content.aspx?aid=1171663243
7. Nomelini RS, da Silva TM, Tavares Murta BM, Murta EFC. Parameters of blood count and tumor markers in patients with borderline ovarian tumors: a retrospective analysis and relation to staging. ISRN Oncol. 2012;2012:947831.
8. Tropé C, Kaern J. Prognosis and management of borderline tumours of the ovary. Curr Opin Obstet Gynecol. 1996;8:12-6.
9. Berek JS, Renz M, Kehoe S, Kumar L, Friedlander M. Cancer of the ovary, fallopian tube, and peritoneum: 2021 update. Int J Gynaecol Obstet. 2021;155 Suppl 1(Suppl 1):61-85.
10. Serous and mucinous borderline tumors: a clinicopathologic and DNA-ploidy study of 102 cases - Kuoppala - 1996 - *International Journal of Gynecological Cancer* - Wiley Online Library [Internet]. [cited 2022 Sep 24]. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1046/j.1525-1438.1996.06040302.x
11. Nyangoh-Timoh K, Bendifallah S, Dion L, Ouldamer L, Levêque J. Tumeurs frontières de l'ovaire. Recommandations pour la pratique clinique du CNGOF – Pertinence des marqueurs tumoraux [Borderline Ovarian Tumours: CNGOF Guidelines for Clinical Practice - Value of Tumor Markers]. Gynecol Obstet Fertil Senol. 2020;48:277-86.
12. Kolwijck E, Thomas CM, Bulten J, Massuger LF. Preoperative CA-125 levels in 123 patients with borderline ovarian tumors: a retrospective analysis and review of the literature. Int J Gynecol Cancer. 2009;19:1335-8.
13. Ayhan A, Guven S, Seda Guvendag Guven E, Kucukali T. Is there a correlation between tumor marker panel and tumor size and histopathology in well staged patients with borderline ovarian tumors? Acta Obstet Gynecol Scand. 2007;86:484-90.
14. Lertkhachonsuk AA, Buranawongtrakoon S, Lekskul N, Rermluk N, Wee-Stekly WW, Charakorn C. Serum CA19-9, CA-125 and CEA as tumor markers for mucinous ovarian tumors. J Obstet Gynaecol Res. 2020;46:2287-91.
15. Skírnisdóttir I, Garmo H, Wilander E, Holmberg L. Borderline ovarian tumors in Sweden 1960-2005: trends in incidence and age at diagnosis compared to ovarian cancer. Int J Cancer. 2008;123:1897-901.
16. Lenhard MS, Mitterer S, Kümper C, Stieber P, Mayr D, Ditsch N, et al. Long-term follow-up after ovarian borderline tumor: Relapse and survival in a large patient cohort. Eur J Obstet Gynecol Reprod Biol. 2009;145:189-94.
17. Chan JK, Lin YG, Loizzi V, Ghobriel M, DiSaia PJ, Berman ML. Borderline ovarian tumors in reproductive-age women. Fertility-sparing surgery and outcome. J Reprod Med. 2003;48:756-60.
18. du Bois A, Ewald-Riegler N, de Gregorio N, Reuss A, Mahner S, Fotopoulou C, et al. Corrigendum to "Borderline tumours of the ovary: A cohort study of the Arbeitsgemeinschaft Gynäkologische Onkologie AGO Study Group" (Eur J Cancer 2013;49:1905-14). Eur J Cancer. 2016;65:192-3.

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# The Relationship Between Thirst Distress and Severity and Compliance with Fluid Control and Interdialytic Weight Gain in Hemodialysis Patients

## Hemodiyaliz Hastalarında Susama Sıkıntısı ve Susama Şiddetinin Sıvı Kontrol Uyumu ve İnterdiyalitik Kilo Alımı ile İlişkisinin İncelenmesi

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## ABSTRACT

**Objective:** This study was performed to examine the relationship between thirst distress and severity and compliance with fluid control and interdialytic weight gain (IDWG) in patients receiving outpatient hemodialysis (HD) treatment.

**Methods:** This two-center, descriptive and cross-sectional study was completed with 148 patients receiving outpatient HD treatment. The data were collected by using the "patient introduction form", the "thirst distress scale (TDS)", the "fluid control scale in hemodialysis patients (FCSHP)", the "visual analog scale (VAS)". IDWG was calculated as the difference between the weight before HD and the weight recorded after the previous session; the mean of sessions over 3 months was recorded. Independent sample t-test, one-way ANOVA test, Mann-Whitney U, and Kruskal-Wallis tests were used to evaluate the data, and Pearson correlation analysis was used to determine the relationship between the scales.

**Results:** According to the results, the mean TDS score was 21.67±5.02, the mean VAS score was 4.62±1.68, the mean FCHPS total scale score was 44.86±6.80, the mean FCHPS behavior subscale score was 22.14±5.74, the mean FCHPS knowledge subscale score was 12.54±2.79, and the mean FCHPS attitude subscale score was 10.17±2.76. A negative correlation was found between TDS scores and FCHPS total scores, FCHPS subscale

## ÖZ

**Amaç:** Bu araştırma, ayaktan hemodiyaliz tedavisi alan hastaların susama sıkıntısı ve susama şiddetinin sıvı kontrol uyumu ve interdiyalitik kilo alımı (IDWG) ile ilişkisini incelemek amacıyla yapıldı.

**Yöntemler:** Bu iki merkezli tanımlayıcı ve kesitsel çalışma, ayaktan hemodiyaliz tedavisi gören 148 hasta ile tamamlandı. Veriler "hasta tanıtım formu", "hemodiyaliz hastalarında susama sıkıntısı ölçeği (HHSSÖ)", "hemodiyaliz hastalarında sıvı kontrol ölçeği (HHSKÖ)", vizüel analog skala (VAS)" kullanılarak toplandı. IDWG, hemodiyaliz öncesi ağırlık ile önceki seanstan sonra kaydedilen ağırlık arasındaki fark olarak hesaplandı; 3 aylık interdiyalitik kilo alımının ortalaması kaydedildi. Verilerin değerlendirilmesinde, Independent sample t-testi ve one-way ANOVA testi, Mann-Whitney U ve Kruskall-Wallis testleri kullanıldı. Ölçekler arasındaki ilişkiyi belirlemek için Pearson korelasyon analizi kullanıldı.

**Bulgular:** Elde edilen sonuçlara göre HHSSÖ puan ortalaması 21,67±5,02, VAS susuzluk puan ortalaması 4,62±1,68, HHSKÖ toplam ölçek puan ortalaması 44,86±6,80, HHSKÖ davranış alt boyutu puan ortalaması 22,14±5,74, HHSKÖ bilgi alt boyutu puan ortalaması 12,54±2,79 ve HHSKÖ tutum alt boyutu puan ortalaması 10,17±2,76 olarak belirlendi. Susama sıkıntısı

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**ABSTRACT**

knowledge scores and FCHPS subscale attitude scores, and IDWG and FCHPS subscale attitude scores. A positive correlation was also found between the VAS score and IDWG.

**Conclusion:** Thirst distress was higher than the moderate level in HD patients, and IDWG increased as thirst severity (VAS score) increased.

**Keywords:** Drinkings, hemodialysis, thirst, weight gain, xerostomia

**ÖZ**

ölçek puanları ile HHSKÖ toplam puanları, HHSKÖ alt boyut bilgi puanları ile HHSKÖ alt boyut tutum puanları, IDWG ile HHSKÖ alt boyut tutum puanları arasında negatif bir korelasyon tespit edildi. VAS susuzluk puanı ile IDWG arasında pozitif bir ilişki tespit edildi.

**Sonuç:** Çalışmamızda, hemodiyaliz hastalarında susama sıkıntısı orta düzeyden yüksek ve susama şiddeti (VAS susuzluk puanı) arttıkça interdiyalitik kilo alımının arttığı saptandı.

**Anahtar Kelimeler:** Sıvı tüketimi, hemodiyaliz, susama, kilo alımı, ağız kuruluğu

## Introduction

Hemodialysis (HD) is a medical procedure that filters blood outside the body using a machine equipped with a semi-permeable membrane. It is essential for managing fluid and electrolyte imbalances in individuals with chronic kidney disease (CKD), a condition affecting approximately 2.6 million people worldwide. Projections indicate that this number could rise to about 5.4 million by 2030, representing around 10% of the global population (1,2). According to the Turkish Society of Nephrology's Turkish Kidney Registration System Report for 2020, the countries with the highest rates of use of HD treatment are Japan (95%), Bangladesh (92%), and Malaysia (86%). In Türkiye, this figure stands at 74% (3).

Thirst, defined as the sensation prompting water intake, is prevalent among HD patients, with studies showing a prevalence range of 30.9% to 95% (4-7). The causes of thirst that develops in patients receiving HD treatment include age, medications, diabetes mellitus, fluid restriction, Sjogren's syndrome (8,9). The saliva flow rate, which begins to decrease in patients with chronic kidney patients, the HD treatment process it decreases thoroughly along with. In these patients, urea comes to saliva from the gum groove fluid with salivary gland secretions (10). It is often associated with inadequate saliva secretion, leading to dry mouth and discomfort (11). Thirst distress is the level of distress caused by thirst or thirst-related conditions (12). For HD patients, maintaining adequate fluid consumption between dialysis sessions is critical, especially as they adhere to a fluid-restricted diet to prevent fluid overload (13). In patients undergoing HD, the level of fluid restriction depends on several factors, including the patient's residual kidney function, comorbid conditions, and the effectiveness of the dialysis treatment itself. However, complete dehydration should be avoided, as it can lead to serious complications. Most HD patients are advised to limit fluid intake to 1-1.5 liters per day in addition to urine output. The total fluid intake includes all drinks and fluids from food, medications and other parameters (14). However, the strong drive of thirst can complicate compliance with these dietary restrictions (15,16).

Non-compliance with fluid restrictions may result in serious complications, including hypertension, acute pulmonary edema, and cardiovascular issues (17). Residual kidney function, thirst sensation comorbid conditions, dialysis frequency and efficacy, patient education and understanding, psychological distress, cognitive function, cultural and social norms, physical activity, dietary habits, dialysis quality are the factors affecting compliance with fluid restriction (18). Additionally, dehydration can lead to increased morbidity and mortality through excessive interdialytic weight gain (IDWG), which is calculated by the difference between pre- and post-dialysis weights (15,16). Dehydration, in a clinical sense, does not directly cause IDWG; rather, it is usually associated with a lack of fluid balance, which can contribute to excessive fluid retention when the body compensates for perceived dehydration. During dialysis, the goal is to remove excess fluid that has accumulated between sessions. However, if the patient has been dehydrated, the dialysis treatment may remove not only the excess fluid but also some of the essential body water, leading to a relative dehydration post-dialysis. After the treatment, patients may then consume more fluid to compensate for the perceived dehydration, resulting in high IDWG between treatments (19). While dehydration can play a role in fluid imbalance, high IDWG is primarily due to excessive fluid intake (non-compliance with fluid restrictions), sodium intake, reduced dialysis efficiency (inadequate ultrafiltration or dialysis treatment), residual renal function, cardiovascular factors, such as heart failure, medications that promote fluid retention, malnutrition and hypoalbuminemia, inflammatory states or infections (17,19).Thirst is a significant factor influencing fluid intake and IDWG, often exacerbating weight gain in patients (20). Many studies highlight a correlation between heightened thirst and increased IDWG, with one indicating that 86% of HD patients reported severe thirst (7,21,22).

To avoid excessive IDWG defined as a weight gain exceeding 5.7% of dry weight between sessions patients must adhere to strict fluid intake guidelines (8). In line with all this information, in this study, we aimed to investigate the relationship between thirst distress, thirst severity and compliance with fluid control and IDWG in HD patients.

## Methods

### Purpose and Type of Research

This descriptive and cross-sectional study was conducted to investigate the relationship between thirst distress, severity and compliance with fluid control, and IDWG in HD patients.

### Research Questions

Question 1: Are thirst distress and severity related to fluid restriction compliance in HD patients?

Question 2: Are thirst distress and severity related to IDWG in HD patients?

### Setting and Time of the Study

The study was conducted between June 2020 and January 2021 at X State Hospital in Gümüşhane province and Y State Hospital HD Unit in Bayburt province.

### Population and Sample of the Study

The population consisted of 180 patients receiving outpatient HD treatment in the HD Units of X and Y State Hospitals. The sample was determined to be at least 138 patients in the G*Power 3.1.9.6 program with an error amount of α=0.05, an effect size of 0.25, and a targeted test power of 0.90 (90%). However, considering the possibility of dropout or death during the study, the sample number was increased by 13%, and 10 more patients were included in the study. The study was completed with 148 patients. The participation rate was determined to be 82.2%.

### Inclusion Criteria

Receiving HD treatment three times a week for at least 3 months (to be defined as a chronic HD program) (15) in the HD Units of X and Y State Hospitals, being over 18 years of age or older, having blood glucose level within the normal interval, not using any medication that affects thirst, the sodium level in the dialysate liquid in the interval of 139-140 mg/dL, being able to measure weight while standing, being able to communicate verbally, having no impairment in mental and cognitive functions, and accepting to participate in the research.

### Exclusion Criteria

Having a psychiatric disorder requiring treatment, receiving peritoneal dialysis, withdrawing from the study, and continuing HD treatment in a different institution.

### Tools of Data Collection

"Patient introduction form", the "thirst distress scale in hemodialysis patients (TDSHP)", the "fluid control scale in hemodialysis patients", "visual analog scale (VAS)". Thirst, and a high-precision scale with a height gauge were used to collecting the data. Clinical and laboratory data were obtained from medical records.

### The Patient Introduction Form

The form was developed by the researcher after reviewing the literature (15,20,23). It consists of two parts and eight questions. The first section included 5 questions to determine the sociodemographic characteristics of the patients (gender, age, marital status, etc.), and the second part includes 3 questions to determine the characteristics related to HD treatment (chronic disease status, family history of kidney disease).

### The Thirst Distress Scale in Hemodialysis Patients (TDSHP)

The scale was developed by Welch (12), and its Turkish validity and reliability were tested by Kara (15). It is a 6-item measurement tool with a single dimension. The scale is a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The possible total score range is 6-30, and high scores indicate high thirst distress. The Cronbach's alpha coefficient of TDSHP was found to be 0.78 (12) for the original scale. The Cronbach alpha coefficient of TDSHP our study is 0.81.

### The Fluid Control in Hemodialysis Patients Scale (FCHPS)

Developed by Albayrak Cosar and Cinar Pakyuz (24), the scale has three subscales and 24 items. Questions 1-7 comprise the "knowledge" subscale, questions 8-18 comprise the "behavior" subscale, and questions 19-24 comprise the "attitude" subscale. Items 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 are scored positively (agree=3, undecided=2, disagree=1), while items 6, 7, 18, 19, 20, 21, 22, 23, and 24 are reverse scored. The lowest and highest scores obtained from the scale are 24 and 72. High scores indicate that the patient's compliance with fluid control is high. Cronbach's alpha internal consistency coefficients were 0.92 for the knowledge subscale, 0.80 for the behavior subscale and 0.67 for the attitude subscale (24). In our study, the Cronbach alpha internal consistency coefficients were found to be 0.85 for the knowledge subscale, 0.78 for the behavior subscale and 0.65 for the attitude subscale.

### High-Precision Weighing Scale with Height Gauge

It was used for interdialytic weight measurement (pre- and post-HD weight measurement). Weight was measured on an empty stomach and without removing any clothes before each HD procedure and 15 minutes after the HD was finished. In the unit, patients were placed barefoot on a precision scale with a calibrated height scale.

### The Visual Analog Scale Thirst

Thirst level means "the intensity, strength, or amount of thirst" (25). VAS was used to measure the thirst intensity of HD patients. The scale is a horizontal line 10 cm long. Patients were asked to rate their thirst since the last dialysis on the VAS. The VAS consists of numerical values arranged on a horizontal line, with "0" indicating "no thirst" and "10" indicating "worst possible thirst." In this study, VAS thirst scores were evaluated as 0-3 mild, 4-6 moderate, and 7-10 severe based on the study of Yang et al. (26). The meaning of VAS thirst was explained ("0" means "no thirst" and "10" means "worst possible thirst"), and the patients were asked to give a value between 0 and 10 for their thirst level, and the numerical value was noted by the researcher. The patients were asked about VAS thirst values before the second dialysis session, and they were noted. The duration of thirst was the same for all patients.

### Data Collection

The "patient introduction form," the "TDSHP," and the "FCHPS" were administered to the patients by the researcher using the face-to-face interview technique before the HD procedure in the HD Unit. The questions were asked to the patients by the researcher, and their answers were recorded on the data collection forms. This application took an average of 15 minutes.

### Interdialytic Weight Measurement

Patients included in the study underwent bicarbonate HD, 4 hour thrice weekly. (Monday-Wednesday, Saturday group, and Tuesday, Thursday, and Sunday group) (15). The researcher used a high-precision weighing scale with a height gauge calibrated by the hospital to weigh the patients. The interdialytic weight measurement value was calculated by subtracting the pre-and post-HD weights of the patients; the average of the HD sessions in 3 month were registered and assessed as absolute IDWG (27). Interdialytic weight measurement was performed in the second dialysis session for each patient. The time between the two hemodialyses was the same for all patients.

### Statistical Analysis

The collected data were analyzed using SPSS (for Windows, version 25.0) package program. Data were presented using descriptive statistics (frequency, percentages, arithmetic mean, standard deviation). The Kolmogorov-Smirnov test was applied for conformity to the normal distribution. Independent samples t-test, one-way ANOVA, and post-hoc tests were used in the evaluation of parametric data; Mann-Whitney U and Kruskal-Wallis tests were used in the evaluation of non-parametric data. In addition, Pearson correlation analysis was used to determine the relationship between the scores obtained from the scales.

### Ethical Considerations

Ethics committee approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee (date: 14.06.2019, approval no: 2019/6), and written institutional permissions were obtained from the Gümüşhane Provincial Health Directorate (date: 24.05.2019, approval no: E.1271) and Bayburt Provincial Health Directorate (date: 14.02.2019, approval no: 91871880/903.07.01). In addition, the patients were informed about the research by the researcher, and their written and verbal consent was obtained.

## Results

The mean age of the patients was 61.82±11.45 years, ranging from 27 to 81 years. The average IDWG during a 3-month HD period was 2724.32±961.40 grams. The mean VAS thirst score was 4.62±1.68. In X province, 51.4% of patients were male, 75.0% were married, and 46.3% were housewives or unemployed. Additionally, 47.9% had only a primary school education, and 80.5% had comorbidities, with hypertension being the most common (57.4%). Furthermore, 60.6% reported a family history of chronic kidney diseas. In Y province, the demographic distribution was similar as 51.4% were male, 65.8% were married, and 51.5% were housewives or unemployed. Primary school education was the highest level attained by 46.7% of patients. The rate of comorbidities was also high (84.8%), with hypertension affecting 53.9% of patients and 60.5% of indivials did not have a family history of CKD (Table 1). Regarding VAS thirst scores, 62.2% of patients had moderate thirst, 25.6% had mild thirst, and 12.2% had severe thirst (Figure 1).

The Mann-Whitney U test revealed significant differences in the total FCHPS scores based on gender (Z=-2.393; p=0.017) and family history of CKD (Z=-3.537; p=0.000). However, no significant differences were found related to marital status, comorbidities, or education level (p>0.05) (Table 2). Similarly, significant differences were observed in the behavior subscale scores of the FCHPS based on gender (Z=-2.228; p=0.026) and the presence of comorbid chronic diseases (Z=-2.337; p=0.019). In contrast, no significant differences were found for marital status, family history of CKD, occupation, or education level (p>0.05) (Table 2).

The Independent samples t-test revealed a significant difference in the FCHPS knowledge subscale scores based on a family history of CKD (t=4.802; p<0.001). However, no significant differences were found for gender, marital status, or the presence of comorbidities (p>0.05).

The Independent samples t-test revealed a significant difference in the FCHPS attitude subscale scores based on the presence of comorbidities (t=2.261; p=0.025). However, no significant differences were found for gender, marital status, family history of CKD, occupation, or education level (p>0.05) (Table 2).

The parametric independent t-test revealed a significant difference in TDSHP scores based on gender (t=3.642; p<0.001). The one-way ANOVA showed a significant difference in TDSHP scores by occupation (F=7.063; p=0.001). Post-hoc analysis indicated that housewives/unemployed patients had significantly higher TDSHP scores (23.08±3.16) compared to employed/self-employed (18.75±7.16) and retired patients (20.76±5.67) (p<0.001). No significant differences were found for marital status, educational level, comorbidities, or family history of CKD with respect to TDSHP scores (p>0.05) (Table 3).

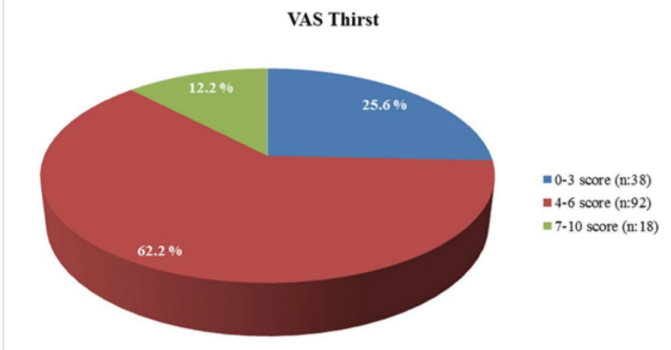


**Figure 1.** VAS severity of thirst (0-10)
VAS: Visual analog scale

**Table 1.** Descriptive, clinical and laboratory characteristics of HD patients in X and Y Hospitals (n=148)

| | | | | | |
|---|---|---|---|---|---|
| **Mean age (year)** | 61.82±11.45 (minimum: 27 maximum: 81) | | | | |
| **IDWG (gr)** | 2724.32±961.40 (minimum: 300 maximum: 5800) | | | | |
| **VAS** | 4.62±1.68 | | | | |
| **Characteristics** | | n | | % | |
| | | **X** | **Y** | **X** | **Y** |
| **Gender** | Female | 36 | 36 | 48.6 | 48.6 |
| | Male | 38 | 38 | 51.4 | 51.4 |
| **Marital status** | Married | 54 | 50 | 75.0 | 65.8 |
| | Single [divorced/widow(er)] | 18 | 26 | 25.0 | 34.2 |
| **Occupation** | Worker/civil servant/self-employed | 10 | 6 | 12.2 | 9.1 |
| | Retired | 34 | 26 | 41.5 | 39.4 |
| | Housewife/unemployed | 38 | 34 | 46.3 | 51.5 |
| **Education level** | Literate | 25 | 21 | 35.2 | 27.3 |
| | Primary school | 34 | 36 | 47.9 | 46.7 |
| | Secondary school and above | 12 | 20 | 16.9 | 26.0 |
| **Any comorbidity disease** | Yes | 66 | 56 | 80.5 | 84.8 |
| | No | 16 | 10 | 19.5 | 15.2 |
| **Type of comorbidity disease** | Hypertension | 66 | 62 | 57.4 | 53.9 |
| | Heart diseases | 20 | 26 | 17.4 | 22.6 |
| | Diabetes | 24 | 22 | 20.9 | 19.2 |
| | Stroke | 5 | 5 | 4.3 | 4.3 |
| **Family history of CKD** | Yes | 26 | 30 | 60.6 | 39.5 |
| | No | 40 | 46 | 39.4 | 60.5 |
| **Clinical and laboratory characteristics** | | **X** | | **Y** | |
| | Dialytic age (months) | 68±1.2 | | 64±2.4 | |
| | Body mass index | 24 (22-25) | | 24 (23-25.6) | |
| | IDWG (kg) | 2.7 | | 2.7 | |
| | Creatinine (mg/dL) | 8.65±2.64 | | 7.49±2.71 | |
| | Albumin (g/dL) | 3.82±0.36 | | 3.6±0.31 | |
| | Hemoglobin (g/dL) | 11.4±1.89 | | 11.4±1.25 | |
| | PTH | 216 (185-261) | | 267(166-328) | |
| | Kt/V | 1.30± 0.42 | | 1.31±0.24 | |
| | Na dialysate (mg/dl) | 140(140-140) | | 139(139-140) | |

CKD: Chronic kidney disease, X, Y: Hospital, PTH: Parathyroid hormone, Kt/V: K: Dialyzer clearance of urea, t: Dialysis time, V: Volume of distribution of urea

The Kruskal-Wallis test showed significant differences between VAS thirst levels and both the mean total FCHPS score (KW=12.298; p=0.002) and the behavior subscale scores of the TDSHP (KW=13.522; p=0.001). However, no significant difference was found between VAS thirst levels and the FCHPS knowledge subscale (p>0.05) (Table 4).

The one-way ANOVA revealed a significant difference between VAS thirst levels and the attitude subscale of the FCHPS (F=3.260; p=0.041). Post-hoc analysis indicated that this difference was driven by patients with mild and severe VAS thirst levels.

The mean scores for the key scales were as follows: TDSHP =21.67±5.02, FCHPS total scale =44.86±6.80, FCHPS behavior subscale =22.14±5.74, FCHPS knowledge subscale =12.54±2.79, and FCHPS attitude subscale =10.17±2.76 (Table 5).

Significant correlations were found between FCHPS scores and TDSHP total scores, FCHPS knowledge and behavior subscale scores, and IDWG and FCHPS behavior subscale scores (p<0.05). Additionally, a positive correlation was observed between the total FCHPS score and both the knowledge and behavior subscale scores, as well as between the VAS thirst score and IDWG (p<0.05). However, no significant correlation was found between TDSHP scores, FCHPS subscales, and IDWG (p>0.05) (Table 6).

**Table 2.** The FCHPS mean total and subscale scores of HD patients according to descriptive characteristics (n=148)

| Characteristics | | n | | FCHPS total | Behavior subscale | Knowledge subscale | Attitude subscale |
|---|---|---|---|---|---|---|---|
| | | X | Y | Mean rank | Mean rank | Score Mean ± SD | Score Mean ± SD |
| **Gender** | Female | 36 | 36 | 65.86 | 66.50 | 12.44±2.57 | 10.08±2.76 |
| | Male | 38 | 38 | 82.68 | 82.08 | 12.63±2.99 | 10.26±2.78 |
| | | | | Z=-2.393; p=**0.017**** | Z=-2.228; p=**0.026**** | t=-0.407; p=0.685 | t=-0.394; p=0.694 |
| **Marital Status** | Married | 54 | 50 | 75.71 | 76.46 | 12.51±2.71 | 10.23±2.59 |
| | Single [widow(er)/divorced] | 18 | 26 | 71.64 | 69.86 | 12.59±2.98 | 10.04±3.16 |
| | | | | Z=-0.530; p=0.596 | Z=-0.863; p=0.388 | t=-0.142; p=0.887 | t=0.371; p=0.711 |
| **Comorbid disease** | Yes | 66 | 56 | 72.60 | 70.73 | 12.49±2.86 | 10.40±2.75 |
| | No | 16 | 10 | 83.43 | 92.19 | 12.76±2.43 | 9.07±2.57 |
| | | | | Z=-1.172; p=0.241 | Z=-2.337; p=0.019** | t=-0.459; p=0.647 | t=2.261; p=0.025* |
| **Family history of CKD** | Yes | 26 | 30 | 90.43 | 86.86 | 13.85±2.28 | 9.92±2.52 |
| | No | 40 | 46 | 64.80 | 66.98 | 11.73±2.77 | 10.32±2.90 |
| | | | | Z=-3.537; p=0.000** | Z=-2.759; p=0.006 | t=4.802; p=0.000* | t=-0.847; p=0.398 |
| **Occupation** | Employee/civil servant/self-employed | 10 | 6 | 83.00 | 87.75 | 12.87±3.55 | 9.75±3.67 |
| | Retired | 34 | 26 | 83.23 | 80.90 | 12.63±2.79 | 10.56±2.38 |
| | Housewife/unemployed | 38 | 34 | 65.33 | 66.22 | 12.38±2.62 | 9.94±2.83 |
| | | | | KW=6.44; p=0.040*** | KW=5.644; p=0,059 | F=0.252; p=0.778 | F=1.040; p=0.356 |
| **Education level** | Literate and below | 25 | 21 | 80.07 | 80.02 | 12.91±3.09 | 9.86±2.48 |
| | Primaryschool graduate | 34 | 36 | 68.79 | 72.33 | 12.25±2.74 | 10.02±3.08 |
| | Secondary school and above | 12 | 20 | 79.00 | 71.31 | 12.62±2.40 | 10.93±2.31 |
| | | | | KW=2.385; p=0.303 | KW=1.139; p=0.566 | F=0.783; p=0.459 | F=1.606; p=0.204 |

*: Independent Samples t-test, **: Mann-Whitney U test, ***: Kruskal-Wallis test, Significance level p<0.001 and p<0.05, FCHPS: Fluid control scale in hemodialysis patients, SD: Standard deviation

## Discussion

In this study, we investigated the relationship between thirst distress, thirst severity, fluid control and IDWG in HD patients.

Thirst is a distressing symptom experienced by many HD patients. Our study found that thirst distress among HD patients was higher than the national norm and exceeded the TDSHP's midpoint of 18. Similar levels of thirst distress were reported in various studies (15,19,24,29), while American and Brazilian samples showed moderate distress (21,29), and Canadian samples showed mild distress (30). These differences may result from variations in sample characteristics, size, research methods, or design. Female HD patients in our study experienced higher thirst distress than males, consistent with findings from other research (29), possibly due to employment status differences. Unemployed patients, including housewives, had greater thirst distress than those employed or retired, similar to findings in other studies (29).

Fluid regulation is critical for HD patients. The mean score for the FCHPS was below moderate, aligning with results from Balım et al. (31). However, other studies (24,29,31-34) reported higher FCHPS scores, possibly due to differences in education levels and social environments among participants. In our study, HD patients with a family history of CKD and male patients showed higher compliance with fluid restriction, indicating increased awareness among those with a CKD family history. Another study (35) also highlighted the impact of gender and marital status on compliance with fluid control, as well as the influence of treatment duration and information on behavior and knowledge levels. Employment and spending time outside may affect male patients' adherence to fluid restrictions. In a related study (33), FCHPS scores for knowledge and attitude were similar to ours, with variations likely stemming from differences in educational background and information provided on fluid and salt restriction.

**Table 3.** TDSHP mean scores of HD patients in X and Y hospitals based on their descriptive characteristics

| Characteristics | | n | | Thirst distress scale |
|---|---|---|---|---|
| | | X | Y | Score mean ± SD |
| **Gender** | Female | 36 | 36 | 23.13±3.14 |
| | Male | 38 | 38 | 20.28±6.00 |
| | | | | t=3.642; p=**0.000*** |
| **Marital Status** | Married | 54 | 50 | 21.61±5.54 |
| | Single [widow(er)/divorced] | 18 | 26 | 21.81±3.55 |
| | | | | t=-0.224; p=0.823 |
| **Comorbid disease** | Yes | 66 | 56 | 21.73±5.01 |
| | No | 16 | 10 | 21.38±5.13 |
| | | | | t=-0.320; p=0.751 |
| **Family history of CKD** | Yes | 26 | 30 | 22.32±4.86 |
| | No | 40 | 46 | 21.28±5.10 |
| | | | | t=-1.237; p=0.219 |
| **Occupation** | Employee/civil servant/self-employed | 10 | 6 | 18.75±7.16 |
| | Retired | 34 | 26 | 20.76±5.67 |
| | Housewife/unemployed | 38 | 34 | 23.08±3.16 |
| | | | | F=7.063; **p=0.001**** |
| **Education level** | Literate and below | 25 | 21 | 22.08±3.47 |
| | Primary school graduate | 34 | 36 | 22.20±5.16 |
| | Secondary school and above | 12 | 20 | 19.93±6.21 |
| | | | | F=2.502; p=0.085 |

*: Independent samples t-test, **: One-way ANOVA, Significance level p<0.001 and p<0.05, TDSHP: Thirst distress scale in hemodialysis patients, HD: Hemodialysis, CKD: Chronic kidney disease SD: Standard deviation

**Table 4.** Mean total and subscale scores of the VAS, TDSHP, and FCHPS (n=148)

| VAS | n | TDSHP | FCHPS total | Behavior subscale | Knowledge subscale | Attitude subscale |
|---|---|---|---|---|---|---|
| | | Score mean±SD | Mean rank | Mean rank | Score mean ± SD | Score mean ± SD |
| Mild (0-3 points) | 38 | 21.57±5.09 | 66.97 | 62.82 | 11.94±3.12 | 10.00±2.90 |
| Moderate (4-6 points) | 92 | 22.06±4.86 | 83.00 | 84.11 | 12.93±2.50 | 9.22±2.15 |
| Severe (7-10 points) | 18 | 19.88±5.54 | 46.94 | 50.06 | 11.77±3.20 | 10.17±2.76 |
| | | F=1.431; p=0.242 | KW=12.298; p=0.002** | KW=13.522; p=0.001** | F=2.499; p=0.86 | F=3.260; p=0.041* |

*: One-way ANOVA, **: Kruskal-Wallis test, Significance level p<0.001 and p<0.05, VAS: Visual analog scale, TDSHP: Thirst distress scale in hemodialysis patients, FCHPS: Fluid control scale in hemodialysis patients

**Table 5.** HD patients' mean total and subscale scores on the FCHPS and TDSHP (n=148)

| Scale | Scale subscale | N | X ± SD | Min.-Max. | Score range/average |
|---|---|---|---|---|---|
| **TDSHP** | - | 148 | 21.67±5.02 | 6-29 | 6-30/18 |
| **FCHPS** | **Behavior subscale** | 148 | 22.14±5.74 | 13-56 | 6-18/12 |
| | **Knowledge subscale** | 148 | 12.54±2.79 | 7-18 | 7-21/14 |
| | **Attitude subscale** | 148 | 10.17±2.76 | 6-18 | 11-33/22 |
| | **Total** | 148 | 44.86±6.80 | 30-78 | 24-72/48 |

HD: Hemodialysis, FCHPS: The fluid control in hemodialysis patients scale, SD: Standard deviation, TDSHP: Thirst distress scale in hemodialysis patients, Min.-Max.: Minimum-maximum

**Table 6.** Relationship between interdialytic weight gain and mean total and subscale scores of the TDSHP, FCHPS, and VAS thirst score (n=148)

| Characteristics | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| (1) VAS thirst score | - | - | - | - | - | - | - |
| (2) FCHPS total score | r=-0.258** | - | - | - | - | - | - |
| (3) TDSHP total score | r=-0.120 | r=0.653** | - | - | - | - | - |
| (4) FCHPS behavior subscale score | r=-0.150 | r=0.831** | r=0.490** | - | - | - | - |
| (5) FCHPS attitude subscale score | r=-0.088 | r=0,003 | r=-0.427** | r=-0.349** | - | - | - |
| (6) Interdialytic weight gain | r=0.021 | r= -0.101 | r=0.004 | r=-0.072 | r=-0.183* | - | - |
| (7) VAS thirst scale score | r=-0.001 | r=-0,100 | r=-0.017 | r=-0.060 | r=-0.147 | r=0.866** | - |

TDSHP: Thirst distress scale in hemodialysis patients, FCHPS: Fluid control in hemodialysis patients scale, VAS: Visual analog scale *: p<0.05, **: p<0.01 (Pearson correlation analysis was used)

Our study's findings regarding FCHPS scores align with other research (34), indicating low knowledge of fluid restriction, moderate behavioral compliance, and low attitudinal compliance. Similar patterns were noted in other studies (31,35), where compliance was found to be moderate overall but varied by subscale, with high knowledge and moderate behavioral compliance but low attitudinal compliance. The low knowledge level in our sample may explain the low attitude score, likely due to the lower education level of participants. Additionally, some studies reported significant non-compliance rates with fluid restriction, such as 21.9% (29), 39.1%, 74%, and 68.8% (36-38), which is consistent with our findings (39-42). Enhanced knowledge, attitudes, and behaviors around fluid control may help HD patients reduce interdialytic fluid intake and, in turn, ultrafiltration needs.

The absence of a significant correlation between thirst distress and FCHPS subscale scores in our study may be due to the small sample size, moderate behavioral compliance, and high awareness in patients with a CKD family history. Thirst complicates fluid management and leads to IDWG in HD patients, impacting their quality of life. Our findings underscore the discomfort and quality of life impacts of thirst for HD patients.

The mean IDWG in our study was 2,724 grams, comparable to findings from other studies (43,44). IDWG levels above 2,500 grams increase the risk of cardiovascular disease and hypertension (45). Some studies reported higher IDWG than ours (35,46), while others observed lower values (6,7,29,31,32,47-49), with differences likely attributable to sample size, sodium levels in dialysis fluid, and seasonal changes. The lack of a significant correlation between thirst distress and IDWG may also be explained by our sample's size and awareness levels.

Thirst often leads to dry mouth and elevated IDWG, as noted in other studies (7,8,11,21,29). Patients often use strategies to manage thirst, such as chewing gum, reducing sodium intake, and measuring fluid intake (21). A study of 21,919 patients (29) also found that weight changes varied by region, and dialysate sodium concentration was a key factor influencing IDWG (50). Literature reviews indicate that thirst prevalence in HD patients ranges from 6% to 95% (50).

The moderate VAS thirst scores in our study align with prior research (6,29,34). A significant association between VAS thirst scores and FCHPS behavior and attitude subscale scores suggests that patients with higher thirst levels face more challenges in adhering to fluid restrictions. Additionally, increased VAS thirst scores were correlated with greater IDWG, indicating higher fluid retention between dialysis sessions, which is consistent with evidence linking thirst to IDWG (24,51,52). The lack of significant differences between VAS and thirst distress scale scores in our study might reflect seasonal variations, as data were collected in summer and autumn.

### Study Limitations

The limitation of the study was that data were collected only from two district hospitals in the black sea region and the period in which data were collected coincided with the time of coronavirus disease 2019.

## Conclusion

HD patients showed moderate behavioral compliance with fluid control and thirst distress but had low knowledge and attitudes, which hindered their ability to exhibit adequate fluid control behaviors. In HD patients with a moderate VAS thirst score, IDWG increased as the VAS thirst score increased. In HD patients with moderate to high thirst distress, no significant association was established between thirst distress scale scores, FCHPS subscale scores, and IDWG. By focusing on practical tools for fluid monitoring, a multi-disciplinary approach, tailored interventions based on compliance levels, and strategies to address thirst management, healthcare providers can help improve fluid control behaviors, reduce thirst distress, and enhance overall compliance among HD patients.

### Ethics

**Ethics Committee Approval:** Ethics committee approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee (date: 14.06.2019, approval no: 2019/6).

**Informed Consent:** The patients were informed about the research by the researcher, and their written and verbal consent was obtained.

**Footnotes**

**Authorship Contributions**

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

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## References

1. Tayaz E. Multidisciplinary evaluation of chronic renal failure and hemodialysis. Turk J Nephrol. 2019;28:303-9.
2. Liyanage T, Ninomiya T, Jha V, Neal B, Patrice HM, Okpechi I, et al. Worldwide Access to treatment for end-stage kidney disease: a systematic review. Lancet. 2015;385:1975-82.
3. Turkish Society of Nephrology. Turkish Kidney Registration System Report for 2020. Avaible from: URL: https://nefroloji.org.tr/tr/slider/tnd-ulusal-kayit-sistemi-2020-yili-verileri-sunulmustur-22
4. Leib DE, Zimmerman CA, Knight ZA. Thirst. Curr Biol. 2016;26:1260-5.
5. Gizowski C, Bourque CW. The neural basis of homeostatic and anticipatory thirst. Nat Rev Nephrol. 2018;14:11-25.
6. Fan WF, Zhang Q, Luo LH, Niu JY, Gu Y. Study on the clinical significance and related factors of thirst and xerostomia in maintenance hemodialysis patients. Kidney Blood Press Res. 2013;37:464-74.
7. Bots CP, Brand HS, Veerman EC, Valentijn-Benz M, Van Amerongen BM, Valentijn RM, et al. Interdialytic weight gain in patients on hemodialysis is associated with dry mouth and thirst. Kidney Int. 2004;66:1662-8.
8. Pan Y, Wu X, Zhu M, Zhang T, Gao L, Zhu Y, et al. Clinical significance and correlation of compliance to thirst in maintenance hemodialysis patients. Technol Health Care. 2023;32:1733-1743.
9. Garlapati K, Kammari A, Badam RK, B E S, Boringi M, Soni P. Meta-analysis on pharmacological therapies in the management of xerostomia in patients with Sjogren's syndrome. Immunopharmacol Immunotoxicol. 2019;41:312-8.
10. Tanasiewicz M, Hildebrandt T, Obersztyn I. Xerostomia of various etiologies: a review of the literature. Adv Clin Exp Med. 2016;25:199-206.
11. Igbokwe VU, Obika LFO. Thirst perception and dryness of mouth in healthy young adults Nigerians. Afr J Biomed Res. 2008;11:39-46.
12. Welch JL. Development of the thirst distress scale. Nephrol Nurs J. 2002;29:337-41.
13. Ahrari S, Moshki M, Bahrami M. The relationship between social support and adherence of dietary and fluids restrictions among hemodialysis patients in Iran. J Caring Sci. 2014;3:11-9.
14. Ikizler TA, Burrowes JD, Byham-Gray LD, Campbell KL, Carrero JJ, Chan W, et al. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. Am J Kidney Dis. 2020;76(3 Suppl 1):1-107.
15. Kara B. Validity and reliability of the Turkish version of the thirst distress scale in patients on hemodialysis. Asian Nurs Res. 2013;7:212-8.
16. Mistiaen P. Thirst, interdialytic weight gain, and thirst-interventions in hemodialysis patients: a literature review. Nephrol Nurs J. 2001;28:601-4.
17. Szczech LA, Reddan DN, Klassen PS, Coladonato J, Chua B, Lowrie EG, et al. Interactions between dialysis-related volume exposures, nutritional surrogates and mortality among ESRD patients. Nephrol Dial Transplant. 2003;18:1585-91.
18. Ozdemir O, Unsar S. The effect of education given to hemodialysis patients based on the Roy Adaptation Model on fluid management, symptom control, and quality of life. Nurs Health Sci. 2024;26:e13118.
19. Zoccali C, Moissl U, Chazot C, Mallamaci F, Tripepi G, Arkossy O, et al. Chronic fluid overload and mortality in ESRD. J Am Soc Nephrol. 2017;28:2491-7.
20. Bossola M, Pepe G, Vulpio C. The frustrating attempt to limit the interdialytic weight gain in patients on chronic hemodialysis: new insights into an old problem. J Ren Nutr. 2018;28:293-301.
21. Jacob S, Locking-Cusolito H. Thirst distress and interdialytic weight gain: how do they relate? CANNT J. 2004;14:33-7.
22. Giovannetti S, Barsotti G, Cupisti A, Morelli E, Agostini B, Posella L, et al. Dipsogenic factors operating in chronic uremics on maintenance hemodialysis. Nephron. 1994;66:413-20.
23. Oliver A, Wright M, Matson A, Woodrow G, King N, Dye L. Low sodium haemodialysis reduces interdialytic fluid consumption but paradoxically increases post-dialysis thirst. Nephrol Dial Transplant. 2004;19:2883-5.
24. Albayrak Cosar A, Cinar Pakyuz S. Scale development study: the fluid control in hemodialysis patients. Jpn J Nurs Sci. 2016;13:174-82.
25. Welch JL, Davis J. Self-care strategies to reduce fluid intake and control thirst in hemodialysis patients. Nephrol Nurs J. 2000;27:393-5.
26. Yang LY, Yates P, Chin CC, Kao TK. Effect of acupressure on thirst in hemodialysis patients. Kidney Blood Press Res. 2010;33:260-5.
27. Zwiech R, Bruzda-Zwiech A. The dual blockade of the renin-angiotensin system in hemodialysis patients requires decreased dialysate sodium concentration. Int Urol Nephrol. 2013;45:1365-72.
28. Nachman F, del Campo MP, González A, Corzo L, Vázquez H, Sfoggia C, et al. Long-term deterioration of quality of life in adult patients with celiac disease is associated with treatment noncompliance. Dig Liver Dis. 2010;42:685-91.
29. Kara B. Determinants of thirst distress in patients on hemodialysis. Int Urol Nephrol. 2016;48:1525-32.
30. Sugizaki CSA, Braga CC, Freitas ATVS, Peixoto MDRG. Transcultural adaptation of the Thirst Distress Scale (TDS) into Brazilian Portuguese and an analysis of the psychometric properties of the scale for patients on hemodialysis. J Bras Nefrol. 2020;42:153-62.

31. Balım S, Pakyüz SÇ. Evaluation of compliance with fluid restriction in hemodialysis patients. Journal of Nephrology Nursing. 2016;11:34-42.
32. Koşar Şahin C, Pakyüz SÇ, Çaydam ÖD. Evaluation the relationship between compliance of fluid restriction and patient activation in patient receiving hemodialysis. Journal of Adnan Menderes University Health Sciences Faculty. 2018;2:126-37.
33. Kulaksız AT, Arslan S. Adaptation to liquid ıntake restriction by persons undergoing haemodialysis treatment. STED. 2019;27:407-14.
34. Özkan ZK, Ünver S, Çetin B, Ecder, T. Determining of compliance of patients receiving hemodialysis for fluid control. Journal of Nephrology Nursing. 2019;14:10-16.
35. Karabulutlu EY, Yılmaz MÇ. Level of Concordance with fluid restriction in ındividuals receiving hemodialysis. Acıbadem Univ. Sağlık Bilim Derg. 2019;10:390-8.
36. Ozen N, Cinar FI, Askin D, Mut D, Turker T. Nonadherence in Hemodialysis Patients and Related Factors: A Multicenter Study. J Nurs Res. 2019;27:36.
37. Günalay S, Taşkıran E, Mergen H. Evaluation of dietary and fluid restriction non-adherence in patients on hemodialysis. DJ Med Sci. 2017;3:9-14.
38. Mollaoğlu M, Kayataş M. Disability is associated with nonadherence to diet and fluid restrictions in end-stage renal disease patients undergoing maintenance hemodialysis. Int Urol Nephrol. 2015;47:1863-70.
39. Saran R, Bragg-Gresham JL, Levin NW, Twardowski ZJ, Wizemann V, Saito A, et al. Longer treatment time and slower ultrafiltration in hemodialysis: Associations with reduced mortality in the DOPPS. Kidney Int. 2006;69:1222-8.
40. Stegmayr BG, Brannstrom M, Bucht S, Dimeny E, Ekspong A, Granroth B, et al. Minimized weight gain between hemodialysis contributes to a reduced risk of death. Int J Artif Organs. 2006;29:675-80.
41. Holmberg B, Stegmayr BG. Cardiovascular conditions in hemodialysis patients may be worsened by extensive interdialytic weight gain. Hemodial Int. 2009;13:27-31.
42. Brunelli SM, Chertow GM, Ankers ED, Lowrie EG, Thadhani R. Shorter dialysis times are associated with higher mortality among incident hemodialysis patients. Kidney Int. 2010;77: 630-36.
43. Turgut Kurt Y, Erdem E, Kaya C, Karataş A, Arık N. The Effect of Education Given to Hemodialysis Patients on Blood Pressure and Weight Gain. Turk J Nephrol. 2012;21:39-44.
44. Hecking M, Moissl U, Genser B, Rayner H, Dasgupta I, Stuard S, et al. reater fluid overload and lower interdialytic weight gain are independently associated with mortality in a large international hemodialysis population. Nephrol Dial Transplant. 2018;33:1832-42.
45. Flythe JE, Curhan GC, Brunelli SM. Disentangling the ultrafiltration rate-mortality association: the respective roles of session length and weight gain. Clin J Am Soc Nephrol. 2013;8:1151-61.
46. Maimani Y, Elias F, Salmi I, Aboshakra A, Alla M, Hannawi S. Interdialytic weight gain in hemodialysis patients: worse hospital admissions and ıntradialytic hypotension. OJ Neph 2021;11:156-70.
47. Şahin M, Altunören O, Sayarlıoğlu H. Effect of ınterdialytic weight gain on cardiovascular mortality and morbidity. KSU Medical Journal. 2022;17:104-11.
48. Bellomo G, Coccetta P, Pasticci F, Rossi D, Selvi A. The effect of psychological intervention on thirst and interdialytic weight gain in patients on chronic hemodialysis: A randomized controlled trial. J Ren Nutr. 2015;25:426-32.
49. Atılgan KG, Aylı MD, Ekenci, KD, Sökmen FC. Effect of hyponatremia on muscle mass and interdialytic weight gain in hemodialysis patients. Acta Haematol Oncol Turc. 2020;53:17-23.
50. Wong MM, McCullough KP, Bieber BA, Bommer J, Hecking M, Levin NW, et al. Interdialytic weight gain: trends, predictors, and associated outcomes in the International Dialysis Outcomes and Practice Patterns Study (DOPPS). Am J Kidney Dis 2017;69:367-379.
51. Bots CP, Brand HS, Veerman EC, Korevaar JC, Valentijn-Benz M, Bezemer PD, et al. Chewing gum and a saliva substitute alleviate thirst and xerostomia in patients on haemodialysis. Nephrol Dial Transplant. 2005;20:578-84.
52. Hoenich NA, Levin NW. Can technology solve the clinical problem of 'dry weight'? Nephrol Dial Transplant. 2003;18:647-50.

Original Article

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# The Role of 4D-CT in Hyperparathyroidism with Negative Scintigraphy: Identifying Causes of Diagnostic Challenges

## Negatif Sintigrafi Hiperparatiroidizmde 4D-BT'nin Rolü: Tanısal Zorlukların Nedenlerinin Belirlenmesi

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## ABSTRACT

**Objective:** The objective of this study is to evaluate the efficacy of four-dimensional computed tomography (4D-CT) in detecting parathyroid lesions not detected by scintigraphy, based on surgical findings, determine the frequency of lesions that go unnoticed or are evaluated as false positives (FP) and identify the causes thereof.

**Methods:** The population of this retrospective study consisted of 44 patients diagnosed as having hyperparathyroidism in our tertiary university hospital between August 2022 and January 2024, underwent scintigraphy, and had a 4D-CT scan upon negative scintigraphy results. A number of preoperative parameters, including demographic, laboratory, and clinical characteristics and imaging results of 38 patients included in the study sample, were analyzed. The patients' preoperative 4D-CT and surgical findings were compared in terms of abnormal parathyroid lesions.

**Results:** The mean age of the sample was 54.8±13.1 years. Twenty (52.6%) patients were asymptomatic, and 18 (47.4%) were symptomatic. 4D-CT imaging results revealed that the diagnoses of 36 (76.6%) patients were true positive (TP), 5 (10.6%) were FP, and 6 (12.8%) were false negative (FN). There were significant differences between the TP, FP, and FN groups in age, preoperative calcium levels, maximum lesion diameter, and short-to-long axis ratio of the lesion.

**Conclusion:** The 4D-CT demonstrates high accuracy in detecting parathyroid lesions in patients with scintigraphy-negative hyperparathyroidism. Factors such as preoperative calcium levels, age, and lesion size significantly influence diagnostic outcomes. The integration of 4D-CT into preoperative evaluation can enhance

## ÖZ

**Amaç:** Bu çalışmanın amacı, sintigrafi ile tespit edilemeyen paratiroid lezyonlarının tespit edilmesinde dört boyutlu bilgisayarlı tomografinin (4D-CT) etkinliğini değerlendirmek, cerrahi bulgulara dayanarak gözden kaçan veya yanlış pozitif (FP) olarak değerlendirilen lezyonların sıklığını belirlemek ve bunların nedenlerini tanımlamaktır.

**Yöntemler:** Bu retrospektif çalışmanın popülasyonu, Ağustos 2022 ile Ocak 2024 arasında üniversitemizin hastanesinde hiperparatiroidizm teşhisi konan, sintigrafiye tabi tutulan ve negatif sintigrafi sonuçları üzerine 4D-CT taraması yapılan 44 hastadan oluşuyordu. Çalışma örneğine dahil edilen 38 hastanın demografik, laboratuvar ve klinik özellikleri ile görüntüleme sonuçları dahil olmak üzere bir dizi parametre analiz edildi. Hastaların 4D-CT ve cerrahi bulguları anormal paratiroid lezyonları açısından karşılaştırıldı.

**Bulgular:** Örneklemin ortalama yaşı 54,8±13,1 yıldı. Yirmi (%52,6) hasta asemptomatik, 18 (%47,4) hasta semptomatikti. 4D-CT görüntüleme sonuçları, 36 (%76,6) hastanın tanısının gerçek pozitif (TP), 5 (%10,6) hastanın false positives (FP) ve 6 (%12,8) hastanın yanlış negatif (FN) olduğunu gösterdi. true positive (TP), FP ve FN grupları arasında yaş, preoperatif kalsiyum seviyeleri, maksimum lezyon çapı ve lezyonun kısa-uzun eksen oranı açısından anlamlı farklılıklar vardı. Daha küçük lezyon boyutu, daha düşük preoperatif kalsiyum seviyeleri ve ileri yaş, daha yüksek FP ve FN sonuçları ile ilişkiliydi.

**Sonuç:** Sintigrafi negatif hiperparatiroidizmi olan hastalarda paratiroid lezyonlarını tespit etmede 4D-CT yüksek doğruluk

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**ABSTRACT**

lesion localization, improving surgical planning and management.

**Keywords:** Four-dimensional computed tomography, primary hyperparathyroidism, parathyroid adenoma, parathyroid hyperplasia

**ÖZ**

göstermektedir. Preoperatif kalsiyum seviyeleri, yaş ve lezyon büyüklüğü gibi faktörler, tanısal sonuçları önemli ölçüde etkiler. Preoperatif değerlendirmeye 4D-CT'nin entegrasyonu, lezyon lokalizasyonunu geliştirerek cerrahi planlama ve yönetimi iyileştirebilir.

**Anahtar Kelimeler:** Dört boyutlu bilgisayarlı tomografi, primer hiperparatiroidizm, paratiroid adenomu, paratiroid hiperplazisi

## Introduction

Primary hyperparathyroidism (pHPT) is a common endocrinological disorder that is often detected within the scope of routine biochemical screening (1). Women are affected two to three times more often than men, especially after menopause. The diagnosis of pHPT is made based on high serum calcium and parathyroid hormone (PTH) levels as part of routine biochemical tests in asymptomatic cases or after presenting with symptoms such as kidney stones, stomach ulcers, bone cysts, and depression (2). In approximately 85% of patients, pHPT is caused by a solitary parathyroid adenoma (2). On the other hand, the incidence of pHPT cases featuring multiglandular involvement due to multiple adenomas (4%) or diffuse hyperplasia (10%) (2) is much less, reported in the literature between 8% and 33% (3).

Parathyroidectomy (PTx) is the only curative treatment method for pHPT (1). Before surgical intervention, technetium-99m sesta-methoxy isobutylisonitrile (Tc-99m sestamibi) scintigraphy is usually performed first, followed by ultrasonography (USG) to confirm the diagnosis (4,5). The parathyroid glands are generally localized at the four ends of the thyroid gland and less frequently in the superior mediastinum. However, it may be difficult to localize the parathyroid glands, which may also be localized elsewhere. The positive predictive value (PPV) for the accurate lateral localization of a parathyroid adenoma can be as high as 97% in cases where scintigraphy and ultrasound results are compatible (6). Cervical USG performed by an experienced parathyroid sonographer is the least costly imaging modality and is the most cost-effective strategy when combined with sestamibi or four-dimensional computed tomography (4D-CT) (7).

Multiglandular diseases (MGDs) of the parathyroid are caused by hyperplasia of all parathyroid glands or sometimes by double adenomas (8). Solitary adenomas can be treated with unilateral neck exploration and excision of the adenoma. Nevertheless, bilateral neck exploration may be required in patients suspected of having MGD and in patients in whom the localization of the lesion cannot be determined on preoperative imaging since the sensitivity of imaging in detecting MGD is lower in these patients.

CT is one of the most widely used modalities, and its usefulness has been demonstrated in several recently published studies (9,10). CT provides high-quality anatomic detail regarding the localization and ectopic localizations of the parathyroid glands in the neck. 4D-CT, first introduced by Rodgers et al. (11) in 2006, has been studied extensively since then. 4D-CT has emerged as a promising method for preoperative localization and consists of multiphase CT acquired at non-contrast, contrast agent-enhanced, arterial, and delayed phases. 4D-CT refers to the addition of time as the fourth dimension to the traditional three spatial dimensions (length, width, and height) used in imaging. In the context of parathyroid adenomas, this means that 4D-CT captures images of the neck at multiple time points during the administration of contrast material. The fact that the hypervascularity of parathyroid lesions leads to rapid enhancement (detectable in the arterial phase) and contrast washout (detectable in the venous and late phases) compared to lymph nodes constitutes the primary basis for the use of 4D-CT in the detection of parathyroid lesions.

Several recent studies recommend 4D-CT for preoperative assessment of parathyroid gland localization, particularly in patients with negative or inconclusive USG and Tc-99m sestamibi results, patients undergoing reoperation for parathyroid disease, and patients with pHPT with mild hypercalcemia and MGD (12-14). 4D-CT disadvantages include exposure to radiation, cost, and need for iodinated contrast. The volume CT dose index ($CTDI_{vol}$) typically ranges between 19 and 24 mGy (32-cm phantom), and the dose length product typically ranges between 400 and 600 mGy cm per CT phase (15).

Although previous studies reported that 4D-CT has higher sensitivity than USG and scintigraphy, the reasons why 4D-CT misses some lesions are not fully clear (16-18). In this context, this study was carried out to evaluate the efficacy of 4D-CT in detecting parathyroid lesions not detected by scintigraphy based on surgical findings, determine the frequency of lesions that go unnoticed or are evaluated as false positives (FP), and identify the causes thereof.

## Methods

### Study Design and Setting

This study was designed as a retrospective study. The protocol of this study was approved by the Akdeniz University ethics committee (approval number: 328, date: 06.06.2024). The study was carried out in accordance with the ethical principles outlined in the revised Declaration of Helsinki adopted by the World Medical Association General Assembly in Edinburgh in 2000. Informed consent was obtained from the patients before the conduct of the study.

**Population and Sample**

The study population consisted of 44 patients diagnosed as having hyperparathyroidism in our tertiary university hospital between August 2022 and January 2024, underwent scintigraphy, and had a 4D-CT scan upon negative scintigraphy results. Of these patients, six patients whose surgical outcomes were not available were excluded from the study. Of the remaining 38 patients included in the study sample, 35 were followed with a diagnosis of pHPT and 3 with a diagnosis of secondary hyperparathyroidism. One of the patients with pHPT had comorbid multiple endocrine neoplasia type 1 syndrome. Nine patients had MGD.

Patients' age, gender, serum calcium and PTH levels, presence of multinodular goiter, PTx history, and histopathological findings were obtained from the hospital's archive system (MIA MED, 1.0.1.3295) (Figure 1).

**Imaging Protocol**

The 4D-CT examinations were performed by obtaining precontrast, postcontrast arterial and venous phase images with a 2 x 64-slice dual-energy CT scanner (Siemens Somatom Definition Edge, Erlangen, Germany). Using the bolus tracking method, the "region of interest" was placed on the single-slice reference image in the descending aorta, and the threshold contrast value was set to 180 hounsfield units (HU) to begin imaging. Then, 80-100 mL of non-ionic iodinated low osmolarity contrast medium was injected via an antecubital vein with an automatic pump at a rate of 4-5 mL/sec. Following the injection, 40 mL of physiological serum solution was administered to ensure the homogeneous distribution of the contrast medium. The timing of the imaging was adjusted using the automatic bolus tracking method.

CT angiography scan parameters were set as follows: tube voltage: 120 kV; tube current: 300-640 mA; collimation: 128×0.5 mm; pitch value: 0.5 mm; gantry rotation time: 400 msec; slice thickness: 1 mm; and reconstruction interval: 1 mm. Per our imaging protocol, the arterial phase was used with a 25-second delay, and the venous phase was used with a 60-second delay.

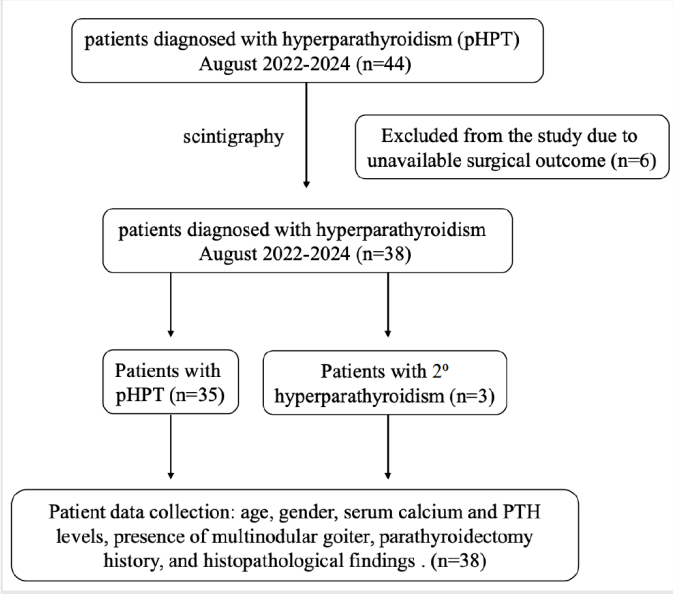


**Figure 1.** Flowchart

**Analysis of Imaging Findings**

The imaging findings of the patients available in the image archive system (Sectra Workstation IDS7; Sectra AB**,** Linköping, Sweden) were evaluated by a head and neck radiologist (A.G.A) who had 35 years of CT experience and was blinded to the clinical and pathological characteristics of the patients. The long axis of each parotid lesion was measured in millimeters using 4D-CT. The localization of the lesions, whether they were single, multiple, or ectopic, whether they had a polar vessel sign, their shape, their homogeneity, and whether they were calcified were evaluated. The densities of each parotid lesion in the precontrast, arterial, and venous phases were calculated in terms of HU (Figure 2).

The locations of all parathyroid lesions obtained with 4D-CT were classified as accurate or inaccurate by a radiologist (A.K.) with 19 years of experience by comparing the surgery notes with the radiological assessment reports. The compatibility of surgical findings with imaging findings and radiology reports in terms of exact anatomical quadrant localization of the parathyroid lesion, depth in the neck, and approximate size of the adenoma was deemed to indicate accurate localization (Figure 3). Missed-out lesions were evaluated retrospectively to identify factors limiting the initial interpretations, such as surgical extent, ectopic localization of multinodular goiter and parathyroid lesions, and multi-glandular disease. Patients with double adenomas or parathyroid hyperplasia were deemed to have MGD.

**Statistical Analysis**

The results of the statistical analyses were expressed using descriptive statistics, i.e., mean ± standard deviation values in the case of continuous (numerical) variables determined to conform to the normal distribution, median with minimum and maximum values in the case of continuous variables determined not to conform to the normal distribution, and numbers and percentage values in the case of categorical variables. The normal distribution characteristics of the numerical variables were analyzed using appropriate tests and visual tools such as histograms and quantile-quantile plots depending on the sample size and the characteristics of the data. Accordingly, while the Shapiro-Wilk test was preferred for small-size comparisons ($n<50$), the Kolmogorov-Smirnov and Anderson-Darling tests were used for large-size comparisons ($n\geq50$).

Kruskal-Wallis H and Mann-Whitney U tests were used to compare age, preoperative calcium and PTH levels, maximum lesion diameter, short-to-long axis ratio of the lesion, attenuation values in non-contrast CT, contrast enhancement in arterial and venous phases, and washout value between the groups.

Additionally, Pearson's chi-square test or Fisher-Freeman-Halton test were used to compare the groups in terms of variables such as gender, symptom status, specific symptoms, presence of multinodular goiter, PTx history, number of

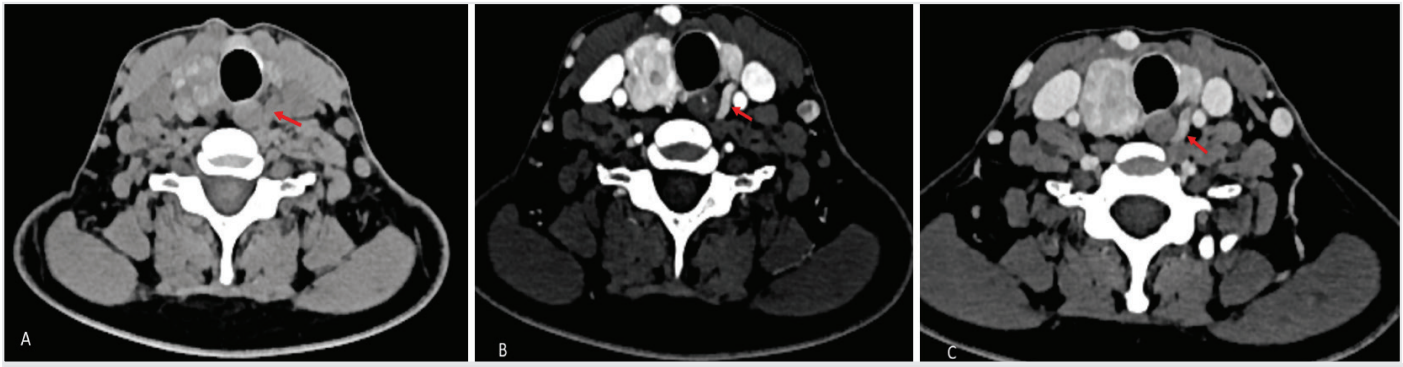


**Figure 2.** In a 48-year-old female patient followed up for recurrent multinodular goiter after total thyroidectomy, a 4D CT image shows a lesion located along the inferior part of the left lobe, between the ICA and the esophagus. The lesion is **A)** hypodense relative to thyroid parenchyma on pre-contrast sections, **B)** homogeneously enhances in the arterial phase, and **C)** shows washout in the venous phase, consistent with a parotid adenoma (red arrow)

*ICA: Internal carotid artery, CT: Computed tomography*

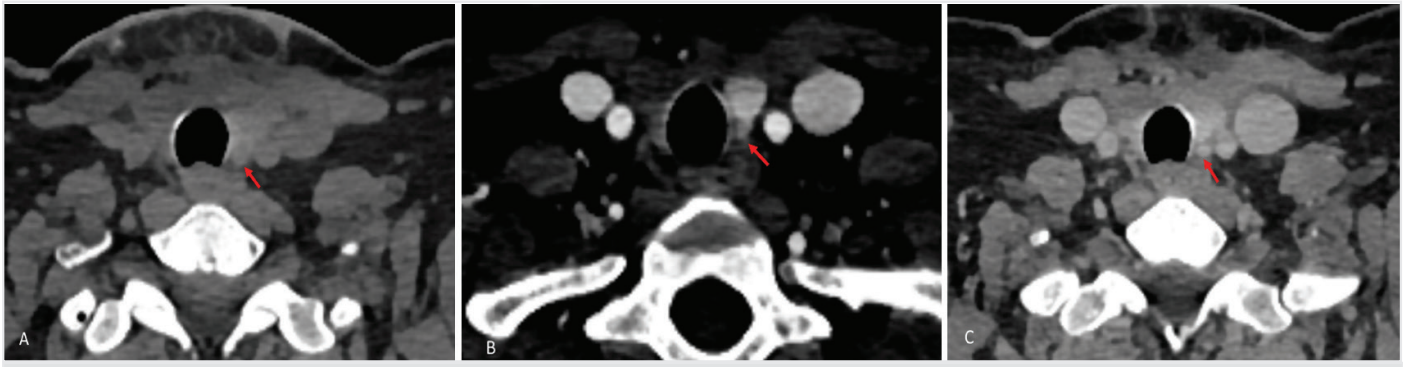


**Figure 3.** In a 46-year-old female patient, 4D-CT images reveal: the right lobe of the thyroid is surgically removed, and in the inferior part of the left lobe, **A)** a hypodense nodule compared to thyroid parenchyma on pre-contrast sequences, **B)** a nodule enhancing with contrast in the arterial phase, and **C)** a 6 mm nodule showing washout in the late phase (red arrow). Histopathological examination confirmed the lesion as a thyroid nodule

*CT: Computed tomography*

parathyroidectomies, pathology findings, localization of the lesion, presence of polar vessel sign, lesion shape, presence of calcification, and homogeneity.

## Results

### Patients' Characteristics

The mean age of the sample, which included 38 participants, 31 (81.6%) females and 7 (18.4%) males, was 54.8±13.1 years. Twenty (52.6%) patients were asymptomatic, and 18 (47.4%) were symptomatic. Among specific symptoms, nephrolithiasis was detected in 8 (44.4%) patients, osteoporosis/osteopenia in 6 (33.3%), chronic kidney disease in 2 (11.1%), and bone pain in 2 (11.1%). The mean preoperative calcium level of the patients was 11.0±0.6 mg/dL. The median preoperative PTH level of the patients was 91.0 pg/mL. Thirteen (34.2%) of the patients had goiter, and 4 (10.5%) had a history of PTx. Of the four patients with a history of PTx, two (50.0%) had undergone PTx once, and two (50.0%) had undergone PTx twice.

Pathology results based on 4D-CT classification indicated that three (60%) out of five FP patients had thyroid nodules, one (20%) had carotid bodies, and one (20%) had lymph nodes. On the other hand, three (50%) out of 6 false negative (FN) patients had parathyroid tissue, and the other three (50%) had parathyroid hyperplasia (Table 1).

### Diagnostic Accuracy of 4D-CT

There were significant differences between the TP, FP, and FN groups in age, preoperative calcium levels, maximum lesion diameter, and short-to-long axis ratio of the lesion ($p<0.05$ for each case). On the other hand, there was a significant difference between the groups in terms of the presence of multinodular goiter ($p=0.032$).

The mean age was significantly lower in the TP group than in the FP+FN group (borderline significant, $p=0.053$). Preoperative calcium level and maximum lesion diameter were significantly higher in the TP group than in the FP + FN group ($p=0.016$ and $p=0.007$, respectively). The lesion's median short-to-long axis

**Table 1.** Distribution of demographic, clinical and imaging characteristics of patients who underwent parathyroid surgery by diagnostic accuracy groups

| | Diagnostic accuracy groups based on 4D-CT imaging results | | | p-value |
|---|---|---|---|---|
| | TP (n=36) | FP (n=5) | FN (n=6) | |
| **Age**§ | 54.5 (15.0-78.0) | 57.0 (45.0-70.0) | 67.0 (60.0-78.0) | **0.027*** |
| **Gender**‡ | | | | |
| Female | 27 (75.0) | 4 (80.0) | 6 (100.0) | 0.481** |
| Male | 9 (25.0) | 1 (20.0) | 0 (0.0) | |
| **Symptom status**‡ | | | | |
| Asymptomatic | 19 (52.8) | 2 (40.0) | 3 (50.0) | 0.895** |
| Symptomatic | 17 (47.2) | 3 (60.0) | 3 (50.0) | |
| **Specific symptoms**‡ | | | | |
| Nephrolithiasis | 8 (47.1) | 1 (33.3) | 1 (33.3) | 0.191** |
| Osteoporosis/osteopenia | 6 (35.3) | 0 (0.0) | 1 (33.3) | |
| Chronic kidney disease | 1 (5.9) | 2 (66.7) | 0 (0.0) | |
| Bone pain | 2 (11.8) | 0 (0.0) | 1 (33.3) | |
| **Preoperative calcium level (mg/dL**§ | 11.1 (10.0-12.0) | 10.5 (9.0-10.7) | 10.9 (10.7-11.5) | **0.006*** |
| **Preoperative PTH level (pg/mL)**§ | 95.5 (32.0-2933.0) | 84.0 (62.0-2933.0) | 69.0 (32.0-98.0) | 0.101* |
| **Presence of multinodular goiter, yes**‡ | 11 (30.6)[a] | 1 (20.0)[a] | 5 (83.3)[b] | **0.032**** |
| **History of parathyroidectomy, yes**‡ | 3 (8.3) | 2 (40.0) | 0 (0.0) | 0.131** |
| **Number of parathyroidectomies (%)**‡ | | | | |
| 1 | 1 (33.3) | 1 (50.0) | 0 (0.0) | 0.999** |
| 2 | 2 (66.7) | 1 (50.0) | 0 (0.0) | |
| **Pathology findings**‡ | | | | |
| Parathyroid tissue | 12 (33.3)[a] | 0 (0.0)[a] | 3 (50.0)[a] | |
| Adenoma | 18 (50.0)[a] | 0 (0.0)[b] | 0 (0.0)[a] | |
| Parathyroid hyperplasia | 6 (16.7)[a] | 0 (0.0)[a] | 3 (50.0)[a] | |
| Thyroid nodule | 0 (0.0)[a] | 3 (60.0)[b] | 0 (0.0)[a] | |
| Lymph node | 0 (0.0)[a] | 1 (20.0)[b] | 0 (0.0)[a,b] | |
| Carotid body | 0 (0.0)[a] | 1 (20.0)[b] | 0 (0.0)[a,b] | |
| **Maximum lesion diameter (mm)**§ | 11.8 (4.6-24.0) | 4.9 (3.0-24.0) | 6.5 (4.3-12.0) | **0.022*** |
| **Localization of the lesion**‡ | | | | |
| Right upper | 2 (5.6) | 0 (0.0) | 1 (20.0) | 0.070** |
| Right lower | 17 (47.2) | 1 (20.0) | 1 (20.0) | |
| Left upper | 1 (2.8) | 1 (20.0) | 2 (40.0) | |
| Left lower | 14 (38.9) | 2 (40.0) | 1 (20.0) | |
| Ectopic | 2 (5.6) | 1 (20.0) | 0 (0.0) | |
| **Presence of polar vessel sign, yes**‡ | 14 (38.9) | 3 (60.0) | 2 (33.3) | 0.769** |
| **Lesion shape**‡ | | | | |
| Oval | 31 (86.1)[a] | 2 (40.0)[b] | 6 (100.0)[a] | **0.045**** |
| Round | 5 (13.9)[a] | 3 (60.0)[b] | 0 (0.0)[a] | |
| **Short-to-long axis ratio of the lesion**§ | 0.4 (0.1-0.9) | 0.7 (0.4-0.7) | 0.4 (0.4-0.6) | **0.050*** |
| **Presence of calcification, yes**‡ | 2 (5.6) | 0 (0.0) | 0 (0.0) | 0.999** |
| **Homogeneity**‡ | | | | |
| Homogeneous | 23 (63.9) | 5 (100.0) | 3 (75.0) | 0.303** |
| Heterogeneous | 13 (36.1) | 0 (0.0) | 1 (25.0) | |
| **Non-contrast CT attenuation values (HU)**§ | 52.5 (25.0-138.0) | 62.0 (31.0-76.0) | 48.0 (42.0-58.0) | 0.910* |
| **Attenuation values in the arterial phase (HU)**§ | 236.5 (70.0-649.0) | 236.0 (112.0-599.0) | 199.0 (116.0-484.0) | 0.793* |
| **Attenuation values in the venous phase (HU)**§ | 121.0 (10.0-258.0) | 136.0 (109.0-151.0) | 136.5 (111.0-242.0) | 0.666* |
| **Washout value**§ | 44.0 (-25.0-85.0) | 40.0 (-21.0-74.0) | 39.5 (-25.0- 50.0) | 0.557* |

‡: n (%), §: Median (minimum-maximum), *: Kruskal-Wallis H test, **: Pearson's chi-square test or Fisher-Freeman-Halton test, FP: False positives, TP: True positive, FN: False negative, CT: Computed tomography, HU: Hounsfield units

ratio was significantly lower in the TP group than in the FP + FN group (p=0.044).

There was no significant difference between the groups in terms of gender, symptom status, specific symptoms (nephrolithiasis, osteoporosis/osteopenia, chronic kidney disease, bone pain), preoperative PTH level, presence of multinodular goiter, PTx history, number of parathyroidectomies, pathology findings, localization of the lesion, presence of polar vessel sign, lesion shape, presence of calcification, homogeneity, non-contrast CT attenuation values, attenuation values in the arterial and venous phases and washout value (p>0.05 for each case) (Table 2).

## Discussion

We conducted this study to evaluate the efficacy of 4D-CT in localizing parathyroid lesions that went unnoticed by scintigraphy in patients with pHPT. Our findings showed that 4D-CT was highly accurate in detecting lesions not detected by scintigraphy and revealed the impact of specific clinical parameters on diagnostic accuracy.

In a meta-analysis of the diagnostic accuracy of 4D-CT in localizing pathological parathyroid glands in patients with hyperparathyroidism, Kluijfhout et al. (16) reported that CT accurately determined the quadrant in which the pathological parathyroid gland was localized with an overall pooled sensitivity of 73%, which increased to 81% with lateralization, and a PPV of 81%. Along these lines, Kairemo et al. (19) reported that 4D-CT had higher sensitivity than USG and parathyroid dual-phase scintigraphy in patients with pHPT. On the other hand, Siraj et al. (20) emphasized that thallium-201 parathyroid scintigraphy might play an additional diagnostic role in patients with negative scintigraphy results. We also found the TP rate of 4D-CT (76.6%) to be high, which was in line with the literature findings (16,19).

The 4D-CT is becoming increasingly popular due to its fast acquisition time, anatomical detail, and sensitivity compared to scintigraphy and/or USG. As demonstrated by the findings of our study, the performance of 4D-CT is even more evident in complex cases where conventional imaging yields negative or inconclusive results or cases requiring reoperation. In a study evaluating the efficacy of 4D-CT in patients in whom one or both single photon emission CT (SPECT)/CT and USG gave negative results, Yanar et al. (21) reported a pathological gland localization rate of 73.7%, sensitivity of 82.4% [95% confidence interval (CI): 60.4-95.3%], PPV of 93.3% (95% CI: 73.8-99.6%), and accuracy of 78.9%. In a study conducted with 100 patients over 50 years of age who underwent PTx for pHPT and whose sestamibi SPECT scintigraphy and USG results were incompatible, Tian et al. (22) found that the sensitivity of 4D-CT (72.9%) was higher than that of sestamibi SPECT scintigraphy (48.3%) and USG (52.3%).

In parallel, our findings revealed the efficacy of 4D-CT in the localization of parathyroid lesions and its capacity to accurately detect lesions that went unnoticed by scintigraphy and thus demonstrated that it could play an important role in surgical planning and management. The findings of our study also showed that factors such as preoperative calcium levels, age, and lesion size significantly affected the risk of misdiagnosis and, therefore 4D-CT might result in higher FP and FN rates in normocalcemic hyperparathyroid cases or patients with low baseline PTH levels. Lower baseline PTH levels and higher rates of MGD are associated with lower localization rates on preoperative imaging and increased rates of failed minimally invasive PTx (23). In another study, Al-Difaie et al. (24) found that 4D-CT had high lesion-based sensitivity in patients with pHPT and low baseline PTH levels but that the success rate of image-guided resection was relatively low in patients with low baseline PTH levels. Low baseline PTH levels have also been associated with lower diagnostic accuracy of methods such as scintigraphy and USG (25,26). In this context, in addition to demonstrating the efficacy of 4D-CT in the scintigraphy-negative patient population, our study demonstrates the importance of increased attention during 4D-CT examination and surgical planning in patients with low baseline PTH levels. The fact that low PTH values are associated with the presence of MGD and the small size of parotid lesions in the literature reveals the importance of considering these factors in the radiological evaluation of cases with low PTH values.

Although it is known that the presence of thyroid nodules limits the efficacy of USG, it did not affect the localization of parathyroid adenoma by 4D-CT in our study. However, when FP patients were evaluated retrospectively, thyroid nodules were the leading cause of incompatibility between 4D-CT and surgical findings, even though our sample size was small. As a matter of fact, in a study including 411 patients in which the diagnostic efficacy of 4D-CT was evaluated, Sho et al. (27) found discordance between 4D-CT results and surgical findings in 123 (29.9%) patients and found that the presence of multinodular goiter/thyroid nodules was associated with discordance between 4D-CT results and pathology findings. They also found that MGD, a parathyroid lesion size of 10 mm or less, and an inferiorly positioned parathyroid lesion were associated with discordance between preoperative parathyroid 4D-CT results and intraoperative findings.

MGDs was the most common source of error in 4D-CT localization studies overall, suggesting that the reported relative superiority of 4D-CT over USG and sestamibi SPECT in detecting the MGD is only modest. Although 4D-CT is the least operator-dependent modality compared to USG or sestamibi SPECT, detecting MGD with 4D-CT remains a significant challenge, as with other localization techniques. In this regard, considering that the surgeons must be aware of the significant limitations of 4D-CT in surgical planning concerning patients with MGD, routine use of a risk-scoring system based on biochemical factors for detecting MGD may improve preoperative identification of these patients.

Both morphologically and on pre-contrast images, lymph nodes can mimic parathyroid lesions due to their similar hypodense appearance relative to the thyroid gland. However, on contrast-enhanced images, lymph nodes exhibit a progressive increase in

**Table 2.** Pairwise comparisons of demographic, clinical and imaging characteristics of patients who underwent parathyroid surgery between true and false diagnosis groups

| | True and false diagnosis groups based on 4D-CT imaging results | | p-value |
|---|---|---|---|
| | TP (n=36) | FP + FN (n=11) | |
| **Age**§ | 54.5 (15.0-78.0) | 60.0 (45.0-78.0) | 0.053* |
| **Gender**‡ | | | |
| Female | 27 (75.0) | 10 (90.9) | 0.413** |
| Male | 9 (25.0) | 1 (9.1) | |
| **Symptom status**‡ | | | |
| Asymptomatic | 19 (52.8) | 5 (45.5) | 0.936** |
| Symptomatic | 17 (47.2) | 6 (54.5) | |
| **Specific symptoms**‡ | | | |
| Nephrolithiasis | 8 (47.1) | 2 (33.3) | 0.399** |
| Osteoporosis/osteopenia | 6 (35.3) | 1 (16.7) | |
| Chronic kidney disease | 1 (5.9) | 2 (33.3) | |
| Bone pain | 2 (11.8) | 1 (16.7) | |
| **Preoperative calcium level (mg/dL)**§ | 11.1 (10.0-12.0) | 10.7 (9.0-11.5) | **0.016*** |
| **Preoperative PTH level (pg/mL)**§ | 95.5 (32.0-2933.0) | 76.0 (32.0-2933.0) | 0.175* |
| **Presence of multinodular goiter, yes**‡ | 11 (30.6) | 6 (54.5) | 0.171** |
| **History of parathyroidectomy, yes**‡ | 3 (8.3) | 2 (18.2) | 0.578** |
| **Number of parathyroidectomies**‡ | | | |
| 1 | 1 (33.3) | 1 (50.0) | 0.999** |
| 2 | 2 (66.7) | 1 (50.0) | |
| **Pathology findings**‡ | | | |
| Parathyroid tissue | 12 (33.3)[a] | 3 (27.3)[a] | |
| Adenoma | 18 (50.0)[a] | 0 (0.0)[b] | |
| Parathyroid hyperplasia | 6 (16.7)[a] | 3 (27.3)[a] | |
| Thyroid nodule | 0 (0.0)[a] | 3 (27.3)[b] | |
| Lymph node | 0 (0.0)[a] | 1 (9.1)[a] | |
| Carotid body | 0 (0.0)[a] | 1 (9.1)[a] | |
| **Maximum lesion diameter (mm)**§ | 11.8 (4.6-24.0) | 5.7 (3.0-24.0) | **0.007*** |
| **Localization of the lesion**‡ | | | |
| Right Upper | 2 (5.6) | 1 (10.0) | 0.053** |
| Right Lower | 17 (47.2) | 2 (20.0) | |
| Left Upper | 1 (2.8) | 3 (30.0) | |
| Left Lower | 14 (38.9) | 3 (30.0) | |
| Ectopic | 2 (5.6) | 1 (10.0) | |
| **Presence of polar vessel sign, yes**‡ | 14 (38.9) | 5 (45.5) | 0.737** |
| **Lesion shape**‡ | | | |
| Oval | 31 (86.1) | 8 (72.7) | 0.367** |
| Round | 5 (13.9) | 3 (27.3) | |
| **Short-to-long axis ratio of the lesion**§ | 0.4 (0.1-0.9) | 0.5 (0.4-0.7) | **0.044*** |
| **Presence of calcification, yes**‡ | 2 (5.6) | 0 (0.0) | 0.999** |
| **Homogeneity**‡ | | | |
| Homogeneous | 23 (63.9) | 8 (88.9) | 0.236** |
| Heterogeneous | 13 (36.1) | 1 (11.1) | |
| **Non-contrast CT attenuation values (HU)**§ | 52.5 (25.0-138.0) | 49.0 (31.0-76.0) | 0.921* |
| **Attenuation values in the arterial phase (HU)**§ | 236.5 (70.0-649.0) | 221.0 (112.0-599.0) | 0.523* |
| **Attenuation values in the venous phase (HU)**§ | 121.0 (10.0-258.0) | 136.0 (109.0-242.0) | 0.460* |
| **Washout value**§ | 44.0 (-25.0-85.0) | 40.0 (-25.0-74.0) | 0.364* |

‡: n (%), §: Median (minimum-maximum), *: Mann-Whitney U test, **: Pearson's chi-square test or Fisher-Freeman-Halton test, [a,b]: Different superscripts indicate statistical differences between groups in each row. There is no statistical difference between groups with the same superscripts, HU: Hounsfield units

enhancement, particularly in the venous phase, which is atypical for parathyroid lesions. Our study, along with the literature, suggests that millimeter-sized carotid body tumors and lymph nodes with atypical enhancement patterns can be misdiagnosed as parathyroid glands. Nonetheless, there is a paucity of literature specifically examining the FP rate of 4D CT for these two lesions.

The findings of this study, together with the relevant findings in the literature, suggest that future research should focus on technical and methodological improvements to increase the efficacy of 4D-CT. In this context, combining new-generation imaging methods, especially fluorocholine positron emission tomography-CT (FCH-PET/CT) with 4D-CT, can potentially increase diagnostic accuracy and reduce FP and FN rates (28). In fact, the study by Stanciu et al. (29) showed that SPECT/CT was superior to scintigraphy and could accurately localize parathyroid adenoma, indicating the future potential of combined imaging methods.

### Study Limitations

This study has several important limitations. First, its retrospective design might have introduced certain biases compared to prospective studies, which might limit the validity of the data obtained. Additionally, our small sample size might have negatively affected the accuracy and reliability of our findings compared to studies with larger sample groups.

Secondly, given that it is a costly imaging modality and exposes patients to radiation, 4D-CT may not be routinely used in every patient, which may limit its widespread clinical use. The literature has raised valid concerns regarding patient radiation exposure with a three-phase protocol. However, the small attributable risk in the typical middle-aged patient with PHPT is outweighed by the benefits of increased diagnostic accuracy.

Thirdly, the fact that 4D-CT yields FN or FP results in some patients has led us to question its reliability. FN results may lead to difficulties in detecting small or ectopic lesions in particular, whereas FP results may lead to unnecessary surgical interventions. Therefore, using 4D-CT in combination with other imaging modalities should be considered, as it may help increase diagnostic accuracy.

## Conclusion

In conclusion, our study revealed that 4D-CT had high diagnostic accuracy in diagnosing scintigraphy-negative hyperparathyroidism and could effectively detect lesions that could not be detected by scintigraphy. Our findings indicated that 4D-CT had a high TP rate and low FP and FN rates. In addition, factors such as preoperative calcium levels, age, and small lesion size were found to significantly affect the risk of misdiagnosis.

### Ethics

**Ethics Committee Approval:** This study was designed as a retrospective study. The protocol of this study was approved by the Akdeniz University ethics committee (approval number: 328, date: 06.06.2024).

**Informed Consent:** Informed consent was obtained from the patients before the conduct of the study.

### Footnotes

### Authorship Contributions

Concept: A.K., G.A., Design: A.K., A.F.G., Data Collection or Processing: A.K., A.F.G., G.A., Analysis or Interpretation: A.K., A.F.G., G.A., Literature Search: A.K., A.F.G., G.A., Writing: A.K.

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

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## References

1. Khan AA, Hanley DA, Rizzoli R, Bollerslev J, Young JE, Rejnmark L, et al. Primary hyperparathyroidism: review and recommendations on evaluation, diagnosis, and management. A Canadian and international consensus. Osteoporos Int. 2017;28:1-19.
2. van Dalen A, Smit CP, van Vroonhoven TJ, Burger H, de Lange EE. Minimally invasive surgery for solitary parathyroid adenomas in patients with primary hyperparathyroidism: role of US with supplemental CT. Radiology. 2001;220:631-9.
3. Barczyński M, Bränström R, Dionigi G, Mihai R. Sporadic multiple parathyroid gland disease--a consensus report of the European Society of Endocrine Surgeons (ESES). Langenbecks Arch Surg. 2015;400:887-905.
4. Kowalski GJ, Buła G, Żądło D, Gawrychowska A, Gawrychowski J. Primary hyperparathyroidism. Endokrynol Pol. 2020;71:260-70.
5. Thier M, Nordenström E, Bergenfelz A, Westerdahl J. Surgery for patients with primary hyperparathyroidism and negative sestamibi scintigraphy-a feasibility study. Langenbecks Arch Surg. 2009;394:881-4.
6. Kunstman JW, Kirsch JD, Mahajan A, Udelsman R. Clinical review: Parathyroid localization and implications for clinical management. J Clin Endocrinol Metab. 2013;98:902-12.
7. Wilhelm SM, Wang TS, Ruan DT, Lee JA, Asa SL, Duh QY, et al. The The American Association of Endocrine Surgeons guidelines for definitive management of primary hyperparathyroidism. JAMA Surg. 2016;151:959-68.
8. Sung JY. Parathyroid ultrasonography: the evolving role of the radiologist. Ultrasonography. 2015;34:268-74.
9. D'Agostino J, Diana M, Vix M, Nicolau S, Soler L, Bourhala K, et al. Three-dimensional metabolic and radiologic gathered evaluation using VR-RENDER fusion: a novel tool to enhance accuracy in the localization of parathyroid adenomas. World J Surg. 2013;37:1618-25.
10. Zald PB, Hamilton BE, Larsen ML, Cohen JI. The role of computed tomography for localization of parathyroid adenomas. Laryngoscope. 2008;118:1405-10.

11. Rodgers SE, Hunter GJ, Hamberg LM, Schellingerhout D, Doherty DB, Ayers GD, et al. Improved preoperative planning for directed parathyroidectomy with 4-dimensional computed tomography. Surgery. 2006;140:932-41.
12. Kelly HR, Hamberg LM, Hunter GJ. 4D-CT for preoperative localization of abnormal parathyroid glands in patients with hyperparathyroidism: accuracy and ability to stratify patients by unilateral versus bilateral disease in surgery-naive and re-exploration patients. AJNR Am J Neuroradiol. 2014;35:176-81.
13. Chazen JL, Gupta A, Dunning A, Phillips CD. Diagnostic accuracy of 4D-CT for parathyroid adenomas and hyperplasia. AJNR Am J Neuroradiol. 2012;33:429-33.
14. Starker LF, Mahajan A, Björklund P, Sze G, Udelsman R, Carling T. 4D parathyroid CT as the initial localization study for patients with de novo primary hyperparathyroidism. Ann Surg Oncol. 2011;18:1723-8.
15. Bunch PM, Randolph GW, Brooks JA, George V, Cannon J, Kelly HR. Parathyroid 4D CT: What the Surgeon Wants to Know. Radiographics. 2020;40:1383-94.
16. Kluijfhout WP, Pasternak JD, Beninato T, Drake FT, Gosnell JE, Shen WT, et al. Diagnostic performance of computed tomography for parathyroid adenoma localization; a systematic review and meta-analysis. Eur J Radiol. 2017;88:117-28.
17. Eichhorn-Wharry LI, Carlin AM, Talpos GB. Mild hypercalcemia: an indication to select 4-dimensional computed tomography scan for preoperative localization of parathyroid adenomas. Am J Surg. 2011;201:334-8.
18. Galvin L, Oldan JD, Bahl M, Eastwood JD, Sosa JA, Hoang JK. Parathyroid 4D CT and Scintigraphy: What Factors Contribute to Missed Parathyroid Lesions? Otolaryngol Head Neck Surg. 2016;154:847-53.
19. Kairemo K, Jessop AC, Vija AH, Ding X, Spence D, Kappadath SC, et al. A Prospective Comparative Study of Using Ultrasonography, 4D-CT and Parathyroid Dual-Phase Scintigraphy with SPECT in Patients with Primary Hyperparathyroidism. Diagnostics (Basel). 2021;11:2006.
20. Siraj QH, Javaid A, Rasulova N. Dual-tracer radionuclide imaging in hyperparathyroidism: thallium-201 parathyroid scintigraphy revisited. Nucl Med Commun. 2021;42:32-42.
21. Yanar C, Kostek M, Unlu MT, Caliskan O, Dincer B, Cetinoglu I, et al. The Role of 4D-CT for Pre-Operative Localization in Patients with Primary Hyperparathyroidism with Negative Ultrasonography and/or Sestamibi SPECT/CT. Sisli Etfal Hastan Tip Bul. 2023;57:238-44.
22. Tian Y, Tanny ST, Einsiedel P, Lichtenstein M, Stella DL, Phal PM, et al. Four-Dimensional Computed Tomography: Clinical Impact for Patients with Primary Hyperparathyroidism. Ann Surg Oncol. 2018;25:117-21.
23. Cron DC, Kapeles SR, Andraska EA, Kwon ST, Kirk PS, McNeish BL, et al. Predictors of operative failure in parathyroidectomy for primary hyperparathyroidism. Am J Surg. 2017;214:509-14.
24. Al-Difaie Z, Scheepers MHMC, Engelen SME, Havekes B, Bouvy ND, Postma AA. Diagnostic Value of Four-Dimensional Dynamic Computed Tomography for Primary Hyperparathyroidism in Patients with Low Baseline Parathyroid Hormone Levels. Diagnostics (Basel). 2023;13:2621.
25. Kandil E, Alabbas H, Tufaro AP, Carson KA, Tufano RP. The impact of baseline intact parathyroid hormone levels on severity of primary hyperparathyroidism and outcomes in patients undergoing surgery. Arch Otolaryngol Head Neck Surg. 2010;136:147-50.
26. Khorasani N, Mohammadi A. Effective factors on the sensitivity of preoperative sestamibi scanning for primary hyperparathyroidism. Int J Clin Exp Med. 2014;7:2639-44.
27. Sho S, Yuen AD, Yeh MW, Livhits MJ, Sepahdari AR. Factors Associated With Discordance Between Preoperative Parathyroid 4-Dimensional Computed Tomographic Scans and Intraoperative Findings During Parathyroidectomy. JAMA Surg. 2017;152:1141-7.
28. Imperiale A, Bani J, Bottoni G, Latgé A, Heimburger C, Catrambone U, et al. Does 18F-Fluorocholine PET/CT add value to positive parathyroid scintigraphy in the presurgical assessment of primary hyperparathyroidism? Front Med (Lausanne). 2023;10:1148287.
29. Stanciu M, Boicean LC, Popa FL. The role of combined techniques of scintigraphy and SPECT/CT in the diagnosis of primary hyperparathyroidism: A case report. Medicine (Baltimore). 2019;98:14154.

Original Article

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# Prevalence of Dental Anomalies in a Sample of Turkish Children: A Retrospective Study

## Bir Grup Türk Çocuğunda Dental Anomalilerin Sıklığının Değerlendirilmesi: Retrospektif Çalışma

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## ABSTRACT

**Objective:** The aim of this study was to determine the prevalence of dental anomalies in Turkish children aged 2-14 years by panoramic radiographies. The most common dental anomaly, the frequency of multiple dental anomalies and gender differences were further evaluated.

**Methods:** Two thousand and thirty panoramic radiographies were scanned by two experts in a dimly illuminated environment. Anomalies were recorded in the Excel table under six main groups and 21 subgroups: size, number, position, texture, shape and eruption anomalies. A chi-square test was used to analyze the data at $p<0.05$.

**Results:** The mean age of the patients evaluated was 9.52±2.68 years, and the gender distribution was balanced. It was found that germ deficiency (8.3%) was the most prevalent anomaly. The most common type of anomaly was number anomaly (11.1%) in which no statistically differences were found between females and males ($p<0.05$). The germ deficiency was more common in the mandible, whereas microdontia, taurodontism, and dilaceration were more common in the maxilla. Additionally, 116 patients (6.1%) had multiple types of anomalies simultaneously.

**Conclusion:** The prevalence of dental anomalies was found to be 23.7%. It is crucial for clinicians to detect these anomalies in their early stages, as they can potentially lead to a variety of clinical complications.

**Keywords:** Children, dental anomaly, gender, panoramic radiography, prevalence

## ÖZ

**Amaç:** Bu çalışmanın amacı, 2-14 yaş arası Türk çocuklarında diş anomalilerinin görülme sıklığının panoramik radyografilerle belirlenmesidir. En sık görülen diş anomalisi türü, aynı anda birden fazla diş anomalisinin görülme sıklığı ve cinsiyet farklılıkları ayrıca değerlendirilmiştir.

**Yöntemler:** İki bin otuz adet panoramik radyografi, iki uzman tarafından loş bir ortamda taranmıştır. Anomaliler Excel tablosunda büyüklük, sayı, konum, doku, şekil ve sürme anomalileri olmak üzere altı ana grup ve 21 alt grup olarak kaydedilmiştir. Verilerin analizinde ki-kare testi kullanılmıştır ($p<0,05$).

**Bulgular:** Değerlendirilen hastaların ortalama yaşı 9,52±2,68 yıl olup cinsiyet dağılımının dengeli olduğu saptanmıştır. Germ eksikliğinin (%8,3) en sık görülen anomali olduğu belirlenmiştir. En sık görülen anomali türü sayı anomalisi (%11,1) olup, kadın ve erkekler arasında istatistiksel olarak anlamlı bir fark olmadığı saptanmıştır ($p<0,05$). Germ eksikliğinin mandibulada daha sık görüldüğü, mikrodonti, taurodontizm ve dilaserasyonun ise maksillada daha sık görüldüğü belirlenmiştir. Ek olarak 116 hastada (%6,1) aynı anda birden fazla anomali tipi görülmüştür.

**Sonuç:** Diş anomalilerinin görülme sıklığı %23,7 olarak bulunmuştur. Potansiyel olarak çeşitli klinik komplikasyonlara yol açabileceğinden, klinisyenlerin bu anomalileri erken evrede tespit etmesi çok önemlidir.

**Anahtar Kelimeler:** Çocuk, diş anomalisi, cinsiyet, panoramik radyografi, prevalans

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## Introduction

Dental anomalies are deviations in tooth structure that arise from improprieties in embryonic development that take place throughout the process of odontogenesis. They may be acquired, congenital, or developmental (1). Dental anomalies can be categorized according to their quantity, form, dimensions, eruption, and structure (2). In addition to dense invaginatus, taurodontism, macrodontia, inversion, and transposition, the term "dental anomaly" encompasses an extensive variety of irregularities (3). Clinical diagnosis of these anomalies is possible via examination or radiograph. They commonly result in dental abrasions, poor aesthetics, and difficulties with mastication. Additionally, they may result in occlusal incompatibilities as a consequence of heightened caries susceptibility caused by increased plaque accumulation, tooth attrition, and fractures. Research on dental anomalies helps to ascertain their prevalence within the population and mitigates complications associated with delayed treatment through the facilitation of prompt diagnosis and optimal treatment strategizing (3).

The occurrence rate of dental anomalies exhibits variation across the populations analyzed (2,4-8). It has been reported that the prevalence of dental anomalies in the Turkish populace ranges from 1.69% to 39.2% (5,6,9). The occurrence rate of dental anomalies has been documented in several scholarly works as follows: 36.7% for the Indian population (7), 40.8% for the Iranian population (4), 45.1% for the Saudi Arabian population (8) and 17.52% for the Nigerian population (2).

By analyzing panoramic radiographies, the study aims to determine the prevalence of dental anomalies among Turkish children aged 2 to 14 years, in addition to identifying the most prevalent dental anomaly, gender differences, and the frequency of multiple dental anomalies.

## Methods

### Research Ethics and Design

This retrospective cross-sectional study received approval from the Hacettepe University's Ethical Committee (approval number: 2023/13-09, date: 25.07.2023). This cross-sectional study assessed panoramic films of children aged 2 to 14 who submitted applications to the university's pediatric dentistry department between 2021 and 2022. All panoramic films utilized in this study were captured in the radiology department of the faculty using the identical panoramic film device (Morita Veraview IC5-HD, Tokyo, Japan). Their capturing purposes varied, including root development time, caries examination, and eruption. None of the films were exposed expressly for this research.

### Criteria for Inclusion and Exclusion

High-quality panoramic radiographies captured for any purpose between 2021 and 2022 were incorporated into the research. Exclusion criteria encompassed low-quality panoramic radiographies featuring artifacts, radiographs taken from patients with craniofacial defects including cleft lip and palate, patients undergoing fixed orthodontic treatment, and patients with syndromes including ectodermal dysplasia.

### The Collection of Data

Two impartial specialists assessed the radiographs using a computer monitor in a dimly illuminated environment. Each specialist assessed every patient's radiograph. The patients' dental anomalies, gender, and age were documented in an Excel file (Excel 2019; Microsoft Office). Amelogenesis imperfecta, germ deficiency, microdontia/macrodontia, ankylosed tooth, ectopic position, inversion, transposition, fusion-gemination, ectopic position, odontoplasia, ghost tooth, talon cusp, dilaceration, conical shaped teeth, taurodontism, dentin dysplasia, talon cusp, impacted tooth, and retained primary tooth were among the anomalies documented. The 21 anomalies mentioned can be classified into six primary categories: size (microdontia/macrodontia), number [germ deficiency (hypodontia, oligodontia), supernumerary teeth], position (ectopic position, inversion, transposition), texture (amelogenesis imperfecta, dentin dysplasia, turner tooth, odontoplasia, ghost tooth); shape (fusion-gemination, taurodontism, conical shaped teeth, dilaceration, dens invaginatus, talon cusp); and eruption (impacted tooth, retained primary tooth, eruption delay, ankylosed tooth) anomalies.

Following the evaluation of all anomalies by two experts, the radiographs that generated disagreement were reassessed, and a consensus was reached. A tooth was classified as having a talon cusp if its structure exhibited a V-shaped radiopaque structure (Figure 1) (10). Patients who exhibited five germ deficiencies or less were categorized as having hypodontia (11), while those who had six or more germ deficiencies were classified as having oligodontia (11). The determination of tarodontism was conducted in accordance with the criteria outlined by Shifman and Chananel (12). These criteria involved the vertical expansion of the pulp chamber and its rectangular shape.

### Statistical Analysis

The SPSS (version 23, SPSS, IBM) software was used to evaluate the data. Percentages were compared using chi-square tests with p=0.05.

**Figure 1.** Eleven years old patient; 11 talon cusp, 18,48 germ deficiency

## Results

### Incidence of Dental Anomalies

Thirty-eight patients with cleft lip palate and one patient with ectodermal dysplasia were excluded from the study, out of a total of 2030 patients whose panoramic radiographies were evaluated. Seventy of the remaining 1991 patients were omitted from the study on account of substandard quality radiographs; the radiographs of patients from 1921 were assessed. The patients who were assessed had an average age of 9.52±2.68 years, and the gender distribution was balanced, with 50.4% females and 49.6% males. Table 1 presents the frequencies of the 21 anomalies that were assessed.

The most common anomaly was found to be germ deficiency (8.3%). A total of 358 patients (928 teeth) exhibited germ deficiency; among these, tooth number 18 (47.5%) was identified as the most frequently affected tooth. Subsequently, teeth numbers 28 (42.2%), 38 (35.8%), and 48 (31.8%) were inserted. Taking into account the prevalence of germ deficiencies in third molars and excluding them, germ deficiency was detected in 160 patients (364 teeth). The most frequently occurring tooth numbers with germ deficiencies were as follows: 35 (36.3%), 45 (34.4%), 22 (28.1%), and 12 (25%). The teeth with the lowest prevalence of germ deficiency (0.6%) were teeth 11, 21, 33, and 36. No deficiency was detected in tooth 46. Of the cases 0.5% involved oligodontia and 7.9% involved hypodontia.

Following germ deficiency, the most prevalent dental anomalies were impacted teeth (4%) (Figure 2), ectopic position (3.7%), and supernumerary teeth (3%) (Figure 3), in that order. Tooth number 45 (16.9%) exhibited the highest frequency of occurrence among teeth exhibiting ectopic position.

A total of 35 patients (89 teeth) exhibited taurodontic disruption, with the molars 16 and 26 being the most commonly affected (57.1%). A total of 48 patients exhibited microdontia, with the number of affected teeth being identified as 21 (31.3%) and 22 (33.1%), respectively. A total of 50 patients (2.6%) exhibited dilaceration, while 77 patients (4%) presented with impacted teeth. The teeth with the highest incidence of impaction were teeth 13 (20.8%) and 23 (15.6%), in that order. Dilaceration was most prevalent (16%) in tooth number 16.

Upon examining 21 anomalies under six headings, it was ascertained that the number anomaly was the most prevalent form of anomaly (Table 2). Eruption anomalies were considerably more prevalent in females than in males statistically. Regarding the remaining categories of anomalies, no gender disparity was observed (Table 2).

### Anomalies in Primary Teeth

An anomaly associated with germ deficiency was observed in one primary tooth (number 82). An anomaly of fusion-gemination was found in one primary tooth, where fusion occurred between the supernumerary tooth and tooth number 72. Dentin dysplasia was detected in primary teeth in only three cases. After thoroughly analyzing all the radiographs, it was determined that there was one primary tooth that was impacted, one primary tooth that was ankylosed, and two phantom teeth that were identified among the primary teeth (Table 1).

### Maxilla-mandible and Gender Differences

While certain dental anomalies such as ectopic position anomalies, microdontia, taurodontism, and dilaceration were more prevalent in the maxilla, germ deficiency is more prevalent in the mandibula (Table 3). A higher incidence of impacted

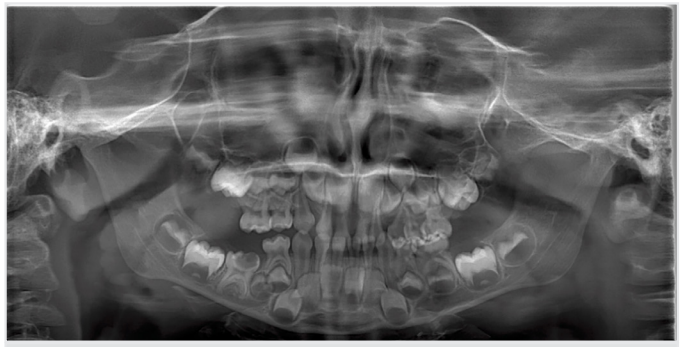

**Figure 2.** Four years old patient; 85 impacted primary tooth, 45 ectopic position

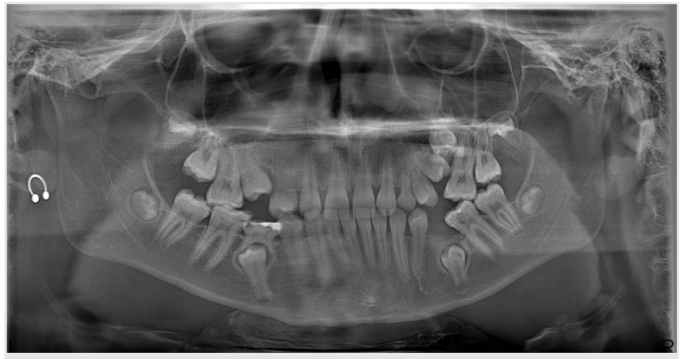

**Figure 3.** Thirteen years old patient; supernumerary tooth in the upper left molar region, 12,22, germ deficiency, 25,35 impacted teeth

**Figure 4.** Thirteen years old patient; 18,28,14,25 germ deficiency (number anomaly), 45,17 microdontia (size anomaly), 24 turner tooth (tissue anomaly), 45 ectopic position (position anomaly) and 85 retained primary tooth (eruption anomaly)

teeth (p=0.009) was observed in females compared to males, as indicated in Table 3.

### The Frequency of Occurrence of Different Types of Anomalies Simultaneously

Figure 4 illustrates a single patient in whom five of the six categories of anomaly types were simultaneously observed. Of all evaluated patients 5.1% were found to have two distinct types of anomalies concurrently. There were 116 patients (6.1%) who presented with multiple types of anomalies simultaneously, as shown in Table 4.

**Table 1.** Distribution of dental anomalies as count and percentage

| Dental anomalies | Total (%) | Permanent | Primary |
|---|---|---|---|
| Germ deficiency | 160 (8.3) | 159 | 1 |
| Impacted tooth | 77 (4) | 76 | 1 |
| Ectopic position | 71 (3.7) | 71 | - |
| Supernumerary tooth | 58 (3,0) | 57 | 1 |
| Dilaceration | 50 (2.6) | 50 | - |
| Microdontia | 48 (2.5) | 48 | - |
| Taurodontism | 35 (1,8) | 35 | - |
| Talon cusp | 34 (1.8) | 34 | - |
| Dens invaginatus | 16 (0.8) | 16 | - |
| Conical shaped tooth | 12 (0.6) | 12 | - |
| Fusion-gemination | 11 (0.6) | 10 | 1 |
| Dentin dysplasia | 11 (0.6) | 10 | 3* |
| Retained primary tooth | 5 (0.3) | - | 5 |
| Inversion | 5 (0.3) | 5 | - |
| Ghost tooth | 3 (0.2) | 2 | 1 |
| Turner tooth | 2 (0.1) | 2 | - |
| Amelogenesis imperfecta | 2 (0.1) | 2 | - |
| Transposition | 1 (0.1) | 1 | - |
| Odontoplasia | 1 (0.1) | 1 | - |
| Ankylosed tooth | 1 (0.1) | - | 1 |
| Eruption delay | 1 (0.1) | 1 | - |

*Two patients have dental anomalies in both their permanent and primary teeth

**Table 2.** Distribution of anomaly groups as count and percentage according to genders

| | Total (%) | Male (%) | Female (%) |
|---|---|---|---|
| Number anomaly | 213 (11.1) | 102 (10.7) | 111 (11.5) |
| Shape anomaly | 148 (7.7) | 78 (8.2) | 70 (7.2) |
| Position anomaly | 86 (4.5) | 44 (4.6) | 42 (4.3) |
| Eruption anomaly | 81 (4.2) | 29 (3)* | 52 (5.4)* |
| Size anomaly | 48 (2.5) | 21 (2.2) | 27 (2.8) |
| Tissue anomaly | 16 (0.8) | 7 (0.7) | 9 (0.9) |
| Total | 455 (23.7) | 219 (23) | 236 (24.4) |

*Reveals statistically significant difference between genders (p<0.05)

## Discussion

The dental anomaly concept contains a wide variety of anomalies such as germ deficiency, supernumerary teeth, taurodontism, macrodontia, microdontia, dense invaginatus, fusion, gemination, inversion and transposition. Dental anomalies can lead to various complications and cause damage. Research on dental anomalies not only determines their prevalence in society but also helps reduce complications related to delayed treatment by allowing rapid diagnosis and optimal treatment planning (2,3).

Utilizing digital panoramic radiographies, the prevalence of dental anomalies in patients aged 2 to 14 years was determined. Digital panoramic radiographies are favored over other advanced imaging techniques, such as computed tomography (CT), because they permit simultaneous examination of the dentition and jaw while consuming negligible amounts of radiation and at a low cost (6). As a result, this approach was favored in this retrospective investigation due to its capacity to assess a substantial quantity of radiographs.

Upon incorporating all dental anomalies that were examined, the overall incidence of anomalies was determined to be 23.7%. Previous studies that examined different Turkish populations regarding this point have reported a range between 1.69% and 39.2% (5,6,9). The variation in these rates between studies could potentially be attributed to differences in the age groups of the patients analyzed and the range of anomaly types assessed. For instance, Buyukgoze-Dindar and Tekbas-Atay (5) evaluated the panoramic radiographies of a patient group between the ages of 12 and 60, while in the current study the population age was between 2 and 14 years old. Furthermore, comprehensive dental anomaly subgroups were evaluated in the current study in comparison to previous studies (5,6,9). It is also important to note that as the number of anomalies increases, the percentage of patients with anomalies also increases. Bilge et al. (6) evaluated a variety of dental anomalies closest to the present study by examining five main and 16 subgroups. Therefore, a similar percentage with this previous study was reported in the current study.

Anomalies of the primary teeth were also assessed in current study. It was ascertained that one participant possessed two turner teeth, four participants amounted to a total of five retained primary teeth, and one participant had one impacted primary tooth (Figure 2). An anomaly in primary teeth was identified at 0.45% in present study and this result was compatible with the previous results which ranged between 0.3-5.46% (13-15) in different Turkish populations. It is thought that this difference between the studies may be due to the difference in the age groups examined. While children between the ages of 2 and 5 were included in Kapdan et al. study (13), in current study, children aged 2-14 were included when determining primary tooth anomaly. An analysis of primary tooth studies conducted globally revealed that the occurrence rate of dental anomalies varied between 0.2% and 7.2% (16,17).

**Table 3.** Distribution of anomalies as count and percentage in jaws and genders

| | Maxilla (%) | Mandible (%) | Male (%) | Female (%) |
|---|---|---|---|---|
| Germ deficiency | 95 (4.9) | 104 (5.4) | 69 (7.2) | 91 (9.4) |
| Taurodontism | 31 (1.6) | 15 (0.8) | 16 (1.7) | 19 (2) |
| Microdontia | 39 (2) | 16 (0.8) | 21 (2.2) | 27 (2.8) |
| Dilaceration | 33 (1.7) | 23 (1.2) | 27 (2.8) | 23 (2.4) |
| Impacted tooth | 51 (2.7) | 28 (1.5) | 27 (2.8)* | 50 (5.2)* |
| Ectopic position | 41 (2.1) | 35 (1.8) | 37 (3.9) | (3.5) |

*Reveals statistically significant difference between genders ($p<0.05$)

**Table 4.** Distribution of patients with anomaly groups as count and percentage

| Number of anomaly groups | Frequency (%) |
|---|---|
| 0 | 1466 (76.3) |
| 1 | 339 (17.6) |
| 2 | 98 (5.1) |
| 3 | 16 (0.8) |
| 4 | 1 (0.1) |
| 5 | 1 (0.1) |
| Total | 1921 (100) |

Anomalies involving impacted were statistically more prevalent in females than males in the present study. While some studies did not find any discernible distinction between the genders (13,15,18,19), others did mention such variations (5,20). Brook et al. (20) found that supernumerary teeth were more prevalent in males and hypodontia was more prevalent in females. Buyukgoze-Dindar and Tekbas-Atay (5) documented a statistically significant increase in the incidence of microdontia and mesiodens anomalies among females.

Size anomaly was determined to be 2.5%, while number anomaly was 11.1% in the present study. The percentages, as reported in a comprehensive study by Jain et al. (19), were 6.25% and 2%, respectively. Although size anomaly occurrences were comparable between the two investigations, number anomaly occurrence rates varied. According to Bilge et al. (6), the Turkish population exhibited a number anomaly of 17% and a size anomaly of 8.2%. Additionally, position anomaly was the most prevalent one (60.8%), according to Bilge et al. (6) In this previous study (6), the most prevalent subgroups were impacted teeth (45.5%), dilaceration (16.3%), hypodontia (13.8%), and taurodontism (11.2%). It has been noted in the literature that while the frequency of anomalies may differ between studies, the sequence of the most prevalent anomalies remains consistent (1,5,6). Furthermore, number anomaly is the most prevalent in the current study. Hypodontia (germ deficiency) and impacted teeth are, in line with findings from other research (6,19), the most prevalent forms of anomalies.

The prevalence of talon cusp was determined to be 1.8% in present research. When the studies conducted in Turkey were examined (5,9), it was seen that there were few studies examining the talon cusp anomaly and its incidence was reported as 0.02-0.03%. It was documented that the prevalence of talon cusp among the population of Jordan was 0.55% (10). The results of the two studies are comparable; however, the age and racial composition of the groups under investigation might account for the marginal disparity between them.

In the literature, the incidence of hypodontia and oligodontia varies. They were 7.9% and 0.5%, respectively, according to present research. Bilge et al. (6) documented that the prevalence of hypodontia was 5.5%, but there was no occurrence of oligodontia. In another study conducted in Turkey, the prevalence of hypodontia was reported as 1.36% and the incidence of oligodontia was reported as 0.04% (5). Studies conducted in the Turkish population reported that the prevalence of hypodontia was between 1.5 and 6.77% (5,21). When other studies conducted around the world were examined, Olatosi et al. (2) reported the prevalence of hypodontia as 1.36%, similar to Buyukgoze-Dindar and Tekbas-Atay (5). Hypodontia was reported in 4.7% of cases by Jain et al. (19). The incidence of hypodontia has been 5.21% in the Iranian population (22) and 6.02% in the Puerto Rican (23) population. Although the characteristics of the population are different, the results are quite similar.

Each anomaly type identified in the current study was classified into six overarching categories, and the occurrence rate of multiple anomaly types concurrently was also ascertained. The study revealed that the occurrence rate for a single anomaly was 17.6%, while the occurrence rate for multiple anomalies concurrently was 6.1%. The number of studies examining the co-occurrence frequency of anomalies is exceedingly limited. The occurrence rate of a single anomaly was documented by Jain et al. (19) as 8%, whereas the occurrence rate of multiple anomalies was 0.27%. According to the findings of Bilge et al. (6), the occurrence rate of a single anomaly was 35.25%, while the occurrence rate of multiple anomalies was 3.91%. The higher frequency of multiple anomalies observed in the current study compared to other studies might be attributed to the subgroup quantity of anomalies that were assessed.

**Study Limitations**

There were some limitations to this study. First, since it was a retrospective study, intraoral examinations of the patients could not be performed. Furthermore, this information is lacking as the patient record archive at our institution does not contain any clinical data regarding the patients. The diagnosis of

many dental anomalies will be made easier by combining the evaluation of clinical examination and radiographic data. In particular, tissue anomalies are diagnosed based on the tissue seen radiographically, and this may cause some tissue anomalies, such as the early stages of mild amelogenesis imperfecta forms, to be overlooked. Another limitation of the study was that some dental anomalies could not be easily diagnosed with panoramic radiographies, which provide us a two-dimensional image of a three-dimensional structure. Therefore, it will be easier to make the diagnosis if you use imaging techniques like CT that offer three-dimensional examination. However, since the amount of radiation the patient would receive was taken into consideration once more and was only taken when necessary, it was believed that the hospital archive would not be sufficient for such a scan while taking CT in the pediatric patient group.

## Conclusion

Dentinal anomalies are extremely prevalent and broadly distributed across populations. Based on the findings of this research, the prevalence of dental anomalies was 23.7%, with number and shape anomalies being the most prevalent. Although there was no gender difference in the incidence of dental anomalies, according to subgroups, eruption anomalies were more common in females than in males. The occurrence rate of multiple anomalies occurring concurrently is 6.1%. There was a single patient who exhibited five distinct kinds of anomalies simultaneously. In the early stages, clinicians can make more accurate diagnoses of dental anomalies by having knowledge of the categories of anomalies, their prevalence in the jaw, and the fact that they may not always manifest symptoms but can lead to a variety of clinical complications.

### Ethics

**Ethics Committee Approval:** This retrospective cross-sectional study received approval from the Hacettepe University's Ethical Committee (approval number: 2023/13-09, date: 25.07.2023).

**Informed Consent:** Retrospective cross-sectional study.

### Footnotes

### Authorship Contributions

Concept: P.S.E., E.U.O., Design: P.S.E., E.U.O., Data Collection or Processing: P.S.E., S.K., E.U.O., Analysis or Interpretation: P.S.E., S.K., E.U.O., Literature Search: P.S.E., Writing: P.S.E., E.U.O.

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

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## References

1. Saberi EA, Ebrahimipour S. Evaluation of developmental dental anomalies in digital panoramic radiographs in Southeast Iranian Population. J Int Soc Prev Community Dent. 2016;6:291-5.
2. Olatosi OO, Oyapero A, Akinwande KO, Ayedun OS, Aladenika ET, Obe OI. Pattern and prevalence of dental anomalies among a paediatric population in Lagos, Nigeria. Niger Postgrad Med J. 2022;29:167-72.
3. Koch G, Poulsen S, Espelid I, Haubek D. Pediatric Dentistry: A Clinical Approach. 3rd ed. Chichester, West Sussex, UK: Ames, Iowa: John Wiley & Sons; 2017.
4. Ezoddini AF, Sheikhha MH, Ahmadi H. Prevalence of dental developmental anomalies: a radiographic study. Community Dent Health. 2007;24:140-4.
5. Buyukgoze-Dindar M, Tekbas-Atay M. Prevalence of Dental Anomalies Assessed Using Panoramic Radiographs in a Sample of the Turkish Population. Chin J Dent Res. 2022;25:189-96.
6. Bilge NH, Yesiltepe S, Torenek Agirman K, Caglayan F, Bilge OM. Investigation of prevalence of dental anomalies by using digital panoramic radiographs. Folia Morphol (Warsz). 2018;77:323-8.
7. Patil S, Doni B, Kaswan S, Rahman F. Prevalence of dental anomalies in Indian population. J Clin Exp Dent. 2013;5:183-6.
8. Afify AR, Zawawi KH. The prevalence of dental anomalies in the Western region of saudi arabia. ISRN Dent. 2012;2012:837270.
9. Almaz ME, Sönmez IS, Oba AA. Prevalence and Distribution of Developmental Dental Anomalies in Pediatric Patients. Meand Med Dent J. 2017;18:130-3.
10. Hamasha AA, Safadi RA. Prevalence of talon cusps in Jordanian permanent teeth: a radiographic study. BMC Oral Health. 2010;10:6.
11. Tsai PF, Chiou HR, Tseng CC. Oligodontia--a case report. Quintessence Int. 1998;29:191-3.
12. Shifman A, Chanannel I. Prevalence of Taurodontism Found in Radiographic Dental Examination of 1,200 Young-Adult Israeli Patients. Community Dent Oral Epidemiol. 1978;6:200-3.
13. Kapdan A, Kustarci A, Buldur B, Arslan D, Kapdan A. Dental anomalies in the primary dentition of Turkish children. Eur J Dent. 2012;6:178-83.
14. Altug-Atac AT, Erdem D. Prevalence and distribution of dental anomalies in orthodontic patients. Am J Orthod Dentofacial Orthop. 2007;131:510-4.
15. Uslu O, Akcam MO, Evirgen S, Cebeci I. Prevalence of dental anomalies in various malocclusions. Am J Orthod Dentofacial Orthop. 2009;135:328-35.
16. Moller P. Oral health survey of preschool children in Iceland. Acta Odontol Scand. 1963;21:47-97.
17. Yonezu T, Hayashi Y, Sasaki J, Machida Y. Prevalence of congenital dental anomalies of the deciduous dentition in Japanese children. Bull Tokyo Dent Coll. 1997;38:27-32.
18. McKibben DR, Brearley LJ. Radiographic determination of the prevalence of selected dental anomalies in children. ASDC J Dent Child. 1971;38:390-8.
19. Jain A, Saxena A, Jain S, Parihar APS, Rawat A. Prevalence of Developmental Dental Anomalies of Number and Size in Indian Population According to Age and Gender. Int J Clin Pediatr Dent. 2021;14:531-6.

20. Brook AH. Dental anomalies of number, form and size: their prevalence in British schoolchildren. J Int Assoc Dent Child. 1974;5:37-53.

21. Topkara A, Sari Z. Prevalence and distribution of hypodontia in a Turkish orthodontic patient population: results from a large academic cohort. Eur J Paediatr Dent. 2011;12:123-7.

22. Amini F, Rakhshan V, Babaei P. Prevalence and pattern of hypodontia in the permanent dentition of 3374 Iranian orthodontic patients. Dent Res J (Isfahan). 2012;9:245-50.

23. Pagan-Collazo GJ, Oliva J, Cuadrado L, Rivas-Tumanyan S, Elias-Boneta AR. Prevalence of hypodontia in 10- to 14-year-olds seeking orthodontic treatment at a group of clinics in Puerto Rico. P R Health Sci J. 2014;33:9-13.

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# The Efficacy of Acupressure Therapy on Chronic Mechanic Low Back Pain

## Kronik Mekanik Bel Ağrısında Akupresör Tedavisinin Etkinliği

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## ABSTRACT

**Objective:** Chronic mechanical low back pain, defined as lasting more than 3 months, is an important health burden causing loss of function and work capacity. The aim of the study was to determine the effectiveness of acupuncture treatment in patients with chronic low back pain.

**Methods:** Sixty patients with chronic mechanical low back pain were randomly divided into two groups. While acupuncture was applied to the first group, the second group received transcutaneous electrical nerve stimulation (TENS) and infrared therapy. All patients in both groups were included in the exercise program containing strengthening of abdominal, low back and back muscles. The effectiveness of treatment modalities were evaluated with low back range of motion parameters, pain with back movements, milligram test, visual analogue scale values of rest and activity pain, Oswestry low back pain disability and Roland-Morris functional assessment scales and short-form 36, at baseline, at the end of treatment and at 1st month follow-up.

**Results:** Significant improvement was observed in favor of acupuncture treatment group not only in the early period in terms of pain with back movements and patient self-reported pain parameters but also especially at the second visit in terms of disability-functional values. Quality of life was also found to be better in acupuncture group.

**Conclusion:** Ten sessions of acupressure application was found to be superior to 10 sessions of TENS combined with infrared therapy. The favorable effect lasted at 1st month follow-up after the end of the treatment.

**Keywords:** Chronic low back pain, acupressure, pain, alternative medicine, treatment

## ÖZ

**Amaç:** Üç aydan uzun süreli olarak tanımlanan kronik mekanik bel ağrısı, fonksiyon ve iş kapasitesi kaybına neden olan önemli bir sağlık yüküdür. Çalışmanın amacı, kronik bel ağrısı olan hastalarda akupunktur tedavisinin etkinliğini belirlemektir.

**Yöntemler:** Kronik mekanik bel ağrısı olan altmış hasta rastgele iki gruba ayrıldı. Birinci gruba akupunktur uygulanırken, ikinci gruba transkütanöz elektriksel sinir stimülasyonu ve infrared terapi uygulandı. Her iki gruptaki tüm hastalar karın, bel ve sırt kaslarının güçlendirilmesini içeren egzersiz programına dahil edildi. Tedavi modalitelerinin etkinliği başlangıçta, tedavi sonunda ve 1. ay takiplerinde bel hareket açıklığı parametreleri, sırt hareketleri ile ağrı, milligram testi, istirahat ve aktivite ağrısı görsel analog skala değerleri, Oswestry bel ağrısı özürlülük ve Roland-Morris fonksiyonel değerlendirme ölçekleri ve kısa-form 36 ile değerlendirildi.

**Bulgular:** Sırt hareketleri ile ağrı ve hastanın kendi bildirdiği ağrı parametreleri açısından sadece erken dönemde değil, özellikle ikinci vizitte özürlülük-fonksiyonel değerler açısından da akupunktur tedavi grubu lehine anlamlı iyileşme gözlendi. Yaşam kalitesi de akupunktur grubunda daha iyi bulunmuştur.

**Sonuç:** On seans akupresür uygulaması, kızılötesi ile kombine edilmiş 10 seans transkütanöz elektriksel sinir stimülasyonuna göre daha üstün bulunmuştur. Olumlu etki tedavi bitiminden sonraki 1 aylık takipte de devam etmiştir.

**Anahtar Kelimeler:** Kronik bel ağrısı, akupresör, ağrı, alternatif tıp, tedavi.

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## Introduction

Low back pain is the second most frequent type of body pain after headache in developed countries (1). Ten percent of back pain becomes chronic and almost 1% of the population is handicapped due to chronic low back pain (CLBP) (2). The aims of the chronic mechanic LBP (CMLBP) treatment are to release the pain, to increase the life quality and functional capacity and to prevent disability. The conservative treatment includes rest, medical treatment, physical treatment and rehabilitation techniques such as acupuncture, manipulation and exercises (3).

Another approach of CMLBP treatment is acupressure. Acupressure is an established treatment method of traditional Chinese medicine. The principle of the acupressure treatment is to press manually on the particular acupuncture points and painful body parts. The major aim here is to stimulate these points by various maneuvers and consequently release the blockings. This cheap and trustworthy treatment method decreases the pain threshold by the mechanisms of speeding up the energy (chi) flow, increasing the temperature, speeding up the circulation, relaxing the muscles and ligaments and increasing the secretion of endorphin (4,5). In recent years, there have been optimistic randomized controlled research reports, especially coming from Far East about the effectiveness of acupressure treatment on patients with different types of CLBP (6-9). The purpose of the study is to evaluate the effectiveness of acupuncture treatment for CLBP.

## Methods

### Selection of the patients

Sixty-two patients aged between 20 and 60 years, who were admitted to Physical Medicine and Rehabilitation Department of Trakya University Hospital, with low back pain lasting for 3 months or longer and diagnosed as having CMLBP by clinical evaluation and lumber radiographs were accepted to this research. Patients having CLBP caused by non-mechanic etiology were excluded and only patients with local CMLBP were included in the study for randomization. Patients' age, sex, height, weight, education, job and marital status were questioned and recorded.

The exclusion criteria were being younger than 20, older than 60; having prior lumbar spine surgery; having severe spinal diseases such as infectious spondylodiscitis, spinal malignity and inflammatory sacroiliitis-spondylitis; having concomitant pathological conditions, having skin lesions, having open wounds and irregular skin sense; being treated with acupressure before and pregnancy.

The study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Scientific Research and Ethics Committee of Trakya University (approval no: 2006/167, date: 02.11.2006). All participants gave written informed consent.

### Sample Size

Patients were randomized with the n, n+1 principle and the ones with the odd numbers were taken to the first group to be treated by acupressure and the other ones with the even numbers were taken to the second group to be treated by transcutaneous electrical nerve stimulation (TENS) + infrared (IR) therapy. Patients in the first group (intervention group) were given 15 minutes of lumbar acupressure as the treatment regime, while patients in the second group (control group) were applied 20 minutes of TENS and IR heating. Additionally, patients in both groups were given exercise programs to strengthen abdominal and dorsal muscles and instructed to take preventive measures to avoid back pain. The patients were advised to take paracetamol if needed. Each patient in both groups was treated once a day, five days a week and totally 10 sessions.

The treatment regime was applied to all the patients in the first group by the same doctor and to the second group (control group) patients by the therapists. Randomization, acupressure and evaluation were performed by the same doctor.

### Acupressure Treatment

Patients were asked to lie in prone position with a pillow under their stomach and relax. Lower extremity regions from feet to thigh, upper extremity regions from hand to elbow and low back region were denuded. Seventeen points were chosen in total. While choosing these points, traditional acupuncture points were considered and the ones which are valuable for the acupressure treatment on CMLBP patients were chosen. These are the chosen acupressure points:

**1. Lumbar acupressure points:** Bilateral BL-23 Shen shu point; on 1.5 cun (1 cun=3.3cm) lateral to the 2nd lumbar vertebra, bilateral BL-24 Qiaishu point; on 1,5 cun lateral to the 3rd lumbar vertebra, bilateral BL-25 Dachangshu point; on 1.5 cun lateral to the 4th lumbar vertebra, on the same level with upper limit of iliac crest, bilateral BL-26 Guangyuanshu point; on 1.5 cun lateral to the 5th lumbar vertebra (5).

**2. Lower extremity points:** BL-40 Weizhong point; in the middle of transverse line on popliteal fossa. BL-57 Chengshan point; on the middle line of the leg, at the conglutination point of gastrocnemius and calcaneus tendons. BL-60 Kunlun point; in the cavity between calcaneus tendon and external malleolus (5).

**3. Upper extremity points:** LI-4 Hegu point; between the 1st and 2nd metacarpal bones, in the middle. If the thumb and the forefinger are united, it is at the highest point of adductor pollicis muscle. LI-11 Quchi point; on the lateral part of the transversal cubital line while the elbow is flexed 90 degrees. PC-6 Neiguan point; 2 cun up from the wrist, between palmaris longus flexor carpi radialis tendons. Chosen acupressure points are shown in Figure 1.

Acupressure treatment was applied to the patients in the first group at these chosen points. The treatment was applied according to the principle of starting with gentle touch, getting harder and faster later and ending with soft, gentle touch (5). One session lasted 15 minutes. It was performed once a day, 5 times a week, for two weeks, makes up a total of 10 sessions.

**TENS**

Acupuncture-like TENS was applied to the lumbar region. (TENS device model: Med 4, serial no: 0349ND, Brazilian). TENS was applied as the patients lie prone with a pillow under their stomach. Four TENS electrodes were placed on the painful parts of the low back. TENS was applied with current passage time of 200-300 ms, the frequency of 2-4 Hz and amplitude enough to make muscle contractions noticeable with bare eyes. 20-minute sessions were applied once a day, 5 times a week, for 2 weeks, 10 times in total. The phrase of "acupuncture-like" is used for describing intense-low frequency model. Severe rhythmic muscle contractions occur without any paresthesia.

**IR**

IR was applied on naked skin with the dose enough to make the patient feel warm. IR was applied with a perpendicular angle to the area. It was applied once a day for 20 minutes, 10 sessions in total. IR is a superficial heater. Beam spectrum of these lamps is about 350-4000 nm. Most of the beams are around 1000 nm wavelength. These reach the superficial fascias. Heat speeds up the healing and helpful with chronic pain.

**Medical Treatment**

Every patient participating on the research was instructed to take 500 mg paracetamol tablets, maximum up to 1500-3000 mg when they had pain. The amount of tablets they needed was noted. The patients were asked not to have any medical treatment before the visits.

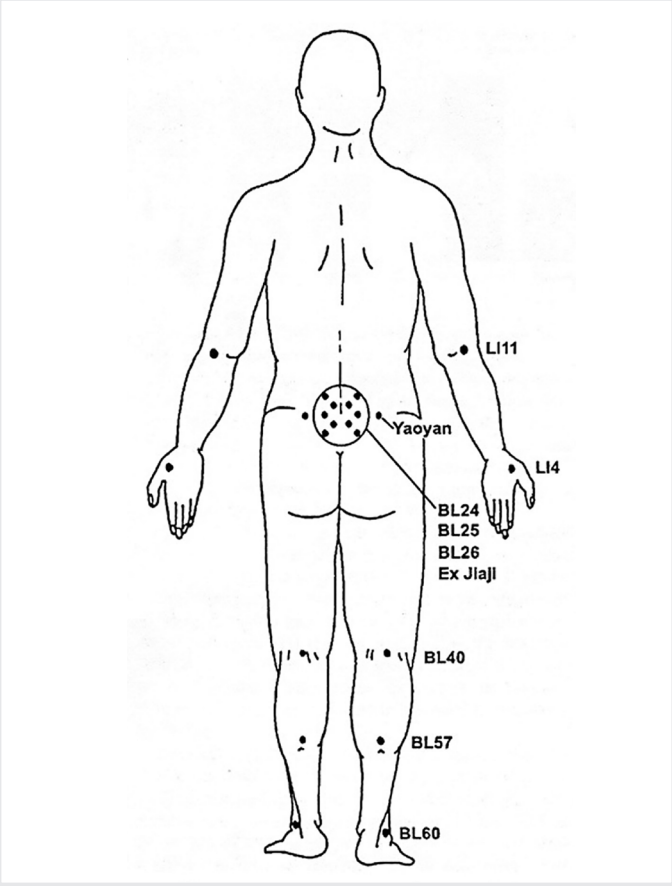


**Figure 1.** Acupressor points

**Outcome Assessment**

The clinical examination, consisting pain and function evaluation were performed at baseline before treatment; at the end of the treatment (1st control); and 30 days after the end of the treatment (2nd control).

The evaluation parameters of physical examination were: low back motion range, pain on back motions, visual analogue scale (VAS) values of pain, milligram test, nerve tension tests, and neurological examination. Severity of the pain was evaluated by VAS, functional state by Roland-Morris functional assessment forms and Oswestry low back pain disability and life quality by short-form 36 (SF-36).

**Oswestry Low Back Pain Disability Score:**

Patients were asked to rate 10 questions on the form from 0 to 5. The sum of the rates was multiplied by 2 and the result was used as the percent (10).

**Roland-Morris Functional Assessment Scala:**

Patients were asked to answer the questions beginning with "because of my low back pain" as yes/no. Every "yes" was counted 1 and every "no" was counted 0 and the sum of 24 questions was calculated. Higher score is worse for this survey (10).

**Visual analog scale:**

Was used to evaluate pain and SF-36 was used to evaluate quality of life at the patient's first and second visits (11).

**Statistical Analysis**

Statistical evaluations were made in statistical 7.1 and serial number program (AXA507C775506FAN3). The conformity of the data to the normal distribution was examined with the one-sample Kolmogorov-Smirnov test. In the comparison of the values of the treatment and control groups, the t-test was used in independent groups for normally distributed variables, and non-parametric type of the same test was used for non-normally distributed variables. Chi-square was used to investigate the intergroup differences of categorical variables. ANOVA was used for repetitive measurements to compare the measurements with normal distribution in the comparison of repetitive measurements within the groups, and Friedman's ANOVA tests were used for the measurements that did not show normal distribution. Wilcoxon test was used when significant difference was found. McNemar chi-square test was used to compare the values of categorical variables within the groups. The statistical significance limit was chosen as $p<0.05$.

## Results

As two patients dropped out of the program because of incompatibility, the research was carried on 60 patients. Thirty patients were included in the first group and the other 30 in the second group. The mean ages were 53.6±10.28 and 53.5±9.29

in the first and the second groups, consecutively. There was no statistically significant difference between the age means of these two groups (p=0.979). In the first group, 17 patients out of 30 were female (56.7%) and 13 patients were male (43.3%). In the second group, 21 patients out of 30 were female (70.0 %) and 9 patients were male (30.0 %). There were no statistically significant difference between these two groups in terms of gender (p=0.284). The mean body mass index (BMI) of the first group was 27.51±39 and for the second group it was 28.78±07. There was no significant difference in terms of mean BMI between the groups (p=0.249). The average durations of the symptoms were 95.24±90.40 months in the first group and 109.50±87.89 months in the second group with no significant difference in between (p=0.538).

**Comparison of the Clinical Assessment Parameters Between Two Groups at Baseline Before the Treatment**

We did not observe significant difference between the two groups in terms of hand-finger ground distance values; left and right lateral flexion, right and left rotation and extension ranges which are used for measuring limits of the low back motion before the treatment (p>0.05). Milligram test positivity, VAS values of the pain while resting and moving, OLBPDF, RMFAS and life quality parameters valued by SF-36 were not found to be significantly different, either (p>0.05).

**Evaluation of the Efficiency of the Treatment Within the Groups**

Clinical changes among baseline and first-second controls after the treatment were compared within the groups. There were significant differences between evaluations before the treatment and first and second controls after the treatment in terms of left and right lateral flexion values for the first group (p<0.05), however there were no significant difference for the second group (p>0.05). Significant improvements in terms of hand-finger ground distance were found between baseline evaluation and first-second controls after the treatment for all groups (p<0.05) (Table 1).

There were significant differences between baseline and first control in terms of left/right rotation and extension values in the first (the acupressure treatment) group (p<0.05), however, a significant difference was observed only for extension in the second group. The change was parallel with these results for the second control.

Milligram test changed significantly in the first group beginning from baseline, in advance to the first and second control visits (p<0.05). No such change was observed in the second group (p>0.05).

Pain evaluation using VAS values while resting and moving revealed significant improvement for both groups beginning from baseline proceeding to the first and second control visits (p<0.05). Such significant longitudinal change in terms of OLBPDF and RMFAS was found out only in the first acupressure treatment group (p<0.05) (Table 2).

Life quality parameters measured by using SF-36 were analyzed and changes between baseline visit and second control visit were analyzed in both groups. In the first group significant changes were determined in terms of physical function, role limitations due to emotional problems, body pain, general mental health, role limitations due to physical problems, general perception of health, social function and state of health scores compared to last year (p<0.05); however, there was no difference in terms of energy/vitality scores between the two visits from baseline to the second visit after treatment (p>0.05) (Table 3). In the second group, significant changes were observed in role limitations due to physical problems, body pain and state of health scores compared to last year (p<0.05); however physical function, social function, general mental health, role limitations due to emotional problems, general perception of health and energy/vitality scores did not change significantly between baseline visit and the second after treatment (p>0.05) (Table 3).

There was no difference between the patients' need for paracetamol during the treatment period (the period between the beginning of the treatment and the end of the 2nd control (p>0.05).

## Discussion

CMLBP lasts three months or longer, increases with physical activity and decreases with rest and consequently limits the use

**Table 1. Variation of lumbar range of motion values with treatment in the first and second groups**

| Group 1 (n=30) | Group 1 (acupressure) Median ± SD | | | |
|---|---|---|---|---|
| **Variables** | **Pretreatment** | **First control** | **Second control** | **p-value** |
| Right lateral flexion (cm) | 52.20±5.75 | 48.93±5.77 | 48.47±5.81 | 0.027*[ab] |
| Left lateral flexion (cm) | 52.13±5.70 | 48.97±5.79 | 48.43±5.81 | 0.031*[ab] |
| Fingertip-to-floor test (cm) | 24.80±8.02 | 12.10±5.07 | 9.53±4.73 | 0.000*[abc] |
| **Group 2 (n=30)** | **Group 2 (TENS + IR) Median ± SD** | | | |
| **Variables** | **Pretreatment** | **First control** | **Second control** | **p-value** |
| Right lateral flexion (cm) | 52.10±5.00 | 50.30±5.29 | 49.13±9.77 | 0.263 |
| Left lateral flexion (cm) | 52.00±4.94 | 50.33±5.37 | 50.63±5.09 | 0.412 |
| Fingertip-to-floor test (cm) | 29.07±10.29 | 18.27±7.59 | 18.87±6.07 | 0.000*[ab] |

SD: Standard deviation, TENS: Transcutaneous electrical nerve stimulation, IR: Infrared, *: p<0.05, [a]: There is a difference between pretreatment and 1st control, [b]: There is a difference between pretreatment and 2nd control, [c]: There is a difference between 1st control-2nd control

of low back or whole physical activities (12). Our purpose with this research was to compare two different treatments applied with exercises at the same time on CMLBP patients.

There are many treatment options for CMLBP, one of which is acupressure. It is a treatment method which is as old as humanity. It's known that people have been pressing and massaging the painful spots to kill the pain since the beginning of the mankind (5,13). The principle of the acupressure treatment is to press to definite acupuncture points which are on the meridians of body surface and painful parts by the hand, manually and to stimulate these points by various maneuvers. By releasing blockages, we can speed up the energy (chi) flow, increase the temperature and relax the muscles and ligaments by protecting the balance between yang and yin or by fixing it if it's imbalanced. Mechanism of the treatment is the composition of all these effects. This theory encourages the hypothesis of acupressure that the intervention may be stimulating the nerve system to block the pain impulses before they reach the brain. Another theory suggests that stimulating acupressure points increases the secretion of opioid proteins which reduces the pain, activates hypothalamus and pituitary, regulates the blood circulation, and changes the immune system and effects secretion of neurohormones. Acupressure treatment handles the whole body unlike a local treatment (4,5,14).

It has been reported systemically that acupressure is found efficient on pain and function in CLBP patients when compared with placebo and other physiotherapy approaches (15). The efficiency of the treatment especially on pain is evaluated by using VAS and the other methods. Hsieh et al. (15) formed two groups and applied acupressure to 69 patients and physiotherapy to 77 patients who were chosen randomly from 146 patients with CLBP. Both of the groups had 6 sessions during 4 weeks and each session lasted 15 minutes for the acupressure group.

**Table 2.** Variation of Visual analog scale values, oswestry low back pain disability questionnaire scores and Roland-Morris functional assessment scores with treatment

| Group 1 (n=30) | Group 1 (acupressure) Median ± SD | | | |
|---|---|---|---|---|
| **Variables** | **Pretreatment** | **First control** | **Second control** | **p-value** |
| Pain at rest | 29.50±18.11 | 8.00±12.14 | 2.00±6.10 | 0.000*[abc] |
| Pain with activity | 71.93±15.46 | 42.00±10.30 | 33.67±13.77 | 0.000*[abc] |
| OLBPDQ | 48.80±21.66 | 35.73±17.83 | 31.00±17.77 | 0.002*[ab] |
| RMDQ | 13.33±5.44 | 10.93±9.70 | 8.03±4.90 | 0.017*[ab] |
| Group 2 (n=30) | Group 2 (TENS + IR) Median ± SD | | | |
| Variables | Pretreatment | First control | Second control | p-value |
| Pain at rest | 29.03±17.43 | 18.33±18.21 | 20.33±17.71 | 0.033*[a] |
| Pain with activity | 69.33±12.58 | 59.73±83.53 | 50.00±9.82 | 0.000*[abc] |
| OLBPDQ | 49.27±18.73 | 42.00±20.52 | 46.60±18.86 | 0.345 |
| RMDQ | 14.90±8.66 | 11.60±8.83 | 12.60±9.72 | 0357 |

SD: Standard deviation, TENS: Transcutaneous electrical nerve stimulation, IR: Infrared, OLBPDQ: Oswestry Low Back Pain Disability Questionnaire, RMDQ: Roland-Morris Disability Questionnaire, *: p<0.05, [a]: There is a difference between pretreatment and 1st control, [b]: There is a difference between pretreatment and 2nd control, [c]: There is a difference between 1st control-2nd control

**Table 3.** Changes of Quality of Life (Short-Form 36) scores with treatment between pretreatment and second control in both groups

| Variables | Group 1 (n=30) Acupressure Median ± SD | | | Group 2 (n=30) TENS + IR Median ± SD | | |
|---|---|---|---|---|---|---|
| | **Pretreatment** | **Second control** | **p-value** | **Pretreatment** | **Second control** | **p-value** |
| Physical function | 44.76±19.70 | 60.33±19.57 | 0.000* | 41.57±23.33 | 49.16±20.60 | 0.138 |
| Roles limited by physical problems | 23.33±29.31 | 47.50±31.03 | 0.000* | 15.83±27.45 | 30.83±29.86 | 0.006* |
| Pain | 36.90±15.89 | 50.23±10.87 | 0.000* | 30.93±16.24 | 42.47±20.80 | 0.004* |
| Social function | 56.90±19.17 | 67.40±20.89 | 0.007* | 64.93±85.99 | 56.43±18.75 | 0.321 |
| General health | 56.53±22.17 | 49.06±20.12 | 0.018* | 50.53±19.32 | 50.53±19.32 | 0.773 |
| Emotional well-being | 23.53±29.67 | 49.67±29.99 | 0.000* | 28.80±34.73 | 26.53±36.42 | 0.718 |
| Vitality | 67.36±21.92 | 55.20±24.12 | 0.061 | 48.50±21.78 | 50.50±19.08 | 0.522 |
| Roles limited by emotional problems | 37.67±19.77 | 45.17±21.19 | 0.034* | 37.13±18.68 | 32.17±17.40 | 0.101 |
| Health change | 37.33±22.61 | 56.50±23.49 | 0.000* | 27.50±16.54 | 38.33±26.04 | 0.021* |

SD: Standard deviation, TENS: Transcutaneous electrical nerve stimulation, IR: Infrared, *: p<0.05

Routine physiotherapy (thermotherapy, infrared, electrical stimulation, pelvic manual traction and exercise) was applied to the second group. Pain scores were evaluated by short-form pain questionnaire before the treatment, right after the treatment and 6 months after the end of treatment and as a result, acupressure treatment was found more efficient.

According to the researches, acupressure treatments applied more than 4 sessions were more efficient and advised. (16) We applied a treatment program including 10 sessions, once a day, for 15 minutes to explore the probable efficiency on CMLBP. Our findings showed that there was a significant difference in favor of acupressure in both rest and movement pain in the medium term, but it showed that the relief in pain at rest was at an earlier stage. Despite of some methodological differences, another research which had parallel results with ours was performed by Yip et al. (16) in Hong Kong analyzing the efficiency of acupressure treatment on 51 patients diagnosed with CLBP. According to the results of this study, the acupressure treatment applied by using aromatic lavender essential oil as a lubricating agent was more effective than acupoint stimulation in terms of a short-term pain relief. Although massage with lavender oil causes regular motions and pain relief in patients with multiple sclerosis and although some may attribute acupressure's positive effects to the use of lavender oil, we did not use lavender oil throughout the study while having results in favor of acupressure.

There are some other researches showing that acupressure is efficient not only on pain but also on disability and functional situation. Lisa Li-Chen Hsieh et al. (17) planned a randomized controlled trial including 129 patients with CLBP to compare the efficiency of acupressure and physiotherapy. Acupressure was applied on 64 patients and physiotherapy on 65 patients. Each patient from acupressure group was treated with 6 sessions of acupressure in a month. Patients in the other group were treated with routine physiotherapy 6 times a month. The outcome parameters were VAS assessment of pain, OLBPDF and RMFAS. The evaluations at baseline before the treatment, right after the treatment and six months after the treatment revealed that acupressure was more efficient than physiotherapy. And also, the state of improvement after acupressure treatment continued six months after the research. Similarly within our research, acupressure group recovered better than TENS+IR group especially on second visits according to OLBPDF and RMFAS.

The SF-36, a reliable and valid measure of life quality, is used by many researches for the evaluation of patients with CLBP (18,19). Quality of life parameters measured with SF-36 varied significantly between baseline and second visits in both groups in our study. In the acupressure group, we had positive results in almost every sub-parameter of the quality of life, except for the energy/vitality parameter. According to this result, we can say that acupuncture treatment improves the quality of life in many ways.

### Study Limitations

The limitations of this study can be listed as follows: Limited amount of patients included, short follow up period, not arranging a personal treatment program and addition of medical treatment and exercises. We could have avoided the medical treatment and exercise to eliminate the confusing effects of other treatments and get more pure results but it would be unethical if we had left the patient without these types of treatment. That's why we advised both of the groups to take paracetamol when needed. Exercise programs were instructed to each group and control group was applied IR in addition to TENS.

Acupressure treatments have to be customized because acupressure handles the whole body instead of just being a local treatment (5,14). Acupressure is stated as an effective control implement for low back pain, headache and neck pain, etc. It's quite hard to handle a randomized controlled trial, aiming to control specifically the low back pain because of the heterogeneity in practice. Our research is based on a randomized controlled trial and asserts the efficacy of acupressure on reducing the pain. At the same time, the efficiency of acupressure or any kind of manipulation treatment are related to the technique and experience of the therapist or the doctor. The applications of acupressure and physiotherapy have to be standard so that the comparison of these two treatments can be certain. It is hard to standardize acupressure as there are limited number of doctors and physicians who are able to apply acupressure. That's why acupressure is applied by only one doctor during our research to avoid the different attitudes. In addition to that, it's arguable if the pain reduces because of the treatment or the psychological interaction between doctor and the patient. The relationship between doctor and the patient may be an important factor for the interaction (5,14,15).

## Conclusion

This research shows that acupressure treatment is effective on reducing pain and increasing the life quality. This improvement seems to be continuous in different visits during the short-term scenario of the study. This evidence supports acupressure to be used as a complementary treatment on CMLBP patients because it is a simple and non-invasive technique. According to the results of our research, acupressure treatment is more effective than TENS+IR treatment in CMLBP patients. Acupressure should rather be taken as a complementary technique to heal CMLBP.

### Ethics

**Ethics Committee Approval:** The study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Scientific Research and Ethics Committee of Trakya University (approval no: 2006/167, date: 02.11.2006).

**Informed Consent:** All participants gave written informed consent.

### Footnotes

### Authorship Contributions

Surgical and Medical Practices: M.R., Concept: M.R., M.B., N.T., K.U., Design: M.R., M.B., N.T., Data Collection or Processing: M.R., N.T., K.U., Analysis or Interpretation: M.R., M.B., N.T., G.E., E.U., Literature Search: M.R., M.B., K.U.,

E.U., Writing: M.R., M.B., N.T., G.E., E.U.

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

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## References

1. Barr KP, Standaert CJ, Johnson SC, Sandhu NS. Low Back Disorders. In: Cifu DX, editors. Braddom's Physical Medicine and Rehabilitation. 6th ed. Philadelphia: Elsevier; 2021:651-89.e9.
2. Biering-Sørensen F. Physical measurements as risk indicators for low-back trouble over a one-year period. Spine (Phila Pa 1976). 1984;9:106-19.
3. Cole AJ, Herring SA. The low back pain handbook : a guide for the practicing clinician. 2nd ed. Philadelphia: Hanley & Belfus Inc; 2003.
4. Lee DH, Qi Shiee Luenn. 1st ed. Taipei: Chih Yuan Publications; 1996.
5. Smith CA, Collins CT, Levett KM, Armour M, Dahlen HG, Tan AL, et al. Acupuncture or acupressure for pain management during labour. Cochrane Database Syst Rev 2020;2:9232.
6. van Tulder MW, Cherkin DC, Berman B, Lao L, Koes BW. The effectiveness of acupuncture in the management of acute and chronic low back pain: A systematic review within the framework of the cochrane collaboration back review group. Spine. 1999;24:1113-23.
7. Urits I, Wang JK, Yancey K, Mousa M, Jung JW, Berger AA, et al. Acupuncture for the management oflow back pain. Curr Pain Headache Rep. 2021;25:2.
8. Acupuncture NCDPo. Acupuncture. JAMA. 1998;280:1518-24.
9. Skelly AC, Chou R, Dettori JR, Turner JA, Friedly JL, Rundell SD, et al. Noninvasive Nonpharmacological Treatment for Chronic Pain: A Systematic Review Update. Agency for Healthcare Research and Quality (US). Rockville (MD): 2020. Report No.: 20-EHC009.
10. Demoulin C, Fauconnier C, Vanderthommen M, Henrotin Y. Recommendations for a basic functional assessment of low back pain. Rev Med Liege. 2005;60:661-8.
11. Kocyigit H, Aydemir O, Fisek G, Olmez N, Memis A. Validity and reliability of Turkish version of short form 36: A study of a patients with romatoid disorder. Drug Therapy. 1999;12:102-6.
12. Pergolizzi JV Jr, LeQuang JA. Rehabilitation for low back pain: A narrative review for managing pain and improving function in acute and chronic conditions. Pain Ther. 2020;9:83-96.
13. Wei L. Acupuncture science and technique. 1st ed. Taipei: Taiwan Chung Hwa Publications; 1986.
14. Muñoz-Ortego J, Solans-Domènech M, Carrion C. Medical indications for acupuncture: Systematic review. Med Clin (Barc). 2016;147:250-6.
15. Hsieh LL, Kuo CH, Yen MF, Chen TH. A randomized controlled clinical trial for low back pain treated by acupressure and physical therapy. Prev Med. 2004;39:168-76.
16. Yip YB, Tse SH. The effectiveness of relaxation acupoint stimulation and acupressure with aromatic lavender essential oil for non-specific low back pain in Hong Kong: a randomised controlled trial. Complement Ther Med. 2004;12:28-37.
17. Hsieh LL, Kuo CH, Lee LH, Yen AM, Chien KL, Chen TH. Treatment of low back pain by acupressure and physical therapy: randomised controlled trial. BMJ. 2006;332:696-700.
18. Nikaido T, Konno SI. Usefulness of lateral lumbar interbody fusion combined with indirect decompression for degenerative lumbar spondylolisthesis: A systematic review. Medicina (Kaunas). 2022;58:492.
19. Kapetanakis S, Gkantsinikoudis N, Charitoudis G. Implementation of percutaneous transforaminal endoscopic discectomy in competitive elite athletes with lumbar disc herniation: Original study and review of the literature. Am J Sports Med. 2021;49:3234-41.

Original Article

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# Analysis of Patients Admitted to the Orthopedic Clinic from the Emergency Department

## Acil Servisten Ortopedi Kliniğine Yatırılan Hastaların Analizi

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## ABSTRACT

**Objective:** Trauma cases have an important place among patients admitted to the emergency department (ED). Orthopedics and traumatology clinic is among the most frequently consulted and hospitalized departments. In this study, we analyzed the patients admitted to the orthopedics clinic from the ED.

**Methods:** This study was a retrospective analysis of all patients admitted to the ward or intensive care unit (ICU) on behalf of the orthopedics clinic from the ED of a second-level state hospital between 01.01.2022 and 31.12.2022. Patient data were accessed through hospital electronic data. Age, gender, time of admission, forensic status, type of trauma, traumatic lesions, femoral neck fractures, length of hospitalization and mortality were analyzed.

**Results:** Of the patients 50.4% were male. The most common presentation was in summer months and during working hours. Of the patients 17.6% were forensic cases. Forensic cases were more common in the young adult age group and in males. The mean age of the patients was 53.2±26.9 years and the most common age range was 61-80 years. Falls and traffic accidents were the most common reasons for admission. The most common hospitalization was due to femur fracture. Femur fractures were most common in males and in the age range of 81-100 years. Lower end of humerus fractures was more common in pediatric age group, tibia fractures in young adult age group and femoral neck fractures in elderly patients. Femoral neck fractures constituted 31.6% of all cases. Of the 8 patients hospitalized in the ICU, 7 were admitted due to femoral neck fractures and all of them (1.5%) died due to complications.

## ÖZ

**Amaç:** Travma olguları acil servise başvuran hastalar arasında önemli bir yere sahiptir. En sık konsültasyon istenen ve hastaneye yatış yapılan bölümlerin arasında ortopedi ve travmatoloji kliniği yer almaktadır. Bu çalışmada acil servisten ortopedi kliniğine yatırılan hastaların analizi yapılmıştır.

**Yöntemler:** Bu çalışma retrospektif olarak 01.01.2022-31.12.2022 tarihleri arasında ikinci basamak bir devlet hastanesinin acil servisinden ortopedi kliniği adına servis veya yoğun bakım ünitesine (YBÜ) yatırılan tüm hastaların analizi şeklinde yapılmıştır. Hasta verilerine hastane elektronik verileri üzerinden ulaşıldı. Hastalarda yaş, cinsiyet, başvuru zamanı, adli olgu durumu, travma çeşidi ve hastalarda görülen travmatik lezyonlar, femur boyun kırıkları, hastanede yatış süreleri ve mortalite incelendi.

**Bulgular:** Hastaların %50,4'ü erkekti. En sık başvuru yaz aylarında ve mesai saatlerinde oldu. Hastaların %17,6'sı adli olguydu. Adli olgular genç erişkin yaş grubunda ve erkeklerde daha fazlaydı. Hastaların yaş ortalaması 53,2±26,9 olup en sık hasta yatışı 61-80 yaş aralığındaydı. Düşme ve trafik kazası en sık başvuru nedenleriydi. En sık hasta yatışı femur kırığına bağlı oldu. Femur kırıkları en fazla erkeklerde ve 81-100 yaş aralığında görüldü. Çocuk yaş grubunda humerus alt uç, genç erişkin yaş grubunda tibia ve ileri yaş hastalarda ise femur boyun kırıkları daha fazla görüldü. Femur boyun kırıkları tüm olgular içerisinde %31,6 orandaydı. YBÜ'ye yatırılan 8 hastanın 7'si femur boyun kırığı nedeniyle yatırıldı ve hastaların tamamı (%1,5) gelişen komplikasyonlar nedeniyle ölümle sonuçlandı.

**Sonuç:** Acil servisten ortopedi kliniğine yapılan hasta yatışlarının büyük çoğunluğu kemik kırıkları nedeniyledir. Özellikle ileri

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**ABSTRACT**

**Conclusion:** The majority of hospitalizations from the ED to the orthopedic clinic are due to bone fractures. It should be kept in mind that femoral neck fractures are more common especially in the elderly and may be mortal.

**Keywords:** Emergency department, trauma, orthopedics and traumatology

**ÖZ**

yaşlarda femur boyun kırıklarının daha sık görüldüğü ve mortal seyredebileceği unutulmamalıdır.

**Anahtar Kelimeler:** Acil servis, travma, ortopedi ve travmatoloji

## Introduction

Trauma-related injuries have an important place among emergencies resulting in disability and death both worldwide and in our country. It was observed that unintentional trauma cases caused the death of 136,053 people in the United States of America (USA) in 2014 (1). Trauma is an extraordinary event that disrupts physical and vital integrity and occurs with the effect of mechanical and chemical energies. Orthopedic injuries include all injuries of the skeletal system except the head region, which occur as a result of mechanical factors such as accidents, natural disasters and gunshot wounds (GW) (2). Apart from simple injuries, orthopedic traumas may negatively affect human life in the long term with physical disability and psychological side effects. Except for pelvic fractures that do not cause severe bleeding, simple bone fractures and soft tissue traumas do not constitute an emergency. However, if accompanied by neurovascular injury, such cases are considered as emergencies because disability in the extremities may be in question (3,4).

Trauma cases have an important place among patients admitted to the emergency department (ED). Fractures and muscle, ligament and joint injuries occurring in soft tissues are the most common orthopedic traumas. In ED, orthopedics and traumatology clinic is one of the most frequently consulted and hospitalized departments in trauma cases (5,6). In this study, we planned to present updated data to the literature by analyzing the patients hospitalized from the ED to the orthopedics and traumatology clinic in a one-year period.

## Methods

The study was started after the approval of the ethics committee of Nevşehir Hacı Bektaş Veli University Rectorate Non-Interventional Clinical Research Publication Ethics Committee dated 16.10.2023 and numbered 2023/02 decision. In this study, all patients admitted to the ward or intensive care unit (ICU) on behalf of the orthopedics clinic from the ED of a second-level state hospital between 01.01.2022-31.12.2022 were analyzed. Patient data were analyzed for age, gender, time of admission, forensic case status, type of trauma and traumatic lesions seen in patients. According to the "International Classification of Disease" (ICD) diagnostic codes "W00-W20", all cases due to falls in the diagnostic code range "W00-W20" were evaluated under the heading "falls", all injuries with sharp objects were evaluated under the heading "piercing and cutting instrument injury (PCII)", and patients who presented with joint, muscle and soft tissue pain without trauma and patients who presented for hospitalization outside working hours were evaluated under the heading 'other'. The percentage of femoral neck fractures and pertrochanteric fractures among all cases was determined. The distribution of these fractures according to age and gender was evaluated. With the data obtained in the analysis, comparative analyses of cases and hospitalizations were made according to months, gender and age range. The average length of hospitalization was determined for patients in the ward and ICU. The percentage of cases that ended in death and the causes of death were determined.

Data collection was done retrospectively and electronically through the hospital software system.

### Statistical Analysis

Statistical Package for Social Sciences for Windows 21.0 (SPSS 21.0) was used to analyze the data. Descriptive statistics (frequency, percentage distribution) and chi-square test were used for the comparison of categorical variables between two groups. Results were expressed as mean ± standard deviation or frequency (percentage) and $p<0.05$ was considered statistically significant at 95% confidence interval.

## Results

Within the scope of the study, 563 patients were evaluated. 50.4% of the patients were male. The mean age of the patients was 53.2±26.9 years, the youngest patient was 4 months old and the oldest patient was 101 years old. When patient admissions were analyzed according to age ranges, the highest number of hospitalizations was in the 61-80 age range (29.6%) (Figure 1). The time of admission to the ED was analyzed in three different time periods. In order of frequency, 282 patients (50.1%) were admitted between 08.00-15.59, 238 patients (42.3%) between 16.00-23.59, and 43 patients (7.6%) between 00.00-07.59. When the distribution of patients according to the months of admission was analyzed, the highest number of cases was in July and the number of cases was higher in the summer months compared to other seasons. The fewest cases were seen in January and February (Figure 2). Of the patients, 99 (17.6%) were evaluated as forensic cases. Seventy of the forensic cases were males (70.7%) and there was a significant difference between forensic cases in terms of gender ($p<0.001$, chi-square: 19.730). According to the age range of the forensic patients, most of them were seen in the 21-40 age range (32.3%) ($p<0.001$, chi-square: 62.542).

The most common reason for hospital admission was falls (Figure 3). Of the cases categorized as "other", 50 (80.6%) were non-emergency cases of gonarthrosis and coxarthrosis with out-of-hours hospitalization. When compared by gender, falls (54%) and gonarthrosis and coxarthrosis (67.7%) were more common in women, while traffic accidents (70.2%) and occupational accidents (87.5%) were more common in men (p<0.001, chi-square: 38.898). When the reasons for admission according to months were analyzed, no significant difference was observed (p=0.459, chi-square: 66,996). When Table 1 was examined, it was observed that especially injuries due to falls and traffic accidents increased in summer months, but this increase was not statistically significant. When the admissions were analyzed according to age ranges, a significant difference was observed (p<0.001, chi-square: 151,863) (Table 2). Falls were more common in the 61-100 age range and traffic accidents were more common in the 0-60 age range.

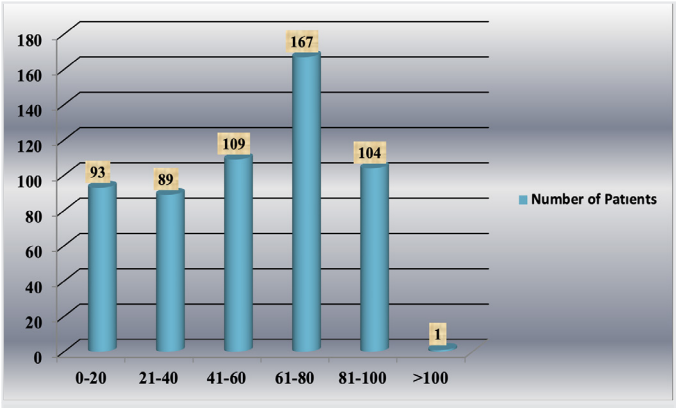


**Figure 1.** Distribution of patients according to age ranges

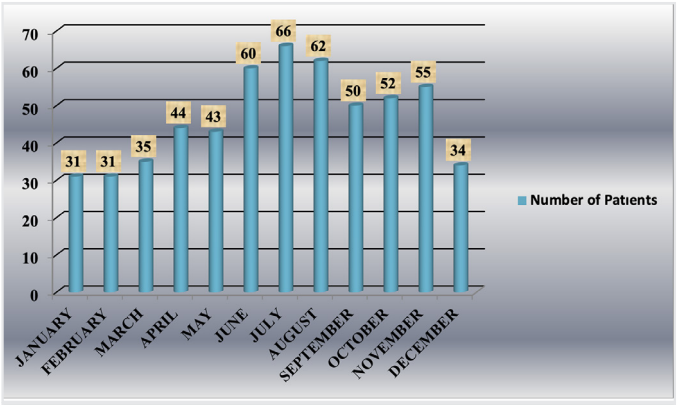


**Figure 2.** Distribution of patient hospitalizations according to months

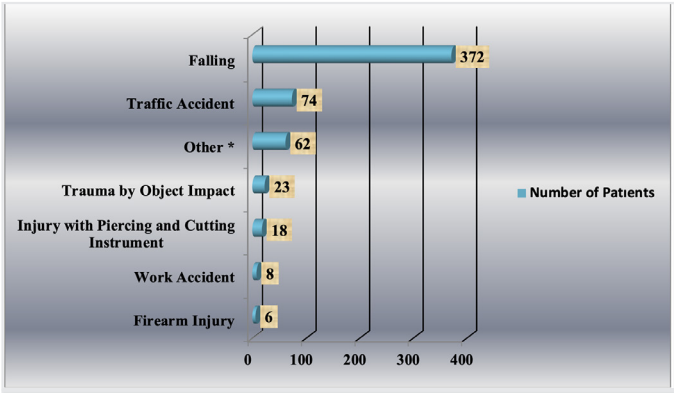


**Figure 3.** Distribution of the reasons for admission

*Patients presenting with joint and muscle pain without acute trauma and patients admitted for hospitalization outside working hours

When the traumatic injuries seen in the patients were analyzed, femur fractures (39.3%) and tibia fractures (16%) were the most common reasons for hospitalization (Table 3). Among femur fractures, the number of patients hospitalized for femoral neck and pertrochanteric fractures was 178, which constituted 31.6% of all patients and 80.5% of femur fractures. Femoral upper end fractures were compared according to gender and age ranges and significant differences were observed (p<0.001, chi-square: 20,197, p<0.001, chi-square: 208,782) (Table 4). When the table was analyzed, it was observed that there were more males (63.4%) and most of the cases were in the 81-100 age range (48.8%). When the diagnoses were analyzed according to age ranges, 59% of humeral fractures were in the 0-20 age group, 42.2% of femur fractures were in the 81-100 age range, and 70% of gonarthrosis/coxarthosis were in the 61-80 age range (p<0.001, chi-square: 386,012) (Table 5). Of the humerus fractures, 33 (54%) were humerus lower end fractures and the age range was 0-10 years. When the types of trauma were analyzed according to the presentations, significant differences emerged and it was observed that tibia (31%) and femur fractures (25.6%) were the most common in traffic accidents. The most common cause of tendon lacerations was PCII (88%) (p<0.001, chi-square: 570,427). While the number of cases with multiple fractures or injuries was 46 (8.1%), the number of cases with simultaneous fractures of radius and ulna was 18 (3.1%), and the number of cases with simultaneous fractures of tibia and fibula was 26 (4.6%).

Of the patients, 555 were hospitalized in the ward (98.5%) and 8 in the ICU (1.5%). The mean duration of hospitalization was 3±3.7 days for all patients, 2.75 days for patients hospitalized in the ward and 23 days for patients hospitalized in ICU. In this study, the mortality rate was 1.4% in patients hospitalized by the orthopedic clinic and all 8 patients followed up in ICU died. In our study, 75% of the patients hospitalized in ICU were hospitalized for femoral neck fracture and/or pertrochanteric fracture. The mean age of the patients who died was 76.3 years. Of the 8 cases who died, 7 patients were hospitalized in ICU for femoral neck fracture and/or pertrochanteric fracture. The causes of death were pneumonia in three patients, postoperative sepsis in two patients, subarachnoid brain hemorrhage due to multiple trauma, acute renal failure and pulmonary embolism in the other patients.

## Discussion

Traumas have an important place in ED admissions. Patients may be hospitalized for surgical procedure and/or clinical follow-up if deemed necessary. Orthopedics and traumatology clinic ranks

**Table 1. Distribution of reasons for admission according to months**

| Months | Reason for application | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fall | Trauma bY object impact | Traffic accident | Work accident | PCII* | GW* | Another** | Total |
| January | 24 | 1 | 2 | 3 | 0 | 0 | 1 | 31 |
| February | 26 | 1 | 1 | 0 | 0 | 1 | 2 | 31 |
| March | 23 | 3 | 4 | 0 | 1 | 0 | 4 | 35 |
| April | 27 | 3 | 6 | 1 | 3 | 0 | 4 | 44 |
| May | 26 | 1 | 5 | 1 | 2 | 2 | 6 | 43 |
| June | 40 | 2 | 9 | 0 | 4 | 0 | 5 | 60 |
| July | 44 | 2 | 11 | 2 | 2 | 1 | 4 | 66 |
| August | 42 | 3 | 8 | 0 | 1 | 0 | 8 | 62 |
| September | 31 | 1 | 7 | 0 | 1 | 1 | 9 | 50 |
| October | 37 | 1 | 9 | 0 | 0 | 0 | 5 | 52 |
| November | 31 | 4 | 7 | 1 | 2 | 0 | 10 | 55 |
| December | 21 | 1 | 5 | 0 | 2 | 1 | 4 | 34 |
| **Total** | **372** | **23** | **74** | **8** | **18** | **6** | **62** | **563** |

p=0.459, chi-square: 66.996, *PCII: Piercing and cutting instrument injury, ***Patients presenting with joint and muscle pain without acute trauma and patients admitted for hospitalization outside working hours, GW: Gunshot wounds

**Table 2. Reasons for presentation to the emergency department according to age ranges**

| Age range | Reason for application | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fall | Trauma by object impact | Traffic accident | Work accident | PCII* | GW* | Another** | Total |
| **0-20** | 57 | 6 | 22 | 0 | 5 | 2 | 1 | 93 |
| **21-40** | 44 | 7 | 21 | 3 | 7 | 2 | 5 | 89 |
| **41-60** | 57 | 4 | 21 | 5 | 6 | 2 | 14 | 109 |
| **61-80** | 112 | 5 | 10 | 0 | 0 | 0 | 40 | 167 |
| **81-100** | 101 | 1 | 0 | 0 | 0 | 0 | 2 | 104 |
| **>100** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Total** | **372** | **23** | **74** | **8** | **18** | **6** | **62** | **563** |

p<0.001, chi-square: 151.863, *PCII; Piercing and cutting instrument injury, ***Patients presenting with joint and muscle pain without acute trauma and patients admitted for hospitalization outside working hours, GW: Gunshot wounds

first among the branches in which consultation is requested from the ED and patients are hospitalized (6-8). Dönmez et al. (6) observed that simple traumas such as bone fractures, tendon cuts and joint dislocations were the most common reasons for requesting consultation with a rate of 33% in their study. In the same study, the surgical clinics from where consultation was most frequently requested were ophthalmology and orthopedics clinics, while the highest number of patients were hospitalized in cardiology and orthopedics clinics.

In this study, 50.4% of the cases were male. In a study by Duman et al. (9) on traumas encountered in the ED, 63.4% of the patients were male. In a study on blunt force trauma encountered in the ED, the rate of male patients was 66.9% (10). In a study on traumas encountered in pediatric ED, 63.9% of the patients were male (11).

The mean age of the patients in our study was 53.2±26.9 years. In another study in which trauma cases admitted to the ED were analyzed, the mean age was reported to be 26.9±18.9 years (9). In another study in which blunt force trauma was analyzed, the mean age was 25.5±21.6 years (10). Aydın (12) reported that 41.6% of the patients were over 71 years of age in his study on pelvic fractures and femoral neck fractures.

**Table 3. Distribution of diagnoses seen in patients**

| Diagnosis | Number of patients (n) | Ratio (%) |
|---|---|---|
| Femur fracture | 221 | 39.3 |
| Tibia fracture | 90 | 16 |
| Humerus fracture | 61 | 10.8 |
| Gonarthosis/coxarthosis | 50 | 8.9 |
| Radius fracture | 36 | 6.4 |
| Tendon incision | 20 | 3.6 |
| Fibula fracture | 18 | 3.2 |
| Muscle and connective tissue injury | 12 | 2.1 |
| Fracture of the bones of the hand | 10 | 1.8 |
| Large joint dislocation* | 9 | 1.6 |
| Fracture of the bones of the foot | 8 | 1.4 |
| Pelvis fracture | 8 | 1.4 |
| Patella fracture | 5 | 0.9 |
| Foreign body in soft tissue | 5 | 0.9 |
| Infection | 4 | 0.7 |
| Ulna fracture | 2 | 0.4 |
| Clavicle fracture | 2 | 0.4 |
| Amputation | 1 | 0.2 |
| Crush injury | 1 | 0.2 |
| **Femur fracture** | **563** | **100** |

*Patients whose reduction procedure failed in the emergency department and surgical procedure is planned

**Table 4.** Distribution of femoral neck fractures and pertrochanteric fractures according to gender and age ranges

| Gender | Number of patients (n) | Ratio (%) | Statistical analysis |
|---|---|---|---|
| Male | 113 | (63.4) | p<0.001 |
| Female | 65 | (26.6) | chi-square: 20.197 |
| **Age range** | **Number of patients (n)** | **Ratio (%)** | **Statistical analysis** |
| 0-20 | 2 | (1.1) | p<0.001 chi-square: 208.782 |
| 21-40 | 8 | (4.4) | |
| 41-60 | 16 | (8.9) | |
| 61-80 | 64 | (36) | |
| 81-100 | 87 | (48.8) | |
| >100 | 1 | (0.8) | |
| **Total** | **178** | **(100)** | |

In our study, 70.7% of the patients evaluated as forensic cases were male. In a study, it was reported that 85% of the forensic trauma patients in whom orthopedic consultation was requested, were male (13). Similarly, in a study on orthopedic forensic cases admitted to the ED, the rate of male patients was 75.2% (14).

In our study, hospitalizations due to forensic cases were mostly observed in the age range of 21-40 years. Kaçmaz et al. (13) reported that the highest number of orthopedic forensic cases encountered in the ED was in the age range of 19-29 years. In the study by Uysal and Acar (14) the highest number of orthopedic forensic cases was in the 19-65 age range (58.6%). In our study, although the average age of forensic cases was similar to the literature, the general average age was higher. We thought that this was due to the fact that we evaluated only hospitalized orthopedic cases in our study and that the hospitalized patient group was older.

**Table 5.** Comparative analysis of reasons for admission and diagnoses

| Diagnosis | Reason for application | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fall | Trauma by object impact | Traffic accident | Work accident | PCII* | GW* | Another** | Total |
| Femur fracture | 193 | 2 | 19 | 1 | 1 | 1 | 4 | **221** |
| Tibia fracture | 58 | 4 | 23 | 4 | 0 | 0 | 1 | **90** |
| Humerus fracture | 51 | 1 | 8 | 1 | 0 | 0 | 0 | **61** |
| Gonarthosis/ coxarthosis | 0 | 0 | 0 | 0 | 0 | 0 | 50 | **50** |
| Radius fracture | 26 | 2 | 6 | 2 | 0 | 0 | 0 | **37** |
| Tendon incision | 0 | 1 | 3 | 0 | 16 | 0 | 0 | **20** |
| Fibula fracture | 16 | 0 | 2 | 0 | 0 | 0 | 0 | **18** |
| Muscle and connective tissue injury | 2 | 5 | 2 | 0 | 0 | 0 | 3 | **12** |
| Fracture of the bones of the hand | 3 | 3 | 2 | 0 | 0 | 2 | 0 | **10** |
| Large joint dislocation | 7 | 2 | 0 | 0 | 0 | 0 | 0 | **9** |
| Fracture of the bones of the foot | 4 | 1 | 1 | 0 | 1 | 1 | 0 | **8** |
| Pelvis fracture | 5 | 0 | 3 | 0 | 0 | 0 | 0 | **8** |
| Patella fracture | 3 | 0 | 1 | 0 | 0 | 1 | 0 | **5** |
| Foreign body in soft tissue | 0 | 0 | 1 | 0 | 0 | 1 | 3 | **5** |
| Infection | 2 | 0 | 0 | 0 | 0 | 0 | 2 | **4** |
| Ulna fracture | 1 | 0 | 1 | 0 | 0 | 0 | 0 | **2** |
| Clavicle fracture | 0 | 0 | 2 | 0 | 0 | 0 | 0 | **2** |
| Amputation | 0 | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| Crush injury | 0 | 1 | 0 | 0 | 0 | 0 | 0 | **1** |

p<0.001, Chi-square: 570.427, *PCII: Piercing and cutting instrument injury, **Patients presenting with joint and muscle pain without acute trauma and patients admitted for hospitalization outside working hours, GW: Gunshot wounds

In our study, we found that the highest number of patient hospitalizations occurred in July and seasonally in summer. In terms of admission time, there were more admissions between 08.00-15.59 hours. Especially, hospitalizations due to traffic

accidents were higher in the summer months. Similarly, in a study conducted by Ateşçelik and Gürger (10) on blunt force trauma, the highest number of admissions was observed in July and seasonally the highest number was observed in summer. In a study on penetrating traumas, the highest number of admissions was observed in June and between 13.00-16.59 hours (15). In our country, the fact that people spend more time outdoors during daylight hours and in the summer, season increases the possibility of exposure to traumas. As in the literature and in our study, it was observed that trauma cases increased during these periods.

In our study, we found that 17.6% of the patients hospitalized in the orthopedics clinic were forensic cases. The reason for the relatively low number of forensic cases may be that non-forensic injuries are more common in our region. In these cases, hospitalizations due to traffic accidents were more common. In the study conducted by Kaçmaz et al. (13), the most common forensic causes for which orthopedic consultation was requested from the ED were GW and PCII. In another study, the most common forensic cause for which orthopedic consultation was requested was traffic accidents (60.2%) (14). In a study conducted on forensic cases for which orthopedic consultation was requested from pediatric EDs, it was observed that consultation was requested most frequently due to blunt force trauma, PCII and GW (16). We think that there may be differences according to the centers and age groups involved.

In a recent study conducted in Türkiye, it was reported that the highest number of ED visits due to trauma was due to crush, fracture and dislocation (17). In another study in which patients were evaluated according to triage classification, ED admissions due to musculoskeletal disorders were significantly higher (18). Fall from height and motor vehicle accidents were among the leading causes of trauma leading to death in young patients (19-21). In our study, the most common causes of trauma were falls and traffic accidents. Falls consisted of different mechanisms such as falling from the same level, falling from a tree, falling on ice and snow, falling from an armchair and bed, and falling from a high position. In similar studies in the literature, the most common reasons for presentation to the ED after trauma were falls and traffic accidents (9,22,23). Musculoskeletal traumas and falls were the most common type of trauma encountered in the ED in patients aged 45 years and older. In studies conducted on the subject, the most common type of trauma in the elderly patient population over 65 years of age was falls, with a higher rate in men (24-26). In this study, it was found that fall cases were more common in patients over 60 years of age. In a recent study on pediatric traumas, it was reported that more than half of the trauma cases encountered under the age of 18 were related with falls (11). In our study, the most common type of trauma in the 0-20 age group was falls (61.2%). In a study conducted on femoral neck fractures and pelvic fractures, it was observed that the most common reason for admission was falls (65.3%) (14).

In our study, we found that admissions due to traffic accidents were the second most common and were significantly higher in males and in the 0-60 age range. In the study by Keskinoğlu and İnan (17) traumas due to assault and traffic accidents were found to be significantly higher in the age range of 18-29 years. In studies conducted in Türkiye, approximately one fourth of the patients admitted to the ED after traffic accidents are in the 20-30 and two thirds in the 16-44 age group (27,28). It is thought that the young and adult age group is more exposed to such traumas because they are more physically active than children and the elderly, have weaker risk perceptions, work more as a productive population and in different fields of work, and are more frequently involved in traffic.

The rate of fractures in trauma-related injuries is quite high. While femoral shaft fracture and wrist fracture are more common in the young and adult age group, fractures are most commonly seen in the hip, pelvis and spine with the effect of osteoporosis development with aging (29). In our study, we found that the most common reasons for hospitalization due to trauma were femur fracture, tibia fracture and humerus fracture, respectively. Femur fractures were seen in the 81-100 age group with 42.2%, tibia fractures in the 21-40 age group with 30% and humerus fractures in the 0-20 age group with 59%. Traffic accidents were the cause of 85.1% of tibia fractures in the 21-40 age group. In one study, it was reported that lower extremity injuries were the most common in the analysis of trauma cases encountered in the ED (9). In a study conducted on pediatric trauma cases, it was observed that the most common fractures in the 0-18 age group were radius and humerus fractures, respectively (17). In our study, we found that hospitalizations for humeral lower end fractures were more common in the pediatric age group. In a study in which patients diagnosed with fractures in the ED were analyzed, it was reported that hospitalizations were in the order of frequency as radius and ulna, fibula, humerus lower end, femur proximal end and tibia lower end fractures (30). We think that the reason for the differences between the studies is the difference in the approach of orthopedic clinics in different hospitals. Discharge after treatment in the ED for conservative treatment may change the hospitalization diagnoses and rates.

90% of femoral neck and pertrochanteric fractures occur in patients over 65 years of age. It is known that hip fractures are the second most common cause of hospitalization in the elderly population. It is predicted that these fractures will become more common with the increase in the elderly population and may increase morbidity and mortality. In the USA, 341,000 cases were observed in 2008 and this number is estimated to be 582,000 in 2040 (14,31). In our study, we found that 31.6% of the patients hospitalized in the orthopedic clinic had proximal end fractures of the femur, and the age group with the highest number of hospitalizations was between 61-80 years. Of the patients 63.4% were male. In his thesis study on the subject, Aydın (12) reported that 41.6% of patients with pelvis and femoral neck fractures were over 71 years of age and 50.5% were male (14). Pamuk (30) reported in his study that 14.3% of the patients hospitalized from the ED to the orthopedic clinic were due to proximal femur and pelvis fractures.

In his study, Pamuk (30) reported the mean length of stay of patients hospitalized in the orthopedic service as 10.3±8.1 days (30). In our study, the mean duration of hospitalization was 3±3.7 days, 2.75 days for patients hospitalized in the ward and 23 days for patients hospitalized in ICU. In our study, the 1-year mortality rate of patients hospitalized from the ED to the orthopedic clinic was 1.5%.

### Study Limitations

The only limitation of the study was that it was planned retrospectively.

## Conclusion

In conclusion, the majority of hospitalizations from the ED to the orthopedic clinic are due to falls. It should be kept in mind that femoral neck and pertrochanteric fractures are common especially in elderly patients and humeral lower end fractures are more common in the pediatric age group.

### Ethics

**Ethics Committee Approval:** The study was started after the approval of the ethics committee of Nevşehir Hacı Bektaş Veli University Rectorate Non-Interventional Clinical Research Publication Ethics Committee dated 16.10.2023 and numbered 2023/02 decision.

**Informed Consent:** Retrospective study.

### Footnotes

### Authorship Contributions

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

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## References

1. Web-based injury statistics query and reporting system (WISQARS), Leading causes of death reports, national and regional, 1999-2014. Centers for disease control and prevention; Date of access: 06/11/2023. Access Address: http://webappa.cdc.gov/sasweb/ncipc/leadcaus10_us.html.
2. Drozd M, Jester R, Santy J. The inherent components of the orthopaedic nursing role: an exploratory study. J Orthop Nurs. 2007;11:43-52.
3. O'Steen D. Orthopedic and neurovasculer trauma. In. Newberry L. Emergency Nursing Principles and Practice. 5th. Mossby London; 2003:314-48.
4. Berry PH, Chapman CR, Covington EC, Dahl JL, Kattz JA, Miaskowski C, et al. "Pain: current understanding of assessment, management and treatments." National Pharmaceutical Council and the Joint Commission for the Accreditation of Healthcare Organizations, VA, USA, 2001:b44.
5. Köse A, Köse B, Öncü MR, Tuğrul F. Profile of patients admitted to a public hospital emergency department and appropriateness of admission. Gaziantep Med J. 2011;17:57-62.
6. Dönmez SS, Durak VA, Torun G, Köksal Ö, Aydın Ş. Examination of the consultation process in the emergency department. Journal of Uludag University Faculty of Medicine. 2017;43:23-8.
7. Korkmaz T, Kahramansoy N, Erkol Z, Sarıçil F, Kılıç A. Acil Servise Başvuran Adli Olguların ve Düzenlenen Adli Raporların Değerlendirilmesi. Haseki Tıp Bülteni. 2012;50:14-20.
8. Keten A, İçme F, Eser M, Kılınç İ, Tümer AR. Evaluation of forensic reports issued in the emergency department within the scope of the Turkish Penal Code. Turkish Med J. 2011;5:94-9.
9. Duman A, Kapçı M, Bacakoğlu G, Akpınar O, Türkdoğan K, Karabacak M. Evaluation of trauma cases admitted to the emergency department. Journal of SDU Faculty of Medicine. 2014;21:45-8.
10. Ateşçelik M, Gürger M. Investigation of patients admitted to the emergency department with blunt trauma. Euphrates Medical Journal. 2013;18:103-8.
11. Çelik E. Evaluation of pediatric trauma cases admitted to the emergency department. Maltepe Medical Journal 2023;15:17-21.
12. Aydın B. Retrospective analysis of diagnosed pelvic fracture and femur head fractures registering to emergency department. Medical Specialization Thesis, Uludağ University, Department of Emergency Medicine, 2022, Bursa.
13. Kaçmaz İE, Uzakgider M, Basa CD, Zhamilov MV, Atilla Duman Ö, Karaman G, et al. Retrospective analysis of adult forensic cases admitted to the emergency medicine clinic and consulted by orthopedics and traumatology. J DEU Med. 2020;34:43-52.
14. Uysal E, Acar YA. Investigation of orthopedic forensic cases admitted to the emergency department of a tertiary hospital. Kocaeli Med J. 2020;9:61-5.
15. Ateşçelik M, Gürger M. Investigation of patients admitted to the emergency department with penetrating trauma. Konuralp Medical Journal. 2014;6(1):40-6.
16. Güleryüz Derinöz O. Retrospective analysis of pediatric forensic cases with orthopedics and traumatology consultation in the pediatric emergency department of Tepecik Training and Research Hospital. J Pediatr Emerg Intensive Care. 2022;9:64-5.
17. Keskinoğlu P, İnan F. Analysis of trauma cases admitted to a state hospital emergency department. Gazi Med J. 2014;25:1-4.
18. Çevik C, Tekir Ö. Diagnostic codes, triage and sociodemographic evaluation of emergency department admissions. Balıkesir Journal of Health Sciences. 2014;3:102-7.
19. LeMone P, Burke K. Nursing care of clients with musculoskeletal trauma. In: Medical-Surgical Nursing, Critical Thinking in Client Care. 4th ed., Upper Saddle River, New Jersey: Pearson Education; 2008. p. 1398-431.
20. Zsiros D, Wollan M. Nursing assesment musculoskeletal trauma and orthopedic surgery. In: Lewis SL, Dirksen SR, Heitkemper MM, Bucher L. (Eds.). Medical- Surgical Nursing, Assesment and Management of Clinical Problems. 9th ed., Mosby, St. Louis, 2014. p. 1505-38.

21. LeMone PT, Burke KM, Bauldoff G, Gubrud P. Nursing care of patients with musculoskeletal trauma. In: Medical- Surgical Nursing, Clinical Reasoning in Patient Care. 6th ed., Upper Saddle River, New Jersey: Pearson Education; 2015. p. 1234-65.

22. Gül M. Epidemiological analysis of trauma cases applying to emergency department. S Ü Tıp Fak Derg. 2003;19:33-6.

23. Çırak B, Güven B, Işık S, Kıymaz N, Demir Ö. An epidemiologic study an patients admitted to the emergency service. Ulus Travma Derg. 1999;5:157-9.

24. Casey ER, Muro F, Thielman NM, Maya E, Ossman EW, Hocker MB, et al. Analysis of traumatic injuries presenting to a referral hospital emergency department in Moshi, Tanzania. Int J Emerg Med. 2012;5:28.

25. Schwartz SW, Rosenberg DM, Wang CP, Sanchez-Anguiano A, Ahmed S. Demographic differences in injuries among the elderly: an analysis of emergency department visits. J Trauma 2005;58:346-52.

26. Hu G, Baker SP. Recent increases in fatal and non-fatal injury among people aged 65 years and over in the USA. Injury Prev. 2010;16:26-30.

27. Durdu T, Kavalcı C, Yılmaz F, Yılmaz MS, Karakılıç ME, Arslan ED, et al. Analysis of trauma cases admitted to our emergency department. J Clin Anal Med. 2014;5:182-5.

28. Ural G, Gün İ. An epidemiologic investigation of the applicants to the emergency departments of Dr. Nafiz Körez Sincan State Hospital and Private Bayındır Hospital due to accidents. Journal of Health Sciences 2008;17:31-9.

29. Türkmen A, Dündar Yılmaz G, Akyolcu N. Orthopedic traumas seen in emergency services and nursing care. JAREN. 2020;6:375-80.

30. Pamuk Ç. Evaluation of patients diagnosed with fracture in a state hospital emergency department. Turkish Journal of Clinics and Laboratory. 2019;10:163-7.

31. Iwasaki K, Yamamoto T, Motomura G, Mawatari T, Nakashima Y, Iwamoto Y. Subchondral insufficiency fracture of the femoral head in young adults. Clin Imaging. 2011;35:208-13.

Case Report

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# Trichoblastoma in a Newborn: A Case Report

## Bir Yenidoğanda Trikoblastom: Olgu Sunumu

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**ABSTRACT**

Trichoblastoma is a benign skin tumor that arises from the hair germ, which is the precursor of the hair follicle. It is most frequently observed on the scalp and face. The occurrence of trichoblastoma in the pediatric population is extremely rare. As far as our research, we have not come across any reported case of trichoblastoma in newborns in the English literature. A 10-day-old male newborn was referred to our clinic because of swelling under the right neck since his birth. Physical examination revealed a painless, firm and mobile mass, approximately 3 cm in size on the right submandibular region. Magnetic resonance imaging showed a smooth contoured mass with diffuse contrast enhancement. Tru-cut biopsy results suggested that the tumor was composed of epithelial and myoepithelial component. Total mass excision was performed and the final pathological result was a trichoblastoma. The patient was discharged on the second day following the surgery and the subsequent two-year follow-up examination showed no signs of wound complications, indicating successful healing. Trichoblastoma should be taken into account in newborns with neck masses.

**Keywords:** Trichoblastoma, trichoepithelioma, newborn, neck mass, case report

**ÖZ**

Trikoblastoma, kıl folikülünün öncüsü olan kıl germinden kaynaklanan benign bir deri tümörüdür. En sık saçlı deride ve yüzde görülür. Pediatrik popülasyonda trikoblastoma oluşumu oldukça nadirdir. Araştırabildiğimiz kadarıyla İngilizce literatürde şimdiye kadar yenidoğanlarda bildirilen herhangi bir trikoblastoma olgusuna rastlamadık. On günlük erkek yenidoğan, doğduğundan beri var olan sağ boyun altında şişlik nedeniyle kliniğimize yönlendirildi. Fizik muayenede sağ submandibuler bölgede yaklaşık 3 cm boyutunda ağrısız, sert ve hareketli kitle tespit edildi. Manyetik rezonans görüntülemesi, yaygın kontrast artışına sahip düzgün konturlu bir kitle ile uyumluydu. Tru-cut biyopsi tümörün epitelyal ve miyoepitelyal bileşenlerden oluştuğunu gösterdi. Total kitle eksizyonu yapıldı ve nihai patolojik rapor trikoblastoma olarak sonuçlandı. Hasta postoperatif ikinci gün taburcu edildi ve sonraki iki yıllık takiplerinde herhangi bir komplikasyon saptanmadı. Boyun kitlesi ile başvuran yenidoğanlarda trikoblastom akılda tutulmalıdır.

**Anahtar Kelimeler:** Trikoblastoma, trikoepitelyoma, yenidoğan, boyun kitlesi, olgu sunumu

## Introduction

Trichoblastomas are extremely rare in childhood and information about these lesions in the literature is primarily derived from studies conducted on adult patient groups. According to general consensus trichoblastoma originates from the hair germ, the precursor of the hair follicle. It is most commonly found as a solitary nodule on the scalp and face. It is mostly diagnosed in the fourth and fifth decades of life. In this case report, we aimed to share a newborn presenting with a submandibular mass which diagnosed as trichoblastoma.

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## Case Report

A 10-day-old male newborn was referred to our clinic because of swelling under the right neck since his birth (Figure 1A). Antenatal and natal history were uneventful. Physical examination revealed a painless, firm, and mobile mass, approximately 3 cm in size on the right submandibular region (Figure 1B). Ultrasound imaging identified a 37x28 mm lesion which is hypervascular on color Doppler ultrasound. A smooth contoured mass with diffuse contrast enhancement on magnetic resonance imaging (Figure 2) was observed, then a tru-cut biopsy was performed. The biopsy results suggested that the tumor was composed of epithelial and myoepithelial components, but the distinction between malignant and benign was not possible.

Total mass excision was performed under general anesthesia when the patient was 4-month-old. The excised material measured approximately 4.5 cm in diameter and had a bilobed appearance.

The patient was discharged on the postoperative day 2 with a clean wound. The final pathological result was a trichoblastoma, showing focal CD10 positivity, predominantly featuring a stromal component with a micronodular pattern (Figure 3).

The 2-year follow-up examination revealed uneventful wound healing (Figure 4).


**Figure 1.** Clinical presentation of the patient. A) Neonatal period, B) Pre-operative period

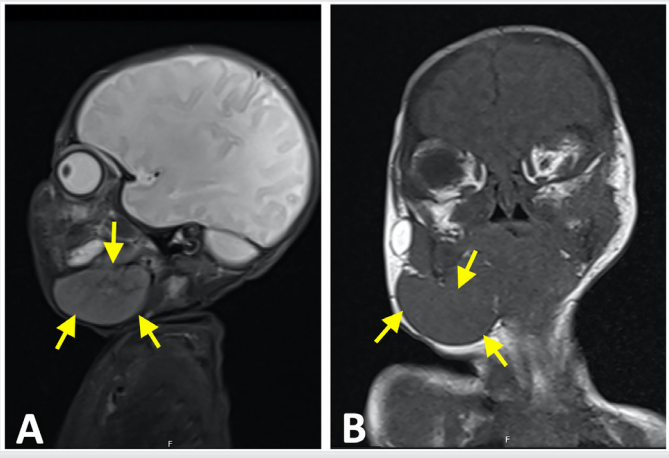


**Figure 2.** Magnetic resonance images. A) Sagittal T2-weighted image, B) Coronal T1-weighted image (The mass signed with yellow arrows)

## Discussion

Trichoblastoma is a benign neoplasm originating from the hair germ, the precursor of the hair follicle (1,2). It is most commonly found as a solitary nodule on the scalp and face, usually less than 2 cm in diameter, and mostly diagnosed in the fourth and fifth decades of life (3). It is extremely rare in childhood. According to the best of our knowledge, we could not find any other case which was reported in the newborn period with trichoblastoma. Moreover, the other distinctive feature of our case was that it had an unusual location such as the neck at birth.

Trichoblastoma can occur sporadically, syndromically or secondarily. In detail, syndromic lesions are found in Curry-Jones and Brooke-Spiegler syndrome (4,5). Secondary lesions are

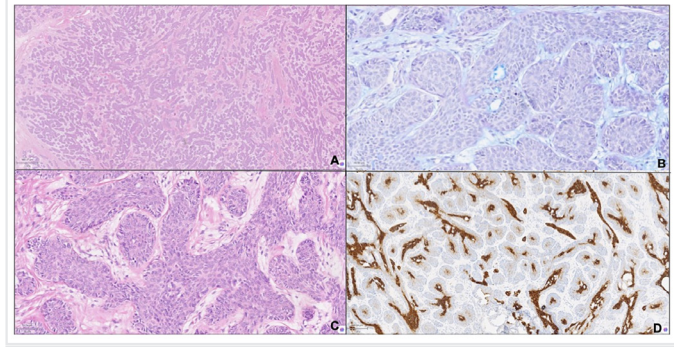


**Figure 3.** Hematoxylin-eosin stained sections. (A; C); PAS-AB histochemical study, a positive reaction was observed in the luminal secretion of the tumor (B) Luminal staining with CK7 (D)

**Figure 4.** An uneventful wound healing after two years from surgery

mostly seen with nevus sebaceous. An evaluation for underlying familial genetic syndromes may be recommended in cases of multiple lesions (6,7). In the family history of our patient, neither a malign nor benign mass, nor a genetic disorder was identified. Furthermore, given the absence of multiple lesion formations in our patient, there was no need for genetic testing. Nevertheless, according to clinical features of our case, even though drawing conclusions based on a singular case is not advisable, it can be also speculated that congenital etiologies might play a role in the development of trichoblastoma. On the other hand, from a clinical perspective, despite regular antenatal follow-up, the absence of any signs during this period indicated the rapid growth of the mass, particularly in close proximity to delivery.

Pathologically, it can be classified as large nodular, small nodular, adamantine (lymphadenoma), retiform, and racemiform. Conventional and desmoplastic trichoepithelioma have also been referred to as cribriform and columnar trichoblastomas, respectively. The common feature of all these types is the presence of follicular germinative (basaloid) cells (2,3,7-9).

Despite its benign nature, it should be taken into account that it may be confused with basal cell carcinoma and the differential diagnosis between the two may be challenging in some cases (10). The main histopathological differential diagnosis includes basal cell carcinoma and trichoepithelioma. Basal cell carcinoma is a basaloid neoplasm that originates from the epidermis. As opposed to trichoblastoma, it is characterized by mitotic active basaloid nodules with necrosis and, with prominent peripheral palisading and clefting between the neoplasm and surrounding stroma (7,10).

## Conclusion

Trichoblastoma shows only peritumoral stromal staining for CD10, whereas basal cell carcinomas typically show intraepithelial staining. The presence of few or many Merkel cells, androjen receptor negativity, PHLDA1 (follicular stem cell marker) positivity, peripheral BCL2 immunostaining in the trichoblastoma differentiates from basal cell carcinoma (7-10). Our case showed no necrosis, the tumor was located in the dermis without connection to the epidermis. It was also observed that the tumor had uniform basaloid cells with narrow cytoplasm, forming follicular papilla-like structures and arranged in layers within the stroma resembling a perifollicular sheath. The absence of peripheral palisading, clefting on the tumor, and immunohistochemical staining features made the distinction.

Trichoblastoma should be taken into account in newborns with neck masses. Additionally, congenital factors may also play a role in the etiology of trichoblastoma.

### Ethics

**Informed Consent:** Written informed consent was obtained from the patient's parents to publish this case report and accompanying images.

### Footnotes

### Authorship Contributions

Surgical and Medical Practices: M.S.K., M.İ., Concept: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ., Design: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ., Data Collection or Processing: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ., Analysis or Interpretation: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ., Literature Search: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ., Writing: M.S.K., C.E.Ç., D.T.T., F.Ö.P., M.İ.

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## References

1. Headington JT. Differentiating neoplasms of hair germ. J Clin Pathol. 1970;23:464-71.
2. Ackerman A, de Viragh P, Chongchitnant N. Neoplasms with follicular differentiation. Philadelphia: Lea & Febiger; 1993.p.359-420.
3. Ponmariappan LP, Shanmuga Sekar C, Rai R, Chaithra V. Unusual presentation of trichoblastoma. J Cutan Aesthet Surg. 2021;14:374-76.
4. Grange DK, Clericuzio CL, Bayliss SJ, Berk DR, Heideman RL, Higginson JK, et al. Two new patients with Curry-Jones syndrome with trichoblastoma and medulloblastoma suggest an etiologic role of the sonic hedgehog-patched-GLI pathway. Am J Med Genet A. 2008;146:2589-97.
5. Kazakov DV. Brooke-Spiegler syndrome and phenotypic variants: an update. Head Neck Pathol. 2016;10:125-30.
6. Zeller KA, Billmire DF. Trichoblastoma: management of a rare skin lesion. J Pediatr Surg. 2012;47:250-2.
7. Jaqueti G, Requena L, Sánchez Yus E. Trichoblastoma is the most common neoplasm developed in nevus sebaceus of Jadassohn: a clinicopathologic study of a series of 155 cases. Am J Dermatopathol. 2000;22:108-18.
8. Kazakov DV, Vanecek T, Zelger B, Carlson JA, Spagnolo DV, Schaller J, et al. Multiple (familial) trichoepitheliomas: a clinicopathological and molecular biological study, including CYLD and PTCH gene analysis, of a series of 16 patients. Am J Dermatopathol. 2011;33:251-65.
9. Schukow C, Ahmed A. Trichoblastoma and trichoepithelioma. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. https://www.ncbi.nlm.nih.gov/books/NBK589680. [Accessed 28 June 2024]
10. Patel P, Nawrocki S, Hinther K, Khachemoune A. Trichoblastomas mimicking basal cell carcinoma: the importance of identification and differentiation. Cureus. 2020;12:8272.

Review

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# Surgery in Geriatric Oncology

## Geriatrik Onkolojide Cerrahi

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**ABSTRACT**

Surgical treatment of older patients with cancer requires careful evaluation of physiological reserve, frailty, concomitant diseases and individual health conditions. The incidence of cancer in this patient group is increasing and surgery is still considered an effective treatment option in many types of cancer. However, the surgical decision-making process in older individuals can be challenging and is often based on subjective assessments. Comprehensive geriatric assessment analyzes the functional, cognitive, psychosocial and general health status of older patients, contributes to the prediction of surgical outcomes and guides individualized treatment decisions.

Surgery can be successfully applied to older individuals with common cancer types such as breast, colon, stomach, hepatobiliary and pancreatic cancers with careful patient selection and a multidisciplinary approach. While palliative surgery aims to control symptoms and improve the quality of life in patients with advanced-stage cancer, the effectiveness of these interventions also depends on accurate assessment processes. Literature shows that older individuals can achieve similar results to younger patients in terms of morbidity and mortality after surgery. Patients for whom surgery is determined to be an appropriate treatment option should not be excluded from this option due to age-related prejudices. In conclusion, surgical treatment decisions in older patients with cancer should be made according to the general health status and frailty level of the individual, as well as tumor biology. With appropriate assessment methods, surgery can improve the duration and quality of life.

**Keywords:** Geriatric oncology, surgical treatment, comprehensive geriatric assessment, elderly cancer patients, palliative surgery

**ÖZ**

Yaşlı kanser hastalarının cerrahi tedavisi, fizyolojik rezerv, kırılganlık, eşlik eden hastalıklar ve bireysel sağlık durumlarının dikkatli değerlendirilmesini gerektirir. Bu hasta grubunda kanser insidansı giderek artmakta ve cerrahi, birçok kanser türünde hala etkili bir tedavi seçeneği olarak kabul edilmektedir. Ancak, yaşlı bireylerde cerrahi karar verme süreci zorlu olabilir ve genellikle öznel değerlendirmelere dayanır. Kapsamlı geriatrik değerlendirme, yaşlı hastaların işlevsel, bilişsel, psikososyal ve genel sağlık durumlarını analiz ederek cerrahi sonuçların tahmin edilmesine katkı sağlar ve bireyselleştirilmiş tedavi kararlarına rehberlik eder. Meme, kolon, mide, hepatobiliyer ve pankreas kanserleri gibi sık görülen kanser türlerinde yaşlı bireylerde cerrahi tedavi, dikkatli hasta seçimi ve multidisipliner bir yaklaşımla başarıyla uygulanabilir. Palyatif cerrahi, ileri evre kanser hastalarında semptom kontrolü ve yaşam kalitesini artırmayı hedeflerken, bu girişimlerin etkinliği de doğru değerlendirme süreçlerine bağlıdır. Literatür, yaşlı bireylerin cerrahi sonrası morbidite ve mortalite açısından genç hastalarla benzer sonuçlar elde edebileceğini göstermektedir. Yaşı ne olursa olsun, cerrahinin uygun bir tedavi yöntemi olduğu belirlenen hastalar, yaşa bağlı önyargılar nedeniyle bu seçeneğin dışında bırakılmamalıdır. Sonuç olarak, yaşlı kanser hastalarında cerrahi tedavi kararları, tümör biyolojisi ile birlikte bireyin genel sağlık durumuna ve kırılganlık düzeyine göre alınmalıdır. Uygun değerlendirme yöntemleriyle cerrahi, yaşam süresi ve kalitesini iyileştirebilir.

**Anahtar Kelimeler:** Geriatrik onkoloji, cerrahi tedavi, kapsamlı geriatrik değerlendirme, yaşlı kanser hastaları, palyatif cerrahi

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## Introduction

The incidence of cancer in geriatric patients is increasing every year. Today, 15.1% of the population consists of individuals aged 65 and over, and this rate is expected to reach 21.4% in 2050. More than two-thirds of cancers are diagnosed in older individuals, and this rate is expected to increase to 70% in the next 30 years (1).

Cancer care in older individuals is a more complex process compared to other patient groups. The main reasons for this are the frequency of concomitant diseases and age-related functional disorders, increased risk of treatment-related toxicity and complications, differences in cancer-related prognostic factors, and the evaluation of non-cancer life expectancy. Failure to adequately address this complex structure may lead to overtreatment or undertreatment in older patients. As a result, more negative clinical outcomes may occur compared to younger patients.

**Preoperative Optimization**

The increasing incidence and prevalence of cancer in older individuals increases the need for studies on the importance and evaluation of surgical treatments. Although the relationship between aging and cancer is complex and elusive, cancer incidence increases with age, as seen in humans and animal models. As global epidemiological and demographic transitions continue, an increasing cancer burden is projected in the coming years, with more than 20 million new cases expected each year by 2025. With surgery becoming the main curative treatment for many solid tumors, the number of older patients undergoing surgery as part of their cancer treatment regimen is also expected to increase (2). Although surgery is generally considered the most effective cancer ablation treatment, complications and mortality rates, as well as length of hospital stay and need for intensive care, increase with age. This may limit the oncological advantages of surgery. In addition, delays in cancer diagnosis in older individuals lead to more frequent emergency visits, and emergency surgeries are associated with increased morbidity and mortality.

Due to the lack of clear guidelines and concerns about treatment tolerance, the rate of recommending standard cancer treatments that have been proven to increase survival to older patients is lower. Geriatric surgery patients require an approach beyond traditional preoperative assessment methods. At this point, geriatricians evaluate this group of patients with the comprehensive geriatric assessment (CGA), a multidisciplinary method. CGA is a multifaceted diagnostic process that focuses on medical, psychological, physical, functional and social dimensions. The application of CGA before surgery is critical in predicting risks such as mortality risk, postoperative complications, need for nursing home after discharge and prolonged hospital stays (3).

The importance of CGA in predicting surgical outcomes has been emphasized in many studies (4). A study of 261 patients showed that CGA-based frailty after surgery in patients over 65 years of age was significantly associated with early overall complications (5). A longitudinal evaluation of surgical intervention for gastrointestinal cancers in patients over 70 years of age revealed changes in quality of life and independence even after six months, which could be improved with focused supportive care (6).

Surgical decision-making in frail older patients is challenging due to the heterogeneity of their health status and the inadequacy of tools used to predict surgical risks. Most of the common tools currently used to predict postoperative complications focus on a single organ system and ignore the patient's physiological reserve. Therefore, multidisciplinary and holistic approaches are increasingly important in surgical evaluation and decision-making in geriatric patients

**Surgical Considerations in Older Adults with Colorectal Cancer**

According to the World Health Organization's 2022 data, the prevalence of colorectal cancer (CRC) in individuals over the age of 65 in Türkiye was reported as 10.7%, with 11,689 cases (7). CRC is a disease that is predominantly seen in older individuals, with approximately 50% of cases being over the age of 70, and more than 40% being over the age of 75. Surgical treatment continues to be the primary treatment method for CRC, and is often supported by chemotherapy-based strategies. However, the effects of surgery and adjuvant treatments in this group remain uncertain due to frailty, geriatric syndromes, comorbidities, polypharmacy, and decreased organ function in older individuals (8).

It has been stated that curative colon resection is generally well tolerated in older individuals, and age alone should not be a criterion for less aggressive treatment decisions. However, older patients often have significant comorbidities that increase postoperative mortality and morbidity, such as cardiovascular and pulmonary diseases (9). Therefore, patient selection for surgical procedures is critical, as this group of patients is at higher risk of developing complications (10).

The Association of Colon Proctology of Great Britain and Ireland has included studies confirming the prevalence of CRC in older individuals. It has been shown that the risk of postoperative death in patients aged 65-74 is 3.5 times higher in those aged 75-84 and 5 times higher in those aged 85 and over. However, these rates have not been adjusted for other risk factors, and the results should be interpreted with caution. It has also been reported that advanced-stage colorectal tumors are common in older individuals and that palliative surgeries are performed more frequently in this group (11).

In a study published in 2021 on patients over the age of 80 who underwent colorectal surgery, it was stated that 92.85% of the patients had one or more accompanying diseases and the postoperative complication rate was 15.10%. The mortality rate was determined to be 46.40% during the study period of 4 years, and the conclusion reached at the end of the study was that the results of CRC surgery in geriatric patients were comparable to those in young patients in terms of postoperative morbidity and mortality rates (12). In another retrospective study that included 202 patients over the age of 70 who underwent colon

or rectal cancer resection between 2016 and 2019, the patients were analyzed in terms of 90-day surgical and 1-year oncological outcomes. When 151 patients with a geriatric 8 score of ≥15 were compared with 51 patients with a score of ≤14, it was determined that the group of patients with a score of ≤14 was significantly older, more frequently malnourished, had preoperative anemia, and had more comorbidities. The results of the study showed that overall postoperative morbidity and complications at 90 days and mortality and recurrence rates at 1 year were similar between the two groups (13). These results are strong examples that the management of comorbidities before surgery can affect postoperative outcome.

Diers et al. (14) also conducted a large cohort study of 330,042 CRC patients from all over Germany to evaluate the effect of advanced age (≥80 years) on surgical treatment, postoperative complications, and mortality. The findings of the study revealed significant differences in mortality rates between the different age groups. In particular, the mortality rate after laparoscopic CRC resection in elderly patients aged 80 years and older was 5.6%, compared to 1.7% in patients aged 60-79 years and 0.4% in patients under 60 years. These results highlight the fragility of older patients and underline the need for improved management strategies for this specific group of patients undergoing CRC resection (14).

Supporting all these comments, a recent study found that CGA in adults aged 75 years and older with CRC who were considered for surgery resulted in a significant reduction in postoperative complications, reiterating the positive impact of personalized geriatric assessment on surgical outcomes in the elderly (15).

Data on rectal cancer surgery is more limited. A systematic review comparing rectal cancer treatment outcomes between older and non-young individuals showed that postoperative morbidity rates in older individuals could be as high as 40%, but these rates were not significantly different from those in younger patients. Comprehensive medical and surgical support is especially important during the first year after surgery, as survival rates in older individuals are similar to those in younger patients.

Quality of life after surgical treatment is an important factor. It has been reported that individuals aged 70 years and older who have underwent surgical resection for rectal cancer may not reach their baseline physical function during 2-year follow-up. Although the role of laparoscopic surgery for rectal cancer has expanded over the last 20 years, studies conducted between 1991 and 2011 have not shown significant improvements in early postoperative complications (e.g., anastomotic leakage, wound infection, and sexual, urinary, and fecal dysfunctions) (16-19).

Current data suggest that age alone should not be a criterion in surgical decision-making and that older individuals can achieve similar outcomes to younger patients when appropriate patient selection is made. However, this process requires a multidisciplinary approach, and more data and a practical, precise scoring system are needed.

**Surgical Considerations in Older Adults with Breast Cancer**

According to the World Health Organization's 2022 data, 6,330 patients with breast cancer have been reported in women over the age of 65 in Türkiye (7). In Western societies, more than one-third of patients diagnosed as having invasive breast cancer and approximately half of breast cancer-related deaths occur in individuals over the age of 70. However, data on the management of breast cancer in older individuals are limited. This is due to the fact that older patients are often excluded from clinical trials due to the prevalence of comorbidities (20,21). It is common practice to delay or completely neglect chemotherapy, radiotherapy, and surgical treatment in this patient group. However, such incomplete treatment approaches can negatively affect treatment outcomes and prognosis. Therefore, an appropriate geriatric assessment is critical to prevent unnecessary incomplete treatment and to protect patients from intolerable toxicities (22).

Surgical resection and ensuring appropriate surgical margins are one of the cornerstones of breast cancer treatment. Thanks to modern surgical and anesthesia techniques, breast cancer surgeries are generally considered safe with low complication rates. However, neglecting surgery may negatively affect treatment outcomes regardless of age, tumor stage, hormone receptor status, and HER2 status. In a study conducted in the United Kingdom on women aged 70 years and older with primary operable invasive breast cancer (T1-4N0-2M0), it was stated that age, frailty, and comorbidities affected decisions for mastectomy and axillary dissection. In addition, it was emphasized that breast cancer surgery was safe in this patient group with low to moderate adverse event rates (19.3%) and no 30-day mortality, but surgery might have negative effects on quality of life and functional independence (23-26). The type and extent of breast cancer surgery generally depend on factors such as comorbidities, functional status, and tumor stage. However, the patient's age remains an independent factor in healthcare professionals' choice of surgery type. In the study by Morgan et al. (27), it was stated that mastectomy rates were higher in the older age group. This is consistent with the retrospective study by Peters et al. (28), who showed that breast-conserving surgery was less frequently preferred in patients aged 70 years and older, and that adjuvant radiotherapy was avoided in order to minimize additional toxicities in these patients.

Surgery without axillary lymph node dissection (ALND) has been shown to be a safe option in older patients with early-stage breast cancer and clinically negative lymph nodes. Mandelblatt et al. (29) evaluated the results of ALND in patients with early-stage breast cancer who were aged 67 years and older, and reported that side effects such as lymphedema, arm pain, and shoulder movement restriction, which negatively affected quality of life, were common. In addition, a randomized study in patients aged 60 years and older with hormonal receptor-positive and clinically negative axillary lymph nodes reported that patients who did not undergo ALND had a better quality of life (30).

Sentinel lymph node biopsy (SLNB) is recommended as a less invasive alternative to axillary surgery, especially in low-risk older patients, with the aim of avoiding unnecessary treatment. However, it has been stated that SLNB may be a useful tool in determining the aggressiveness of adjuvant treatment in suitable older patients. Not performing SLNB should not be generalized to all older patients, as it may increase the risk of regional recurrence but does not have a significant effect on overall survival or breast cancer-specific survival (31-33). Axillary management requires an individualized approach shaped by clinical stage, response to chemotherapy, and SLNB findings. Several studies including older patient groups are ongoing, and it is anticipated that the results of these studies will better guide surgical decision-making processes for different scenarios.

**Surgical Considerations in Older Adults with Hepatobiliary Cancer**

The incidence of hepato-pancreatobiliary (HPB) malignancies is increasing, with the majority of cases occurring in patients between the ages of 60 and 80. Surgical resection, adjuvant, and neoadjuvant therapies form the basis of treatment for these cancers. Hepatocellular carcinoma is one of the most common causes of cancer-related deaths worldwide. Early studies reported higher mortality after liver resection in older individuals, but in recent years, improved patient selection and advances in surgical techniques have shown that operative mortality rates have decreased. However, the 5-year overall survival rate after liver resection in older individuals ranges from 18% to 76%. Kaibori et al. (34) reported that underlying liver diseases were more common in older patients with HPB cancer, which increased the risk of perioperative complications and worsened the prognosis. It has been stated that laparoscopic liver resection can provide similar results to younger patients without a significant difference in postoperative morbidity or mortality in carefully selected patients (34,35).

According to GLOBOCAN 2022 data, liver cancer is the 14$^{th}$ most common cancer type in Türkiye with 5,039 new cases annually and 9$^{th}$ among cancer-related deaths with 4,929 deaths (36). With the increase in average life expectancy, the number of older patients requiring liver surgery also increases. It is known that the incidence of hepatocellular carcinoma increases with age. However, the decision to undergo liver resection remains controversial due to the high prevalence of concomitant diseases and functional disabilities in older patients. Although age has been defined as an independent risk factor for complications and mortality after liver surgery, recent studies have reported that the postoperative prognoses of older patients are similar to those of young patients.

The results of 133 patients over the age of 65 who underwent liver resection at Memorial Sloan-Kettering Cancer Center between 1991 and 1993 were studied. The mortality rate was 4%, and the mean hospital stay was 13 days, compared with 11.9 days for patients under the age of 65 (p=0.02). Updated results showed that patients aged 75 and over had smaller resections and longer hospital stays. However, major complication rates and overall outcomes were similar between the two groups. However, 90-day mortality rates were noted to be higher in patients over the age of 75 (37).

In a study evaluating 856 patients who underwent major hepatectomy according to age groups (<50 years, 50-64 years, 65-74 years, ≥75 years), it was shown that age was independently associated with mortality (odds ratio: 1.039; 95% confidence interval: 1.021-1.058; p=0.0029) (38). In another study evaluating 7,764 patients who underwent liver resection for colorectal liver metastases, it was found that the 60-day mortality rate and the incidence of complications increased in patients over 70 years of age, while the 3-year overall survival rates decreased (39).

According to GLOBOCAN 2022 data, pancreatic cancer in Türkiye ranks 8$^{th}$ with 8,636 new cases and 4$^{th}$ among cancer-related deaths with 8,415 deaths. The basis of pancreatic cancer treatment is the combination of surgical resection and chemotherapy. However, pancreatic surgery has been associated with high rates of postoperative complications. Although it has been stated that age alone should not be a contraindication for pancreatic cancer surgery, surgeons are generally hesitant to perform these major surgical procedures in older patients.

Previous studies have shown that older patients are at high risk of postoperative complications due to comorbid conditions and functional disabilities. A study evaluating 2,698 patients who underwent pancreaticoduodenectomy reported that age (<80 years, 80-89 years, ≥90 years) was not an independent risk factor for perioperative morbidity or mortality (40). However, a study conducted in the USA between 1999 and 2005 found that in-hospital mortality rates (from 2.4% to 11.4%), length of hospital stay (from 11 days to 15 days), and the need for inpatient care after discharge (from 3.5% to 38.2%) increased significantly with increasing age (41).

In a recent study in which 88 patients aged 75 years and older were included, patients were evaluated using various clinical parameters such as gender, cancer type, stage, performance status, body mass index and CGA using the geriatric prognostic scoring system and it was concluded that it was useful in predicting prognosis and could provide useful information to surgeons in determining treatment strategies in older patients with liver cancer (42).

Surgical treatment in geriatric patients with hepatobiliary cancer poses significant challenges due to comorbidities that increase with age, functional disabilities, and surgery-related complication risks. However, with good patient selection and multidisciplinary approaches, significant results can be obtained from surgical treatment in these patients. Since the number of studies on hepatobiliary cancers is quite insufficient, larger-scale and standardized studies are needed.

**Surgical Considerations in Older Adults with Gastric Cancer**

According to GLOBOCAN 2022 data, gastric cancer ranks 7$^{th}$ in Türkiye with 12,773 new cases and 3$^{rd}$ in cancer-related deaths

with 10,457 deaths. Surgery is still considered the only curative treatment method for patients with gastric cancer. However, in most studies in this area, older patients have generally been excluded from the studies, which has limited the data. This situation increases the debate about the effectiveness and safety of extensive oncological resections in older individuals. Although perioperative complication rates have not been clearly stated in previous studies, some studies have suggested that the risk of complications after gastric cancer surgery is increased in older population, while other studies have reported that this risk is similar in older patient group compared to younger patients (43,44).

Gretschel et al. (45), who analyzed the effect of patient age and comorbidities on tumor recurrence and survival in gastric cancer, stated that more than 80% of patients over the age of 75 had extensive comorbidities and that this affected their surgical preferences. The study reported that extensive surgeries were performed 28% more frequently in patients under the age of 60; whereas, in patients over the age of 60, narrower procedures, especially subtotal resections, were preferred. In addition, it was stated that despite having the same tumor characteristics, older patients were less frequently subjected to gastrectomy, D2 lymphadenectomy, and splenectomy.

As a result, surgical and non-surgical postoperative morbidity rates in older patients did not show a significant difference compared to young patients; however, it was found that common comorbidities in patients over the age of 75 increased postoperative mortality by 8%. Kang et al. (46), who examined the risk factors for poor surgical outcomes in older patients with gastric cancer, evaluated 247 patients with a mean age of 72.8 years. In the study, 20.2% of the patients (50 patients) had postoperative complications and 8.1% (20 patients) had serious postoperative complications. Postoperative mortality was reported as 2.4% (6 patients). The mean postoperative hospital stay was determined as 17.1 days. In the study, low serum albumin level was found to be a general risk factor and a determinant of serious postoperative complications in older patients with gastric cancer. Other risk factors related to surgery included tumor size, length of operation, and procedures such as total gastrectomy.

In addition to these data, the recently published study by Yüksel et al. (47) has shown the effectiveness of robotic surgery in oncological operations in the older population. The results of the study, in which those aged 70 and over were defined as the old patient group and those under 70 as the young patient group, showed that the postoperative hospital stay, 30-day mortality and 90-day rehospitalization rates were similar in both groups (47). The data from this study once again emphasize the importance of correctly evaluating the patient population and selecting the appropriate treatment method in geriatric patients.

**Palliative Surgery in Geriatric Oncology**

Palliative surgery is defined as "surgery performed to provide symptom control and improve quality of life in cases where curative surgery is not an option". Such interventions focus on improving the patient's quality of life with minimal intervention and aim to provide the greatest benefit to the patient. In this context, many procedures considered "life-prolonging" have emerged as palliative practices performed to relieve pain and discomfort. The main purpose of palliative surgery in patients with cancer is to relieve symptoms caused by cancer or prevent complications (48).

No surgical intervention is risk-free, and the risk rate of palliative surgery is even higher due to the high morbidity and mortality rates. The most difficult stage in this area is the decision for surgical intervention. During this process, the problems that threaten the patient's life should be carefully evaluated. The main purpose of the surgical intervention to be performed should be clearly determined. The basic principles of palliative surgery in patients with advanced cancer can be classified as a comprehensive evaluation of the disease, providing local control, management of bleeding, discharge, fistula and pain, reconstruction and rehabilitation.

The conditions in which palliative surgery is most frequently required are skin and soft tissue cancers, gastrointestinal system cancers, breast cancer, endocrine cancers and head and neck region cancers. These surgical procedures usually include resection, reconstruction, functional repair, drainage or biopsy. The success of palliative surgery increases significantly when managed with a multidisciplinary approach and by an experienced team.

## Conclusion

Surgical treatment of older patients with cancer requires accurate assessment of individuals' physiological reserves, frailty levels, and comorbidities. Although many surgeons today evaluate these factors based on their clinical experience, these approaches are often subjective and may cause some older patients to miss the opportunity for surgical treatment. This situation reveals the need for more objective and comprehensive methods to increase the predictability of surgical outcomes in older individuals.

CGA stands out as a critical tool in surgical planning by providing a detailed analysis of the general health status, frailty level, functional capacity, cognitive skills, and psychosocial factors of older patients. This approach supports the development of personalized treatment strategies by allowing an understanding of not only tumor biology but also the individual needs of the patient.

Surgery should be considered as a treatment option in older patients with cancer where age alone is not a determining factor, and can provide effective results when managed appropriately. The literature shows that with careful patient selection and multidisciplinary approaches, older patients can achieve similar results to younger patients in terms of postoperative morbidity and mortality. For this, frailty, performance status and comorbidities should be included in the surgical decision-making process.

In conclusion, surgery can be safely performed in older individuals with good assessment and adequate perioperative care. Regardless of age, patients for whom surgery is a suitable treatment option should not be deprived of this important opportunity. This

approach will not only improve quality of life but also contribute to preventing age-related inequalities in access to treatment.

**Footnotes**

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## References

1. Johnston ME 2nd, Sussman JJ, Patel SH. Surgical oncology and geriatric patients. Clin Geriatr Med. 2019;35:53-63.
2. Plas M, de Haan JJ, van der Wal-Huisman H, Rutgers A, Absalom AR, de Bock GH, et al. The systemic impact of a surgical procedure in older oncological patients. Eur J Surg Oncol. 2019;45:1403-9.
3. Kim KI, Park KH, Koo KH, Han HS, Kim CH. Comprehensive geriatric assessment can predict postoperative morbidity and mortality in elderly patients undergoing elective surgery. Arch Gerontol Geriatr. 2013;56:507-12.
4. Penning Y, El Asmar A, Moreau M, Raspé J, Dal Lago L, Pepersack T, et al. Evaluation of the comprehensive geriatric assessment (CGA) tool as a predictor of postoperative complications following major oncological abdominal surgery in geriatric patients. PLoS One. 2022;17:e0264790.
5. Chang SY, Son J, Park SM, Chang BS, Lee CK, Kim H. Predictive value of comprehensive geriatric assessment on early postoperative complications following lumbar spinal stenosis surgery: a prospective cohort study. Spine (Phila Pa 1976). 2020;45:1498-505.
6. Deschler B, Ihorst G, Hüll M, Baier P. Regeneration of older patients after oncologic surgery. A temporal trajectory of geriatric assessment and quality of life parameters. J Geriatr Oncol. 2019;10:112-9.
7. https://gco.iarc.who.int/today/en/dataviz/pie?mode=cancer&types=0&sexes=0&populations=792&age_start=13, Accessed from: December 2024.
8. Zhang L, Li Q, Hu C, Zhang Z, She J, Shi F. Real-world analysis of survival benefit of surgery and adjuvant therapy in elderly patients with colorectal cancer. Sci Rep. 2023;13:14866.
9. Hermans E, van Schaik PM, Prins HA, Ernst MF, Dautzenberg PJ, Bosscha K. Outcome of colonic surgery in elderly patients with colon cancer. J Oncol. 2010;2010:865908.
10. Kristjansson SR, Nesbakken A, Jordhøy MS, Skovlund E, Audisio RA, Johannessen HO, et al. Comprehensive geriatric assessment can predict complications in elderly patients after elective surgery for colorectal cancer: a prospective observational cohort study. Crit Rev Oncol Hematol. 2010;76:208-17.
11. Tekkis PO, Poloniecki JD, Thompson MR, Stamatakis JD. ACPGBI colorectal cancer study 2002 – part a: unadjusted outcomes. (b) Tekkis PP, Poloniecki JD, Thompson MR, Stamatakais JD: ACPGBI Colorectal study 2002 Part B Risk adjusted outcomes The ACPGBI colorectal Cancer Model.
12. Chandio A, Rai A, Chandio M, Rhody A, Brown K. Outcome of colorectal cancer in geriatric patient. J Cancer Research and Cellular Therapeutics. 2021;5:1-7.
13. Pille A, Meillat H, Braticevic C, Lelong B, Rousseau F, Cecile M, et al. How to compensate for frailty? The real life impact of geriatric co-management on morbi-mortality after colorectal cancer surgery in patients aged 70 years or older. Aging Clin Exp Res. 2024;36:163.
14. Diers J, Baum P, Lehmann K, Uttinger K, Baumann N, Pietryga S, et al. Disproportionately high failure to rescue rates after resection for colorectal cancer in the geriatric patient population – a nationwide study. Cancer Med. 2022;11:4256-64.
15. Sugiyama M, Nishijima TF, Kasagi Y, Uehara H, Yoshida D, Nagai T, et al. Impact of comprehensive geriatric assessment on treatment strategies and complications in older adults with colorectal cancer considering surgery. J Surg Oncol. 2024;130:329-37.
16. Manceau G, Karoui M, Werner A, Mortensen NJ, Hannoun L. Comparative outcomes of rectal cancer surgery between elderly and non-elderly patients: a systematic review. Lancet Oncol. 2012;13:525-36.
17. Schmidt CE, Bestmann B, Kuchler T, Longo WE, Kremer B. Impact of age on quality of life in patients with rectal cancer. World J Surg. 2005;29:190-7.
18. Shearer R, Gale M, Aly OE, Aly EH. Have early postoperative complications from laparoscopic rectal cancer surgery improved over the past 20 years? Colorectal Dis. 2013;15:1211-26.
19. Dekker JW, van den Broek CB, Bastiaannet E, van de Geest LG, Tollenaar RA, Liefers GJ. Importance of the first postoperative year in the prognosis of elderly colorectal cancer patients. Ann Surg Oncol. 2011;18:1533-9.
20. DeSantis CE, Ma J, Gaudet MM, Newman LA, Miller KD, Goding Sauer A, et al. Breast cancer statistics, 2019. CA Cancer J Clin. 2019;69:438-51.
21. Shachar SS, Hurria A, Muss HB. Breast cancer in women older than 80 years. J Oncol Pract. 2016;12:123-32.
22. Abdel-Razeq H, Abu Rous F, Abuhijla F, Abdel-Razeq N, Edaily S. Breast cancer in geriatric patients: current landscape and future prospects. Clin Interv Aging. 2022;17:1445-60.
23. Parks R, Cheung KL. Challenges in geriatric oncology-a surgeon's perspective. Curr Oncol. 2022;29:659-74.
24. Ward SE, Richards PD, Morgan JL, Holmes GR, Broggio JW, Collins K, et al. Omission of surgery in older women with early breast cancer has an adverse impact on breast cancer-specific survival. Br J Surg. 2018;105:1454-63.
25. Yin M, Verschraegen C, Vincent VH, Patel SM, George T, Truica CI. Impact of lack of surgery on outcomes in elderly women with nonmetastatic breast cancer-A surveillance, epidemiology, and end results 18 population based study. Medicine (Baltimore). 2020;99:18745.
26. Morgan JL, George J, Holmes G, Martin C, Reed MWR, Ward S, et al. Breast cancer surgery in older women: outcomes of the Bridging Age Gap in Breast Cancer study. Br J Surg. 2020;107:1468-79.
27. Morgan JL, Walters SJ, Collins K, Robinson TG, Cheung KL, Audisio R, et al. What influences healthcare professionals' treatment preferences for older women with operable breast cancer? An application of the discrete choice experiment. Eur J Surg Oncol. 2017;43:1282-7.
28. Peters E, Anzeneder T, Jackisch C, Dimpfl T, Kunz G, Katalinic A, et al. The treatment of primary breast cancer in older women with

adjuvant therapy: a retrospective analysis of data from over 3000 patients from the PATH biobank, with two-year follow-up. Dtsch Arztebl Int. 2015;112:577-84.

29. Mandelblatt JS, Edge SB, Meropol NJ, Senie R, Tsangaris T, Grey L, et al. Sequelae of axillary lymph node dissection in older women with stage 1 and 2 breast carcinoma. Cancer. 2002;95:2445-54.
30. International Breast Cancer Study Group; Rudenstam CM, Zahrieh D, Forbes JF, Crivellari D, Holmberg SB, et al. Randomized trial comparing axillary clearance versus no axillary clearance in older patients with breast cancer: first results of International Breast Cancer Study Group Trial 10-93. J Clin Oncol. 2006;24:337-44.
31. Christian N, Heelan Gladden A, Friedman C, Gleisner-Patton A, Murphy C, Kounalakis N, et al. Increasing omission of radiation therapy and sentinel node biopsy in elderly patients with early stage, hormone-positive breast cancer. Breast J. 2020;26:133-8.
32. Sun J, Mathias BJ, Sun W, Fulp WJ, Zhou JM, Laronga C, et al. Is it wise to omit sentinel node biopsy in elderly patients with breast cancer? Ann Surg Oncol. 2021;28:320-9.
33. Xu L, Wen N, Qiu J, He T, Tan Q, Yang J, et al. Predicting survival benefit of sparing sentinel lymph node biopsy in low-risk elderly patients with early breast cancer: a population-based analysis. Front Oncol. 2020;10:1718.
34. Kaibori M, Ishizaki M, Matsui K, Iida H, Inoue K, Nagashima F, et al. Geriatric assessment as a predictor of postoperative complications in elderly patients with hepatocellular carcinoma. Langenbecks Arch Surg. 2016;401:205-14.
35. Cauchy F, Fuks D, Nomi T, Dokmak S, Scatton O, Schwarz L, et al. Benefits of laparoscopy in elderly patients requiring major liver resection. J Am Coll Surg. 2016;222:174-84.
36. https://gco.iarc.who.int/media/globocan/factsheets/populations/792-turkiye-fact-sheet.pdf. Accessed from: December 2024.
37. Fong Y, Brennan MF, Cohen AM, Heffernan N, Freiman A, Blumgart LH. Liver resection in the elderly. Br J Surg. 1997;84:1386-90.
38. Reddy SK, Barbas AS, Turley RS, Gamblin TC, Geller DA, Marsh JW, et al. Major liver resection in elderly patients: a multi-institutional analysis. J Am Coll Surg. 2011;212:787-95.
39. Adam R, Frilling A, Elias D, Laurent C, Ramos E, Capussotti L, et al. Liver resection of colorectal metastases in elderly patients. Br J Surg. 2010;97:366-76.
40. Makary MA, Winter JM, Cameron JL, Campbell KA, Chang D, Cunningham SC, et al. Pancreaticoduodenectomy in the very elderly. J Gastrointest Surg. 2006;10:347-56.
41. Riall TS, Reddy DM, Nealon WH, Goodwin JS. The effect of age on short-term outcomes after pancreatic resection: a population-based study. Ann Surg. 2008;248:459-67.
42. Sakano Y, Noda T, Kobayashi S, Akasaka H, Kato K, Sasaki K, et al. Geriatric prognostic scoring system predicts survival after hepatectomy for elderly patients with liver cancer. Ann Gastroenterol Surg. 2023;8:498-506.
43. Wu CW, Lo SS, Shen KH, Hsieh MC, Lui WY, P'eng FK. Surgical mortality, survival, and quality of life after resection for gastric cancer in the elderly. World J Surg. 2000;24:465-72.
44. Kunisaki C, Akiyama H, Nomura M, Matsuda G, Otsuka Y, Ono HA, et al. Comparison of surgical outcomes of gastric cancer in elderly and middle-aged patients. Am J Surg. 2006;191:216-24.
45. Gretschel S, Estevez-Schwarz L, Hünerbein M, Schneider U, Schlag PM. Gastric cancer surgery in elderly patients. World J Surg. 2006;30:1468-74.
46. Kang SC, Kim HI, Kim MG. Low serum albumin level, male sex, and total gastrectomy are risk factors of severe postoperative complications in elderly gastric cancer patients. J Gastric Cancer. 2016;16:43-50.
47. Yüksel S, Topal U, Songur MZ, Yılmaz Özgüven B, Karaköse E, Teke Z, et al. Robotic gastrectomy is safe in geriatric patients with gastric cancer: a retrospective cohort study. Eur Rev Med Pharmacol Sci. 2024;28:3041-7.
48. Akçakaya A, editor. Palliative care and medicine (Palyatif bakım ve tıp). Istanbul: Istanbul Medical Bookstores; 2019.