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Original Article

Determinants of Postoperative Sleep Deterioration After Surgery for Gynecologic Malignancies

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ABSTRACT

Objective: This study aimed to prospectively evaluate the factors influencing sleep quality in patients undergoing surgical interventions for gynecological malignancies, with a particular focus on the impact of surgical menopause.

Methods: This prospective cohort study included 142 patients who underwent surgical procedures for endometrial, ovarian, or cervical cancer at a tertiary care institution. Participants were divided into two cohorts: Those who underwent surgical menopause (SM group, n=68) and those who did not (non-SM group, n=74). Sleep quality was assessed usingethe Pittsburgh Sleep Quality Index (PSQI) both preoperatively and three months postoperatively. Preoperative anxiety and depression levels were measured using the Hospital Anxiety and Depression Scale (HADS). Demographic, clinical, and surgical data were collected systematically. Multiple linear regression analysis was performed to identify independent associated factor of poor postoperative sleep quality, as indicated by changes in the PSQI score.

Results: The mean global PSQI score significantly worsened from 5.1±2.8 at baseline to 8.9±4.1 at 3 months postoperatively ($p<0.001$). The deterioration in sleep quality was significantly greater in the SM group than in the non-SM group (mean PSQI change: +5.6 vs. +2.1, $p<0.001$). In the multivariate regression model, surgical menopause ($\beta=3.12$, $p<0.001$), adjuvant chemotherapy ($\beta=1.89$, $p=0.002$), higher baseline HADS anxiety score ($\beta=0.25$, $p=0.005$), and higher postoperative pain score (VAS) ($\beta=0.31$, $p=0.018$) were identified as independent associated factor of a greater increase in the PSQI score (worse sleep quality).

Conclusion: Postoperative sleep quality significantly deteriorated following gynecologic cancer surgery, with surgical menopause identified as the most significant independent associated factor of this decline. Furthermore, pre-existing anxiety, adjuvant chemotherapy, and postoperative pain substantially contributed to this deterioration. These findings highlight the necessity of routine screening of sleep quality and the implementation of targeted interventions, including the management of menopausal symptoms, provision of psychological support, and effective pain control within this vulnerable patient cohort.

INTRODUCTION

Gynecologic malignancies pose a significant health challenge for women worldwide, with treatment protocols often encompassing aggressive surgical interventions, chemotherapy, and radiotherapy.[1] While oncologic outcomes remain the primary focus, there is increasing acknowledgment of the effects of these treatments on patients' quality of life (QoL).[2] Among the most common and distressing symptoms affecting QoL in cancer survivors is poorr sleep quality, which may present as insomnia, fragmented sleep, and nonrestorative rest.[3]

Sleep disturbances in patients with cancer are multifactorial, stemming from the psychological distress associated with the diagnosis, side effects of treatment such as pain and nausea, and direct physiological changes.[4,5] In gynecologic oncology, surgical menopause is a distinct and abrupt physiological stressor. The removal of both ovaries (bilateral salpingo-oophorectomy) in premenopausal women induces an immediate and significant state of estrogen deficiency, which triggers severe vasomotor symptoms (hot flashes and night sweats), mood instability, and urogenital atrophy.[6,7] These symptoms are well-documented disruptors of sleep architecture and continuity.[8]

While the correlation between menopause and sleep disturbances is well established, the specific effects of iatrogenic surgically induced menopause, exacerbated by the stress of a cancer diagnosis and major surgery, remain less clearly defined. Previous research has often aggregated all gynecologic cancer patients or focused solely on vasomotor symptoms, without isolating the independent impact of surgical menopause from other significant variables such as preoperative psychological state, type of surgery, adjuvant therapy, and postoperative pain.[9,10] Understanding the hierarchy and interactions of these factors is crucial for developing targeted interventions.

This study aimed to address this gap by prospectively evaluating the factors influencing changes in sleep quality following surgical intervention for gynecological malignancies. The primary objective was to determine the independent effect of surgical menopause on postoperative sleep quality, considering other relevant clinical, surgical, and psychological variables.

MATERIALS AND METHODS

This prospective cohort study will be conducted at The Diyarbakır Gazi Yaşargil Training and Research Hospital, a tertiary referral center, from January 2024 to May 2025. This study was conducted in accordance with the principles of the Declaration of Helsinki. The protocol was approved by the Institutional Review Board of Health Sciences University Gazi Yaşargil Training and Research Hospital Ethics Committee. (No: 525, Date: 27/06/2025) and all participants provided written informed consent.

The inclusion criteria were as follows: (a) Individuals aged ≥ 18 years; (b) A recent diagnosis of endometrial, ovarian, or cervical cancer with plans for primary surgical intervention; and (c) The capacity to comprehend and complete the study questionnaires. The exclusion criteria were as follows: (a) A pre-existing diagnosis of a primary sleep disorder, such as sleep apnea or narcolepsy; (b) Regular use of hypnotic medications at baseline; (c) Severe psychiatric disorders other than anxiety or depression; and (d) Metastatic disease that precludes surgery with curative intent.

A total of 158 patients were initially evaluated for their eligibility. After exclusions, 142 patients were enrolled in the study. For the primary analysis, the patients were divided into two groups:

1. Surgical Menopause (SM) Group: Premenopausal patients who underwent bilateral salpingo-oophorectomy.

2. Non-Surgical Menopause (non-SM) Group: Postmenopausal patients undergoing any type of surgery or premenopausal patients undergoing fertility-sparing surgery.

Data Collection and Measures: Data were collected at two time points: Baseline (within one week before surgery) and three months postoperatively during a follow-up visit.

1. Primary Outcome: Sleep Quality. The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality over the preceding month.[11] The PSQI is a 19 item self-report instrument that generates seven component scores and a global score ranging from 0 to 21. A global score of >5 indicates poor sleep quality. The Turkish version of the PSQI has been shown to possess high reliability and validity.[12] The primary outcome was the change in the global PSQI score from baseline to three months postoperatively.

2. Psychological Distress: The Hospital Anxiety and Depression Scale (HADS) was employed at baseline to evaluate preoperative psychological conditions.[13] This instrument comprises 14 items and provides distinct scores for anxiety (HADS-A) and depression (HADS-D).

3. Postoperative Pain: At 3-month follow-up visit, patients rated their average pain over the preceding 7 days usingg a 10-cm Visual Analog Scale (VAS), where 0represented no pain and 10representeds the worst imaginable pain. No discharge VAS was collected

4. Clinical and Demographic Data: Information on age, BMI, cancer diagnosis, FIGO stage, surgical approach (laparotomy vs. minimally invasive surgery, MIS), and planned adjuvant therapy (chemotherapy/radiotherapy) were collected from the patient records.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize patient characteristics. Paired t-tests were used to compare pre-and postoperative PSQI scores. Independent t tests or Mann Whitney U tests were used to compare continuous variables between groups, while Chi-square or Fisher's exact tests were used for categorical variables.

Multiple linear regression analysis was performed to identify independent associated factor of postoperative sleep disturbance. To control for baseline sleep quality and isolate the factors contributing to sleep deterioration, the change in the global PSQI score (ΔPSQI=postoperative PSQI, preoperative PSQI) was used as the dependent variable in the regression analysis. The independent variables included in the model were those found to be significant ($p<0.1$) in the bivariate analyses, including surgical menopause status, age, cancer stage, adjuvant chemotherapy, baseline HADS-A score, and postoperative VAS pain score. Statistical significance was set at $P<0.05$.

Table 1. Baseline demographic and clinical characteristics of participants (N=142)

Characteristic	Total Cohort (n=142)	SM Group (n=68)	Non-SM Group (n=74)	p-value
Age (years), mean±SD	55.2±10.1	48.5±5.2	61.3±8.9	<0.001
BMI (kg/m²), mean±SD	29.8±5.5	29.1±5.1	30.4±5.8	0.215
Cancer Type, n (%)				0.340
Endometrial	84 (59.1)	37 (54.4)	47 (63.5)	
Ovarian	41 (28.9)	22 (32.4)	19 (25.7)	
Cervical	17 (12.0)	9 (13.2)	8 (10.8)	
FIGO Stage, n (%)				0.002
Stage I-II	105 (73.9)	58 (85.3)	47 (63.5)	
Stage III-IV	37 (26.1)	10 (14.7)	27 (36.5)	
Surgical Approach, n (%)				0.411
MIS	65 (45.8)	33 (48.5)	32 (43.2)	
Laparotomy	77 (54.2)	35 (51.5)	42 (56.8)	
Adjuvant Chemo, n (%)	59 (41.5)	21 (30.9)	38 (51.4)	0.015
HADS-Anxiety, mean±SD	7.9±3.5	9.1±3.1	6.8±3.6	<0.001
HADS-Depression, mean±SD	6.5±3.1	6.8±2.9	6.2±3.3	0.288

Data are presented as mean±SD or n (%). SM: Surgical Menopause; non-SM: Non-Surgical Menopause; BMI: Body Mass Index; FIGO: International Federation of Gynecology and Obstetrics; MIS: Minimally Invasive Surgery; HADS: Hospital Anxiety and Depression Scale; PSQI: Pittsburgh Sleep Quality Index; VAS: Visual Analog Scale. p-values refer to between-group comparisons.

Table 2. Preoperative and postoperative PSQI scores

PSQI Score	Total Cohort (n=131)	SM Group (n=62)	Non-SM Group (n=69)	p-value (between groups)
Baseline Global PSQI	5.1±2.8	5.4±2.7	4.9±2.9	0.354
Post-op Global PSQI	8.9±4.1	11.0±3.5	7.0±3.4	<0.001
Mean Change (ΔPSQI)	+3.8±2.9	+5.6±2.9	+2.1±2.0	<0.001

Higher PSQI scores indicate worse sleep quality; ΔPSQI: postoperative minus preoperative global PSQI. PSQI: Pittsburgh Sleep Quality Index; SM: Surgical Menopause; non-SM: Non-Surgical Menopause. Independent tests were used for between-group comparisons, and paired tests were used for within-group changes.

RESULTS

Of the 142 enrolled patients, 131 completed the 3 month follow-up (92.3% follow-up rate). The baseline demographic and clinical characteristics are shown in Table 1. The mean age was 55.2±10.1 years old. The most common diagnosis was endometrial cancer (n=58.9%). The SM (n=68) and non-SM (n=74) groups were similar at baseline in terms of BMI, cancer type distribution, and HADS-D scores. However, the SM group was significantly younger, had a higher proportion of early stage disease, and had higher baseline HADS-A scores ($p<0.05$).

As shown in Table 2, the mean global PSQI score for the entire cohort significantly increased from 5.1±2.8 at baseline to 8.9±4.1 at 3 months postoperatively ($p<0.001$), indicating a clinically significant worsening of sleep quality. The percentage of patients classified as "poor sleepers" (PSQI score >5) increased from 40.1% to 71.0%. Deterioration was significantly more pronounced in the SM group than that in the control group. The mean change in PSQI score (ΔPSQI) was +5.6±2.9 in the SM group, compared to +2.1±2.0 in the Non SM group ($p<0.001$).

Multiple linear regression analysis identified four independent associated factor of worsened postoperative sleep quality (higher ΔPSQI score). The final model was statistically significant ($F(4, 126)=28.5$, $p<0.001$) and explained 47.5% of the variance in changes in sleep quality ($R^2=0.475$). As shown in Table 3, surgical menopause was the strongest independent associated factor. Adjuvant chemotherapy, higher baseline HADS anxiety score, and higher postoperative pain (VAS) were also significant independent associated factor. In the multivariable model, the effect sizes with 95% confidence intervals were as follows: Surgical menopause ($\beta=3.12$, 95% CI=2.15-4.09, $p<0.001$), adjuvant chemotherapy ($\beta=1.89$, 95% CI=0.72-3.06, $p=0.002$), baseline HADS-anxiety ($\beta=0.25$, 95% CI=0.07-0.43, $p=0.005$), and postoperative pain (VAS) ($\beta=0.31$, 95% CI=0.05-0.57, $p=0.018$).

Table 3. Multiple linear regression analysis predicting change in PSQI score (ΔPSQI)

Variable	Unstandardized Coefficient (B)	Standard Error (SE)	Standardized Coefficient (β)	95% Confidence Interval	p-value
(Constant)	-1.54	0.65		-2.82 to -0.26	0.019
Surgical Menopause (Yes)	3.12	0.49	0.45	2.15 to 4.09	<0.001
Adjuvant Chemotherapy (Yes)	1.89	0.59	0.23	0.72 to 3.06	0.002
Baseline HADS-Anxiety Score	0.25	0.09	0.20	0.07 to 0.43	0.005
Post-op Pain (VAS Score)	0.31	0.13	0.17	0.05 to 0.57	0.018

Dependent variable: ΔPSQI. Variables with p<0.10 in bivariate analyses were entered into the model. Abbreviations: B: Unstandardized coefficient; β: Standardized coefficient; CI: Confidence Interval; HADS: Hospital Anxiety and Depression Scale; VAS: Visual Analog Scale.

DISCUSSION

This prospective study offers essential insights into the significant impact of gynecological cancer surgery on sleep quality, identifying surgical menopause as the most critical associated factor of its decline. Our primary finding that sleep quality deteriorates markedly for all patients, with a particularly pronounced effect in those experiencing acute menopause, underscores a vital area for intervention in oncologic care.

The observed deterioration in sleep quality within our cohort, as evidenced by the increase in mean PSQI from 5.1 to 8.9, aligns with existing literature that reports high incidences of sleep disturbances among cancer survivors.[3,14] This decline can be attributed to a confluence of factors, including the psychological trauma associated with diagnosis, the physical stress of surgical interventions, and the adverse effects of subsequent treatments.[4] Our study effectively disentangled some of these contributing factors.

The significant independent effect of surgical menopause ($\beta=3.12$, $p<0.001$) corroborates our primary hypothesis. This result builds upon previous research by quantifying its impact in relation to other variables. It is particularly noteworthy that a substantial negative effect of surgical menopause on sleep quality was identified, despite this cohort being significantly younger and having a lower incidence of advanced-stage disease and adjuvant chemotherapy. This underscores the potent physiological impact of sudden estrogen withdrawal. The abrupt cessation of estrogen induces severe vasomotor symptoms, notably night sweats, which are known to cause frequent awakenings and fragmented sleep.[8,15] Beyond hot flashes, estrogen deficiency also directly influences central neurotransmitter systems that regulate the sleep-wake cycle, such as serotonin and norepinephrine, thereby contributing to primary insomnia.[16] Our findings strongly indicate that the physiological shock of surgical menopause is a more potent disruptor of sleep than the baseline menopausal status of older patients.

Our model has also identified adjuvant chemotherapy as independent associated factor of poor sleep quality. This finding is consistent with extensive research on "chemobrain" and cancer-related fatigue, wherein inflammatory cytokines, direct neurotoxicity, and corticosteroid use during treatment cycles disrupt normal sleep patterns.[17,18] It is imperative for clinicians to recognize that sleep disturbances in patients undergoing chemotherapy are not merely secondary symptoms of fatigue but constitute a distinct clinical entity that necessitates management. In subgroup analyses stratified by adjuvant chemotherapy status, the direction and significance of associations remained consistent.

The substantial association between preoperative anxiety and postoperative sleep quality highlights the critical mind-body connection in surgical recovery. Patients exhibiting elevated baseline anxiety levels are more susceptible to hyperarousal, which complicates the initiation and maintenance of sleep, a vulnerability further intensified by the stress associated with surgery.[19,20] This observation underscores a potential opportunity for preoperative psychological interventions, such as cognitive behavioral therapy (CBT) or mindfulness training, which may mitigate the decline in postoperative sleep quality.[21]

In conclusion, the identification of postoperative pain as an independent associated factor, persisting even at the three-month mark, underscores the critical need for effective and sustained analgesic interventions. Chronic postsurgical pain is an established syndrome, and our findings indicate that its effects extend beyond immediate discomfort, significantly disrupting essential restorative processes such as sleep.[22]

Clinical Implications The results of this study bear significant clinical implications. Firstly, they advocate for the incorporation of routine sleep assessments, utilizing validated instruments such as the PSQI, into the standard care protocol for gynecologic oncology. Secondly, patients identified as high-risk, particularly premenopausal women scheduled for bilateral oophorectomy, necessitate targeted preoperative and postoperative counseling. This counseling should encompass education regarding anticipated menopausal symptoms and their impact on sleep quality. Thirdly, the management of these patients should adopt a multidisciplinary approach, which includes proactive treatment of vasomotor symptoms, potentially employing hormone replacement therapy (HRT) in carefully selected patients with non-hormone-sensitive cancers, following a comprehensive risk-benefit analysis, rigorous management of postoperative pain, and the provision of accessible psychological support.[23,24] While menopausal symptom control is pivotal, hormone replacement therapy (HRT) is not universally appropriate; contraindications include hormone-sensitive malignancies, a history of thromboembolic disease, active liver disease, or uncontrolled hypertension. In such cases, non-hormonal options (SSRIs/SNRIs, gabapentin, CBT-I, and lifestyle interventions) should be considered.The principal strengths of our study encompass its prospective design, which facilitates the evaluation of temporal changes, the employment of validated questionnaires, and the implementation of multivariate analysis to control for key confounding variables.

Nevertheless, it is imperative to acknowledge the limitations inherent in this study. Firstly, the study was conducted at a single center, which may constrain the generalizability of the findings. Additionally, this study was conducted at a single tertiary center, which may limit the generalizability of the findings. Objective sleep assessments such as actigraphy or polysomnography were not performed, and thus the results rely on self reported data. Secondly, the follow-up period was limited to three months, leaving the long-term trajectory of sleep quality unexplored. Thirdly, the study did not employ objective measures of sleep, such as polysomnography or actigraphy, relying instead on self reported data, which is susceptible to recall bias. Lastly, other potential confounding variables, including social support, physical activity levels, and dietary habits, were not assessed.

Future research should prioritize long term follow-up studies to enhance understanding of the chronic nature of these sleep disturbances. Additionally, there is an urgent need for randomized controlled trials to evaluate the efficacy of targeted interventions, such as cognitive behavioral therapy for insomnia (CBT-I), exercise programs, and various hormone replacement therapy (HRT) regimens, in improving sleep quality among gynecological cancer patients who undergo surgical menopause.[25,26]

Conclusion

In conclusion, the quality of sleep is a critical determinant in the outcomes of gynecological cancer surgery, with surgical menopause identified as the most significant and independent factor contributing to its deterioration. Additionally, preoperative anxiety, adjuvant chemotherapy, and postoperative pain are recognized as significant risk factors. Our research highlights the imperative for a paradigm shift in postoperative care, advocating for a comprehensive approach that incorporates proactive screening and management of sleep disturbances as an essential component of survivorship care.

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Ethics Committee Approval

The protocol was approved by the Institutional Review Board of (Health Sciences University Gazi Yaşargil Training and Research Hospital Ethics Committee (Date: 27.06.2025, Decision No: 525).

Informed Consent

Written informed consent was obtained from all participants prior to enrollment.

Peer-review

Externally peer-reviewed.

Authorship Contributions

Concept: K.A.; Design: K.A., G.C.C.; Supervision: K.A., G.C.C.; Fundings: K.A.; Materials: P.B.I.; Data collection &/ or processing: K.A., G.C.C.; Analysis and/or interpretation: K.A., P.B.I.; Literature search: K.A., P.B.I.; Writing: K.A.; Critical review: K.A., G.C.C.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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Jinekolojik Malignite Cerrahisi Sonrası Postoperatif Uyku Bozulmasının Belirleyicileri

Amaç: Bu çalışmanın amacı, jinekolojik maligniteler nedeniyle cerrahi müdahale geçiren hastalarda uyku kalitesinin belirleyicilerini, cerrahi menopozun etkilerine özel bir vurgu yaparak prospektif bir şekilde değerlendirmektir.

Gereç ve Yöntem: Bu prospektif kohort çalışmasına, bir üçüncü basamak sağlık kuruluşunda endometrium, over veya serviks kanseri nedeniyle cerrahi müdahale geçiren 142 hasta dahil edilmiştir. Katılımcılar, cerrahi menopoz yaşayanlar (SM grubu, n=68) ve yaşamayanlar (non-SM grubu, n=74) olmak üzere iki gruba ayrılmıştır. Uyku kalitesi hem preoperatif hem de postoperatif üçüncü ayda Pittsburgh Uyku Kalitesi İndeksi (PUKİ) kullanılarak değerlendirilmiştir. Preoperatif anksiyete ve depresyon düzeyleri, Hastane Anksiyete ve Depresyon Ölçeği (HADÖ) ile ölçülmüştür. Demografik, klinik ve cerrahi veriler sistematik olarak toplanmıştır. PUKİ skorundaki değişimlerle gösterilen kötü postoperatif uyku kalitesinin bağımsız belirteçlerini belirlemek amacıyla çoklu lineer regresyon analizi yapılmıştır.

Bulgular: Genel olarak, ortalama global PUKİ skoru başlangıçtaki 5.1±2.8'den postoperatif 3. ayda 8.9±4.1'e yükselerek anlamlı derecede kötüleşti ($p<0.001$). Uyku kalitesindeki bozulma, non SM grubuna göre SM grubunda anlamlı derecede daha fazlaydı (ortalama PUKİ değişimi: +5.6'ya karşılık +2.1, $p<0.001$). Çok değişkenli regresyon modelinde, cerrahi menopoz ($\beta=3.12$, $p<0.001$), adjuvan kemoterapi ($\beta=1.89$, $p=0.002$), daha yüksek başlangıç HADÖ-anksiyete skoru ($\beta=0.25$, $p=0.005$) ve daha yüksek postoperatif ağrı skoru (VAS) ($\beta=0.31$, $p=0.018$), PUKİ skorunda daha büyük bir artışın (daha kötü uyku kalitesi) bağımsız belirteçleri olarak tanımlandı.

Sonuç: Jinekolojik kanser cerrahisinin ardından postoperatif uyku kalitesinde belirgin bir azalma gözlemlenmiş olup, bu kötüleşmenin en önemli bağımsız öngörücüsü cerrahi menopoz olarak tanımlanmıştır. Ayrıca, önceden var olan anksiyete, adjuvan kemoterapi ve postoperatif ağrı da bu düşüşe önemli ölçüde katkıda bulunmuştur. Bu bulgular, bu hassas hasta kohortunda menopozal semptomların yönetimi, psikolojik destek sağlanması ve etkili ağrı kontrolü dahil olmak üzere, rutin uyku kalitesi taramasının ve hedefe yönelik müdahalelerin uygulanmasının gerekliliğini vurgulamaktadır.

Anahtar Sözcükler: Cerrahi menopoz; jinekolojik onkoloji; Pittsburgh Uyku Kalitesi İndeksi (PUKİ); postoperatif bakım; uyku kalitesi; yaşam kalitesi.