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The effect of preoperative anxiety levels on intraoperative hemodynamics and postoperative pain in rhinoplasty surgery

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Ethical Approval
The study was approved by the Non-Interventional Clinical Research Ethics Committee of Necmettin Erbakan University (Approval No. 2025/5652; March 21, 2025).

Informed Consent
Written and verbal informed consent was obtained from all participants.

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

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Abstract

Background/Aim: Preoperative anxiety is common among surgical patients and may adversely affect perioperative outcomes; however, its influence in patients undergoing rhinoplasty remains insufficiently characterized. This study aimed to investigate the impact of preoperative anxiety levels on intraoperative hemodynamic parameters, postoperative pain intensity, analgesic consumption, postoperative complications, and patient satisfaction in patients undergoing rhinoplasty.

Methods: This single-center, prospective observational study included 150 patients aged 18–60 years with American Society of Anesthesiologists (ASA) physical status I–II who underwent rhinoplasty. Preoperative anxiety was assessed using the State-Trait Anxiety Inventory-State (STAI-I), and patients were stratified into low- and high-anxiety groups. Intraoperative hemodynamic parameters, anesthetic agent consumption, postoperative pain scores, rescue analgesic requirements, postoperative complications, and patient satisfaction were compared between groups.

Results: No significant between-group differences were observed in intraoperative hemodynamic parameters or intraoperative adverse events. Patients in the high-anxiety group had higher postoperative pain scores at most assessed time points and more frequently required rescue analgesia at 4 hours (61.3% vs 44.0%; $P = 0.034$) and 12 hours (42.7% vs 21.3%; $P = 0.005$). Postoperative nausea and vomiting ($P = 0.048$) and shivering ($P = 0.019$) were more frequent in the high-anxiety group, and patient satisfaction was lower ($P = 0.001$). Female sex ($P = 0.043$), younger age ($P = 0.005$), and occupation ($P = 0.031$) were significantly associated with anxiety group.

Conclusion: Elevated preoperative anxiety does not appear to influence intraoperative hemodynamic stability in patients undergoing rhinoplasty; however, it is associated with greater postoperative pain, higher rescue analgesic requirements, and lower patient satisfaction. These findings support the clinical value of targeted preoperative anxiety-reduction strategies to optimize perioperative outcomes.

Keywords: analgesia, anxiety, rhinoplasty

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Introduction

Preoperative anxiety is common among surgical patients and has been associated with adverse perioperative outcomes, including changes in hemodynamic parameters, increased postoperative pain, and impaired recovery [1, 2]. These effects are largely mediated through heightened sympathetic activity, which may compromise intraoperative stability. Preoperative anxiety is a multifactorial phenomenon influenced by previous surgical experiences, personality traits, and concerns related to the procedure, particularly the anticipation of postoperative pain [3]. Elevated anxiety levels have been linked to increased pain perception, greater analgesic consumption, and lower patient satisfaction [4]. Rhinoplasty is a unique surgical procedure in which psychological factors play a particularly prominent role because patients often have high aesthetic expectations and emotional investment in surgical outcomes. Despite this, the impact of preoperative anxiety on intraoperative hemodynamic stability and postoperative outcomes in patients undergoing rhinoplasty remains insufficiently characterized.

The Spielberger State-Trait Anxiety Inventory-State (STAI-I) is a validated tool that is widely used to assess situational anxiety in clinical settings [5]. Therefore, this study aimed to evaluate the effects of preoperative anxiety levels, as measured by the STAI-I, on intraoperative hemodynamic parameters, postoperative pain intensity, analgesic consumption, postoperative complications, and patient satisfaction in patients undergoing rhinoplasty. We hypothesized that higher preoperative anxiety levels would be associated with impaired intraoperative hemodynamic stability, increased postoperative pain and analgesic requirements, and lower patient satisfaction.

Materials and methods

This study was conducted between April 15, 2025, and August 15, 2025, at the Department of Anesthesiology and Reanimation, Faculty of Medicine, Necmettin Erbakan University, with patient data protected and in accordance with the principles of the Declaration of Helsinki. A total of 150 patients aged 18–60 years who were scheduled for rhinoplasty, provided written and verbal informed consent, and were classified as American Society of Anesthesiologists (ASA) physical status I–II were included. The study protocol was approved by the Non-Interventional Clinical Research Ethics Committee of Necmettin Erbakan University (Approval No. 2025/5652; March 21, 2025).

Patients with ASA physical status III or higher; hypertension; renal or hepatic insufficiency; cardiovascular disease, including heart failure, coronary artery disease, or arrhythmia; malignancy; pregnancy or lactation; illiteracy; a psychiatric disorder or psychotropic medication use; chronic alcohol or opioid use; failure to respond to at least three items on the STAI questionnaire; or refusal to participate were excluded.

During the preoperative anesthesia evaluation, demographic and clinical data, including age, sex, marital status, parental status, educational level, occupational group, body mass index, ASA physical status, comorbidities, and previous anesthesia experience, were recorded. Patients were informed about the STAI-I questionnaire, the general anesthesia process, and postoperative pain assessment. To account for sociocultural differences, the questionnaires were administered by the researcher, who read the items aloud and recorded the responses.

Anxiety levels were assessed using the STAI-I immediately before general anesthesia induction. The scale scores range from 20 to 80. Scores ≤35 were classified as low anxiety, scores between 36 to 46 as moderate anxiety, and scores ≥47 as high anxiety. Patients with moderate anxiety scores (36–46) were not included in the study. Accordingly, patients with low anxiety were assigned to Group I (n=75), while those with high anxiety were assigned to Group II (n=75).

All patients received a standardized general anesthesia protocol, and open rhinoplasty procedures were performed by the same surgical team. Baseline hemodynamic parameters were recorded before induction. After peripheral venous access was established, intravenous (IV) crystalloid infusion was initiated at 10 mL/kg/h. No premedication was administered preoperatively. Anesthesia was induced with IV propofol (1–2 mg/kg), fentanyl (1 µg/kg), lidocaine (1 mg/kg), and rocuronium (0.6 mg/kg). After endotracheal intubation, tidal volume and respiratory rate were adjusted to maintain end-tidal carbon dioxide ($EtCO_2$) between 35 and 40 mmHg. Anesthesia was maintained with 50% oxygen, continuous IV remifentanil infusion (0.1 µg/kg/min), and 1 minimum alveolar concentration (MAC) of desflurane, with a fresh gas flow of 1 L/min. Hemodynamic parameters were recorded at predefined intraoperative time points. Controlled hypotension was used to improve surgical field visibility, targeting a systolic arterial pressure (SAP) of 80–90 mmHg and a mean arterial pressure (MAP) of 50–65 mmHg. Remifentanil and desflurane doses were increased by 20% as needed to achieve these targets. If MAP decreased below 50 mmHg and persisted for longer than 1–3 minutes, anesthetic doses were reduced by 20%. If no improvement was observed, crystalloid infusion was increased, and IV vasopressors were administered when necessary. Bradycardia (heart rate <40 beats/min) was treated with IV atropine (0.01 mg/kg). At the end of surgery, total remifentanil use (mg) and desflurane consumption (mL) were recorded.

For postoperative analgesia, tenoxicam (20 mg) was administered at the beginning of the operation, and tramadol (2 mg/kg) was administered as a slow IV bolus 30 minutes before the end of surgery. IV ondansetron (0.1 mg/kg) was administered as an antiemetic. At completion of the procedure, desflurane and remifentanil were discontinued. Extubation was performed after spontaneous respiration resumed. Postoperative pain was assessed using the Numeric Rating Scale (NRS), where 0 indicated no pain, 1–3 mild pain, 4–6 moderate pain, and 7–10 severe pain. Patients rated their pain from 0 to 10, and responses were recorded on the data collection form. Postoperative analgesia was evaluated using NRS scores at 0, 1, 2, 4, 8, 12, 16, and 24 hours and rescue analgesic use at 4, 12, and 24 hours. In the postoperative care unit, all patients routinely received IV paracetamol (1 g) 2 hours after arrival on the ward and every 12 hours thereafter. Patients with an NRS score ≥4 despite this regimen received IV tramadol (1 mg/kg) as rescue analgesia.

The primary outcomes were changes in intraoperative hemodynamic parameters, postoperative pain levels, and the need for rescue analgesia. Secondary outcomes included associations between anxiety and demographic and clinical characteristics and the effects of anxiety on intraoperative anesthetic consumption, postoperative nausea and vomiting, shivering, and patient satisfaction.

Statistical analysis

The sample size was calculated using G*Power software (version 3.1.9.7; Heinrich Heine University Düsseldorf, Germany). An a priori power analysis was performed for the comparison of postoperative pain scores between two independent groups (test family: t tests; statistical test: difference between two independent means [two groups]), assuming an effect size of approximately 0.41 (Cohen's d), a significance level of 5% (α=0.05), a statistical power of 80% (1−β=0.80), and an equal allocation ratio (1:1). A one-tailed test was used because the prespecified hypothesis was directional, anticipating higher postoperative pain scores in patients with high preoperative anxiety. Based on these assumptions, approximately 75 patients per group were required.

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences), version 22.0. A *P*-value < 0.05 was considered statistically significant. The normality of continuous variables was assessed using the one-sample Kolmogorov–Smirnov test. Normally distributed data were expressed as mean (SD), whereas non-normally distributed data were presented as median (25th–75th percentile). Associations between categorical variables were analyzed using the Pearson chi-square test; Fisher's exact test was used when chi-square assumptions were not met. Continuous variables were compared between two independent groups using the independent-samples t-test when the normality assumption was met and the Mann–Whitney U test otherwise. For within-group comparisons of repeated measurements over time, the paired-samples t-test was used for normally distributed data, whereas the Wilcoxon signed-rank test was used for non-normally distributed data.

Results

Seventy-five patients with low anxiety scores were classified as Group I, and 75 patients with high anxiety scores were classified as Group II. The median STAI-I score was 30 (25–33) in Group I and 49 (46–53) in Group II. Demographic comparisons showed that female sex (*P* = 0.043), younger age (*P* = 0.005), and occupation (*P* = 0.031) were significantly associated with anxiety group, with a higher proportion of students in Group II (Table 1). Body mass index, ASA physical status, comorbidities, marital status, parental status, educational level, and previous anesthesia history were not significantly associated with anxiety group.

Regarding intraoperative adverse events, vasopressor requirement, bradycardia, and desaturation were each observed in one patient (1.3%) in Group I and in no patients (0%) in Group II. Each adverse event was analyzed separately using Fisher's exact test, and no significant between-group difference was observed for vasopressor requirement (*P* = 0.238), bradycardia (*P* = 0.238), or desaturation (*P* = 0.238).

Regarding intraoperative anesthetic consumption, the median desflurane consumption was 38 mL (range: 10–93) in Group I and 36 mL (range: 15–78) in Group II. The median remifentanil consumption was 1.4 mg (range: 1–3.2) in Group I and 1.5 mg (range: 0.8–3.0) in Group II. There were no significant differences between the groups in desflurane or remifentanil consumption (*P* = 0.523 and *P* = 0.656, respectively). Evaluation of intraoperative hemodynamic parameters revealed no significant between-group differences in MAP, heart rate (HR), or oxygen saturation (SpO_2) at any measurement time point (Figure 1).

Analysis of postoperative NRS scores over time showed significantly higher scores in Group II than in Group I at most assessed time points (*P* < 0.05) (Figure 2).

At 4 postoperative hours, 46 patients (61.3%) in Group II and 33 patients (44.0%) in Group I required rescue analgesia (*P* = 0.034). At 12 hours, rescue analgesia was required by 32 patients (42.7%) in Group II and 16 patients (21.3%) in Group I (*P* = 0.005). No significant between-group difference was observed at 24 hours. Among the 79 patients who required rescue analgesia at 4 hours, 35 continued to require rescue analgesia at 12 hours; 10 were in Group I and 25 were in Group II. Eight patients required rescue analgesia at both 12 and 24 hours, including 2 in Group I and 6 in Group II. Five patients required rescue analgesia at all assessed time points, including 2 in Group I and 3 in Group II.

Patient satisfaction differed significantly between groups (*P* = 0.001). In Group I, 62.7% of patients rated their satisfaction as excellent, whereas satisfaction in Group II was more frequently rated as good or moderate (Table 2).

Postoperative nausea and vomiting (*P* = 0.048) and shivering (*P* = 0.019) were significantly more frequent in Group II than in Group I (Table 3).

Table 1. Baseline demographic characteristics of the groups (mean (SD), n(%))

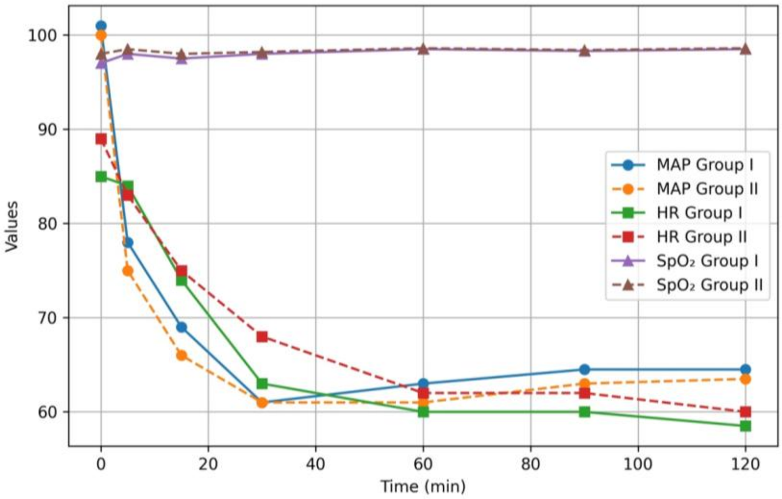
Variables	Group I (n=75)	Group II (n=75)	*P*-value
Gender (F / M)	41(54.7%) / 34(45.3%)	53(70.7%) / 22(29.3%)	**0.043**
Age (years)	27(7)	24(7)	**0.005**
BMI (kg/m²)	22.49(7)	24(7)	0.870
ASA physical status			0.414
ASA I	39 (52%)	34 (45.3%)	
ASA II	36 (48%)	41 (54.7%)	
Comorbidity			0.113
Absent	70 (93.3%)	64 (85.3%)	
Present	5 (6.7%)	11 (14.7%)	
Comorbid diseases			
Diabetes mellitus	2 (2.7%)	4 (5.4%)	0.316
Asthma/COPD	3 (4%)	7 (9.3%)	0.190
Marital status			0.193
Married	23 (30.7%)	16 (21.3%)	
Single	52 (69.3%)	59 (78.7%)	
Parental status			0.453
Has children	54 (72%)	58 (77.3%)	
No children	21(28%)	17 (22.6%)	
Educational level			0.074
Literate	1 (1.3%)	0 (0%)	
Primary education	12 (16%)	3 (4%)	
High school	37 (49.3%)	38 (50.7%)	
University	25 (33.3%)	34 (45.3%)	
Occupation			**0.031**
Retired	0 (0%)	0 (0%)	
Civil servant	10 (13.3%)	11 (14.7%)	
Worker	19 (25.3%)	11 (14.7%)	
Self-employed	27 (36%)	17 (22.7%)	
Unemployed	6 (8%)	7 (9.3%)	
Student	13 (17.3%)	29 (38.7%)	
History of general anesthesia			0.072
Yes	34 (45.3%)	45 (60%)	
No	41 (54.7%)	30 (40%)	

Abbreviations: F: female, M: male, BMI: body mass index, ASA: American Society of Anesthesiologists, COPD: chronic obstructive pulmonary disease, SD: standard deviation.

Table 2. Comparison of patient satisfaction levels between groups [n (%)]

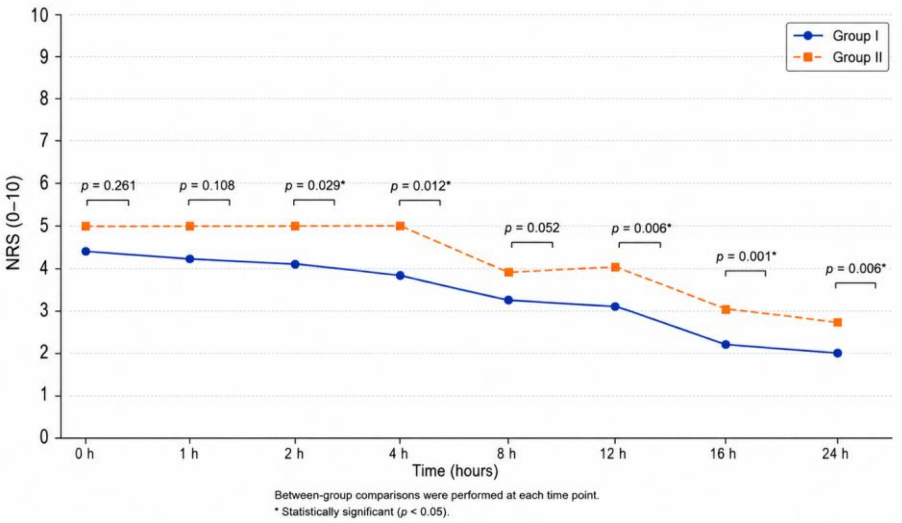
Patient satisfaction	Group I (n = 75)	Group II (n = 75)	Total (n = 150)	*P*-value
Poor	0 (0%)	3 (4.0%)	3 (2.0%)	0.001
Moderate	5 (6.7%)	12 (16.0%)	17 (11.3%)	
Good	23 (30.7%)	35 (46.7%)	58 (38.7%)	
Excellent	47 (62.6%)	25 (33.3%)	72 (48.0%)	

Figure 1. Comparison of intraoperative hemodynamic parameters between groups



Abbreviations: MAP: mean arterial pressure, HR: heart rate, SpO_2: peripheral oxygen saturation.

Figure 2. Changes in postoperative NRS scores over time between groups



Abbreviations: NRS: Numeric Rating Scale.

Table 3. Incidence of postoperative nausea and vomiting and shivering [n (%)]

Outcome	Group I (n = 75)	Group II (n = 75)	Total (n = 150)	*P*-value
Nausea and vomiting				0.048
Yes	26 (34.7%)	38 (50.7%)	64 (42.7%)	
No	49 (65.3%)	37 (49.3%)	86 (57.3%)	
Shivering				0.019
Yes	22 (29.3%)	36 (48.0%)	58 (38.7%)	
No	53 (70.7%)	39 (52.0%)	92 (61.3%)	

Discussion

This study comprehensively evaluated the effects of preoperative anxiety on intraoperative hemodynamic parameters, postoperative pain, analgesic requirements, complications, and patient satisfaction in patients undergoing rhinoplasty. The findings indicate that preoperative anxiety is particularly associated with postoperative clinical outcomes, whereas it does not appear to have a significant effect on intraoperative hemodynamic parameters.

The preoperative STAI-I scores observed in this study were consistent with those reported in the literature, supporting the representativeness of the sample [6, 7]. Compared with previously reported mean STAI-I values, the scores in this study were within a similar range, indicating that anxiety is a common and predictable phenomenon in rhinoplasty and other elective surgical procedures. This finding underscores the importance of routinely assessing preoperative anxiety.

Analysis of demographic factors revealed a notable association between younger age and higher anxiety levels, consistent with the literature [8, 9]. The higher anxiety observed in younger patients may be related to less previous surgical experience, greater uncertainty, and various psychosocial factors. Similarly, the association between female sex and higher anxiety levels is frequently reported and may be influenced by hormonal, psychosocial, and cultural factors [10]. The higher anxiety levels observed among students in the present study may reflect the influence of sociodemographic and occupational factors on preoperative anxiety [11].

No significant between-group differences were observed in intraoperative hemodynamic parameters, suggesting that preoperative anxiety alone may not determine intraoperative hemodynamic stability. In this study, the standardized anesthesia protocol and controlled hypotension strategy may have attenuated potential sympathetic responses. Although some studies have reported that preoperative anxiety may cause hemodynamic changes during induction, its effect appears to diminish during anesthesia maintenance [12, 13]. Our findings are consistent with this perspective.

The absence of a significant between-group difference in intraoperative anesthetic consumption suggests that the impact of anxiety on pharmacologic requirements may be limited. However, the literature presents conflicting findings on this issue [4, 14].

These discrepancies may reflect differences in anesthetic techniques, choice of agents, and dose-titration protocols. In particular, the stable pharmacodynamic properties of the desflurane–remifentanil combination may have attenuated or masked the effects of anxiety.

In contrast, postoperative outcomes were affected by anxiety levels. Patients with higher anxiety reported greater pain intensity, particularly later in the postoperative period, and required more rescue analgesia. These findings suggest that anxiety has a clinically relevant association with postoperative pain and analgesic needs. The higher incidence of postoperative nausea and vomiting and shivering in the high-anxiety group further supports a broader association between anxiety and postoperative recovery. Patient satisfaction was also strongly associated with anxiety level, with higher satisfaction in the low-anxiety group. These observations highlight the importance of psychological factors in the overall surgical experience and support integrating anxiety assessment into perioperative care.

This study has several limitations. First, because it was conducted at a single center, the generalizability of the findings may be limited. Second, the observational design does not permit causal inference between anxiety and clinical outcomes. Anxiety was also assessed using a self-reported scale, which may be subject to response bias. Advanced intraoperative monitoring techniques were not used. Finally, postoperative pain was evaluated using the NRS, a subjective measure that may be influenced by individual psychological factors. In particular, patients with higher anxiety may have a lower pain perception threshold, resulting in higher reported pain scores independent of actual nociceptive input or tissue trauma. Therefore, the observed association between anxiety and increased postoperative pain may partly reflect differences in pain perception and reporting rather than differences in physiologic pain generation alone.

In conclusion, high preoperative anxiety in patients undergoing rhinoplasty does not appear to affect intraoperative hemodynamic stability; however, it is associated with greater postoperative pain, higher rescue analgesic requirements, and lower patient satisfaction. Routine assessment and appropriate management of preoperative anxiety may contribute to improved perioperative outcomes.

References

1. Caumo W, Schmidt AP, Schneider CN, Bergmann J, Iwamoto CW, Adamatti LC, et al. Risk factors for postoperative anxiety in adults. Anaesthesia. 2001;56(8):720-8. doi: 10.1046/j.1365-2044.2001.01842.x.
2. Kim WS, Byeon GJ, Song BJ, Lee HJ. Availability of preoperative anxiety scale as a predictive factor for hemodynamic changes during induction of anesthesia. Korean J Anesthesiol. 2010;58(4):328-33. doi: 10.4097/kjae.2010.58.4.328.
3. Nigussie S, Belachew T, Wolancho W. Predictors of preoperative anxiety among surgical patients in Jimma University Specialized Teaching Hospital, South Western Ethiopia. BMC Surg. 2014;14:67. doi: 10.1186/1471-2482-14-67.
4. Qaddumi J, Arda AM, Alkhawaldeh A, ALBashtawy M, Abdalrahim A, ALBashtawy S, et al. Preoperative anxiety, postoperative pain tolerance and analgesia consumption: a prospective cohort study. J Perioper Pract. 2025;35(10):426-36. doi: 10.1177/17504589241253489.
5. Oh J, Lee W, Ki S, Suh J, Hwang S, Lee J. Assessment of preoperative anxiety and influencing factors in patients undergoing elective surgery: an observational cross-sectional study. Medicina (Kaunas). 2024;60(3):403. doi: 10.3390/medicina60030403.
6. Şahin C, İmer Aras H. Influence of nasal pack removal on patients' anxiety after septoplasty. Kulak Burun Bogaz Ihtis Derg. 2015;25(5):266-70. doi: 10.5606/kbbihtisas.2015.93609.
7. Çelik MR, Güneş HY. The effects of detailed preoperative information on postoperative pain and anxiety levels in rhinoplasty surgery. East J Med. 2023;28(3):471-6. doi: 10.5505/ejm.2023.34022.
8. Aloweidi A, Abu-Halaweh S, Almustafa M, Marei Z, Yaghi S, Hababeh L, et al. Preoperative anxiety among adult patients undergoing elective surgeries at a tertiary teaching hospital: a cross-sectional study during the era of COVID-19 vaccination. Healthcare (Basel). 2022;10(3):515. doi: 10.3390/healthcare10030515.
9. Erkilic E, Kesimci E, Soykut C, Doger C, Gumus T, Kanbak O. Factors associated with preoperative anxiety levels of Turkish surgical patients: from a single center in Ankara. Patient Prefer Adherence. 2017;11:291-6. doi: 10.2147/PPA.S127342.
10. Bedaso A, Mekonnen N, Duko B. Prevalence and factors associated with preoperative anxiety among patients undergoing surgery in low-income and middle-income countries: a systematic review and meta-analysis. BMJ Open. 2022;12(3):e058187. doi: 10.1136/bmjopen-2021-058187.
11. Topal Hançer A, Erturhan Türk K. Determination of Preoperative Anxiety Levels and Affecting Factors in Patients Undergoing Elective Surgery: A Descriptive and Cross-Sectional Study. Turkiye Klinikleri J Nurs Sci. 2024;16(1):35-42. doi: 10.5336/nurses.2023-100081.
12. Ahmetovic-Djug J, Hasukic S, Djug H, Hasukic B, Jahic A. Impact of preoperative anxiety in patients on hemodynamic changes and a dose of anesthetic during induction of anesthesia. Med Arch. 2017;71(5):330-3. doi: 10.5455/medarh.2017.71.330-333.
13. Bayrak A, Sagiroglu G, Copuroglu E. Effects of preoperative anxiety on intraoperative hemodynamics and postoperative pain. J Coll Physicians Surg Pak. 2019;29(9):868-73. doi: 10.29271/jcpsp.2019.09.868.
14. Chen YYK, Soens MA, Kovacheva VP. Less stress, better success: a scoping review on the effects of anxiety on anesthetic and analgesic consumption. *J Anesth.* 2022;36(4):532-53. doi: 10.1007/s00540-022-03081-4.