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Preoperative anxiety on postoperative pain in craniotomy patients

Kraniyotomide preoperatif anksiyetenin postoperatif ağrı üzerine etkileri

Berna Yılmaz[1] Meltem Uyar[2] Abdurrahim Derbent[3]
Can Eyigör[4] Semra Karaman[5]

[1] Tekirdag Corlu State Hospital, Department of Anesthesiology Reanimation and Intensive Care Unit, Tekirdag, Türkiye

[2] Ege University School of Medicine Hospital, Department of Anesthesiology Reanimation and Algology, Izmir, Türkiye

[3] Ege University School of Medicine Hospital, Department of Anesthesiology and Reanimation, Izmir, Türkiye

[4] Ege University School of Medicine Hospital, Department of Anesthesiology Reanimation and Algology, Izmir, Türkiye

[5] Ege University School of Medicine Hospital, Department of Anesthesiology and Reanimation, Izmir, Türkiye

ABSTRACT

Aim: This study aimed to determine preoperative anxiety and pain levels in patients who underwent craniotomy and investigate the effects on the development of postoperative acute-chronic pain.

Materials and Methods: In this prospective, observational study, STAI-I (State-Trait Anxiety Inventory) and STAI-II were used to measure preoperative anxiety levels in a total of 104 patients who underwent craniotomy, and a visual analog score (VAS) was used to determine pain. Demographic data of the patients, ASA (American Society of Anesthesiologists) scores, comorbidities, preoperative and postoperative VAS scores, cause of preoperative anxiety, type, and duration of operation were recorded.

Results: The mean values of STAI tests showed that 31.3% of our patients had mild preoperative anxiety, 58.7% had moderate and 10% had severe preoperative anxiety. In the STAI tests we performed before the operation, the mean values were 44 ± 11.2 for STAI-I and 44.5 ± 9.4 for STAI-II. The causes of preoperative anxiety in patients were determined as surgical operation (35.6%), anesthesia applications (17.3%), insufficient information (11.5%), and the possibility of postoperative pain (3.8%). It was observed that 60.6% of our patients had pain in the preoperative period, 51.9% of patients had acute pain in postoperative the 0th minute, 69.2% in 30th minute, 54.8% in 1st hour, 44.2% in 2nd hour, 34.6% in 24th hour, 22.1% in 48th hour, and 51% of patients had chronic pain in postoperative 6th month. We found a significant relationship between STAI-I and VAS scores at the 48th hour and, between STAI-II and VAS scores at the 2nd, 24th hour, and 6th month ($p<0.05$).

Conclusion: It was observed that craniotomy patients mostly had moderate anxiety and moderate to severe pain before the operation, and moderate-severe acute and chronic pain developed after the operation. A significant correlation was found between preoperative anxiety and postoperative pain.

Keywords: Anxiety, postoperative pain, visual analog scale.

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Corresponding author: Berna Yılmaz
Tekirdag Corlu State Hospital, Department of Anesthesiology Reanimation and Intensive Care Unit, Tekirdag, Türkiye
E-mail: *berna_ylmz@yahoo.com*
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ÖZ

Amaç: *Bu çalışmada kraniyotomi uygulanan hastalardaki preoperatif anksiyete ve ağrı düzeylerinin belirlenmesi ve postoperatif akut veya kronik ağrı gelişimi üzerine olan etkilerinin araştırılması amaçlanmıştır.*

Gereç ve Yöntem: *Prospektif, gözlemsel yapılan çalışmamızda, kraniyotomi uygulanan toplam 104 hastanın operasyon öncesi anksiyete düzeylerini ölçmek için STAI-I (State Trait Anxiety Inventory) ve STAI-II, ağrı düzeylerini belirlemek için ise VAS (Vizüel Analog Skoru) kullanıldı. Hastaların demografik verileri, ASA (American Society of Anesthesiologists) skorları, eşlik eden hastalıkları, preoperatif ağrı varlığı ve preoperatif- postoperatif VAS skorları, preoperatif anksiyete kaynağı, operasyon çeşidi ve süresi kaydedildi.*

Bulgular: *STAI testleri ortalama değerleri hastalarımızın %31,3' ünde hafif, %58,7' sinde orta ve %10' unda şiddetli düzeyde preoperatif anksiyete olduğunu gösterdi. Operasyon öncesi uygulanan STAI testlerinde ortalama değerler, STAI-I için 44 ± 11,2 ve STAI-II için 44,5 ± 9,4 olarak bulundu. Preoperatif anksiyete nedenleri cerrahi operasyon (%35,6), anestezi uygulamaları (%17,3), eksik bilgilendirilme (%11,5) ve ameliyat sonrası ağrı olasılığı (%3,8) olarak belirlendi. Hastaların %60,6'sında preoperatif dönemde, %51,9 'unda postoperatif 0.dakikada, %69,2 'sinde 30. dakikada, %54,1'inde 1.saatte, %44,2 'sinde 2. saatte, %34,6'sında 24.saatte, %22,1'inde 48.saatte akut ağrı ve %51'inde ise postoperatif 6. ayda kronik ağrı geliştiği görüldü. STAI-I skorları ile 48. saat VAS, STAI-II skorları ile 2. saat, 24. saat ve 6. ay VAS skorları arasında istatistiksel olarak anlamlı ilişki bulundu (p<0,05).*

Sonuç: *Kraniyotomi hastalarının ameliyat öncesi çoğunlukla orta düzeyde anksiyeteye ve orta -ciddi düzeyde ağrıya sahip oldukları, operasyon sonrası orta-ciddi düzeyde akut ve kronik ağrı geliştiği görüldü. Operasyon öncesi anksiyete ile ameliyat sonrası ağrı arasında anlamlı bir ilişki olduğu bulundu.*

Anahtar Sözcükler: *Anksiyete, postoperatif ağrı, vizüel analog skalası.*

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INTRODUCTION

Although it is stated that craniotomy does not cause as much pain as other surgical operations in general, the number of articles reporting that most craniotomy patients have postoperative moderate-to-severe pain is increasing (1, 2). Different results have been reported between the incidences of pain after craniotomy (30-90%), and this incidence is probably over 40% (2). In addition, it has been stated in some articles that 50% of the patients complain about chronic pain in the months following surgery (3).

Pain, a sensory and emotional experience, is affected by psychological, sensory, affective, cognitive, sociocultural, and behavioral factors. In many studies, preoperative anxiety has been defined as an important risk factor for postoperative pain (4-7). Persistent pain following wound healing in surgical patients is considered either a result of continuing inflammation or neuropathic pain caused by damage to peripheral nerves. There is a strong correlation between post-craniotomy pain and gender, anxiety, and depression; however, different results have been obtained in studies. Although the same operative techniques and anesthetic methods are used by the same experienced surgical and anesthesia teams, no postoperative chronic pain is observed in some patients. Patients differ from each other in medical history, genotype, previous experiences, beliefs, and psychosocial situation. The type of surgery, anesthesia method, perioperative analgesia, and medical treatment can be considered as other environmental factors affecting postoperative pain (8).

Preoperative anxiety can be defined as a vague, uneasy feeling and can be associated with abnormal hemodynamics as a consequence of sympathetic, parasympathetic, and endocrine stimulation (9). In studies, patients report being anxious about not awakening after the operation, waking up during the operation and feeling pain, nausea, vomiting, being taken into the intensive care unit, lack of knowledge and experience of the anesthesiologist, needle pricks, and death (10). In various surgical patient groups, the

preoperative anxiety incidence rate is reported to be between 11% and 92% (11). Neurosurgical patients are thought to have much more anxiety, as the surgery is to be performed directly in the brain, and there is no exact foresight about the result of the operation (11). There are many methods—subjective or involving more detailed evaluation—to determine the degree of anxiety. The State-Trait Anxiety Inventory (STAI) is frequently used with this aim (7, 12).

Although preoperative anxiety is frequently observed in patients undergoing craniotomy, there are not enough prospective studies on the effects of this on postoperative pain. This study aimed to determine the level of preoperative anxiety and pain in patients undergoing craniotomy and to investigate its effects on acute and chronic postoperative pain.

MATERIALS and METHODS

After the ethics committee approval (11- 5.1/4), this study, which was conducted as a prospective observational, included 104 ASA I-III class patients (age 18-70) who underwent elective craniotomy surgery. Written, informed consent was obtained from all patients. Patients who were unconscious or whose cooperation and cognitive functions were limited before and after the surgery were excluded from the study. In the preoperative period, the patients were informed about the anesthesia method, surgery, the State-Trait Anxiety Inventory (STAI-I and STAI-II), and the Visual Analogue Scale (VAS) tests. Then, STAI tests for preoperative anxiety levels and VAS scores for pain levels were recorded. In addition, demographic data of the patients, ASA values, coexisting diseases, use of drugs before the surgery, smoking, alcohol consumption, the existence of preoperative pain in the cranium, cause of preoperative anxiety, type of surgery, and duration of the surgery were all recorded.

The STAI inventory, developed by Spielberger, consists of 40 statements about the feelings of the participant. The State Anxiety Inventory includes 20 statements indicating the intensity of their feelings of anxiety at a particular moment, using scores ranging from 1 to 4 points. The Trade Anxiety Inventory consists of other 20 statements that describe how they generally feel. The total score of each part may range between 20 and 80, with higher scores indicating higher levels of anxiety. STAI scores are commonly classified as “no or low anxiety” (20-37), “moderate anxiety” (38-44), and “high anxiety” (45-80) (8). Adaptation of the inventory to Turkish people and its validity-reliability studies has been carried out by Öner and Le Comte (13). In our study, the pain was described as any pain in the cranium, surgical incision, or operation site, and a 10 mm VAS, ranging from 0 (no pain) to 10 (very severe pain), was used to measure pain intensity. The absolute values of pain on a 0–10 scale are naturally grouped into three categories: 1–4 (mild pain), 5 or 6 (moderate pain), and 7–10 (severe pain) in the studies. We grouped VAS scores as VAS<4 (mild pain) and VAS≥ 4 (moderate-severe pain) (14). The acute postoperative pain was questioned in the 0^{th}, 30^{th} minutes, 1^{st}, 2^{nd}, 24^{th}, and 48^{th} hours, and chronic postoperative pain was examined at 6^{th} months after surgery.

Vascular access was established in all patients before being taken to the surgery room, and standard monitorization was performed with the electrocardiogram (ECG), non-invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2), end-tidal carbon dioxide pressure ($ETCO_2$). Our patients didn’t receive premedication. Anesthesia was induced using thiopental sodium (5 mg/kg), fentanyl (2 mcg/kg), rocuronium (0.6 mg/kg), and was maintained with propofol (0.1-2 mg/kg/h) and remifentanil (0.15-1 mcg/kg/min) infusions, 50% O_2- 50% air, rocuronium (0.15 mg/kg) when required. After the last suture of the surgery, the anesthesia was stopped and decurarization was performed with atropine and neostigmine. The patients were extubated when their spontaneous breathing and reflexes were sufficient.

After surgery, the patient’s ability to communicate verbally was checked every 5 min. The moment the patients were able to communicate with us and answer our questions was considered as the 0^{th} min. When communication started, the patients were asked whether they had any discomfort (i.e., nausea, vomiting, dizziness, coldness, shivering). The patient's pain was evaluated according to the VAS scale. The same procedures were repeated at the postoperative 30^{th} min, 1^{st}, 2^{nd}, 24^{th}, and 48^{th} hour, and 6^{th} month; and analgesic consumption was determined with concurrent measurements.

When the patients complained of pain, analgesia was provided by the postoperative analgesia protocol of the neurosurgery post anesthesia care unit. According to this protocol, if the VAS score was 4 or more, intravenous paracetamol (1 g) infusion was administered. If the patient’s pain

did not subside 30-45 min after the infusion or continued to increase, intramuscular diclofenac (75 mg) was administered. Patients who did not respond after 45-60 min were administered intravenous tramadol (100 mg) infusion. The patients in stable condition were transferred to the neurosurgery service.

Statistical Analyses

All the statistical analyses were made using SPSS 20.0 by the university medical school department of information and statistics and the data were expressed as absolute values, percentages, median (±IR), or means (±standard deviation) as needed. Pain scores were evaluated using the Kruskal-Wallis test, and the correlation between pain scores and vitals was evaluated using Spearman's rho correlation coefficient. The Wilcoxon signed-rank test was used to assess the scores in different time slots, the chi-squared test was used to evaluate demographic and operative data, and the Mann-Whitney U test was used to determine differences between the parameters. A p-value of < 0.05 was accepted as statistically significant.

RESULTS

A total of 104 patients (45 males, 59 females) were included in this study, 93 of whom were operated on for malignancy and 11 for an aneurysm. Demographic data of the patients are presented in Table-1.

The average and minimum-maximum values of STAI-I and STAI-II tests we applied preoperatively were 44 ± 11.2 (22-73) and 44.5 ± 9.4 (26-70) respectively. Although the anxiety scores of female patients were higher than males, no statistically significant difference was found between the genders. According to STAI tests, 31.3% of our patients had mild, 58.7% had moderate and 10% had severe preoperative anxiety scores. The causes of preoperative anxiety were surgery (35.6%), anesthesia (17.3%), lack of being informed (11.5%), and the possibility of postoperative pain (3.8%) (Table-2). There was a significant relationship between surgical anxiety and STAI -I scores (p= 0.03).

In the preoperative period, 63 (60.6%) of 104 patients had a headache (VAS score of ≥ 4). In the acute postoperative period, 51.9% of patients had pain in the postoperative 0^{th} minute, 69.2% in the 30^{th} minute, 54.8% in 1^{st} hour, 44.2% in the 2^{nd} hour, 34.6% in the 24^{th} hour, 22.1% in 48^{th} hour, and the incidence of chronic postoperative pain in our study is found to be 51 % (Table-3). We found a significant correlation between STAI-I scores and 48^{th}-hour VAS scores (p=0.007) and between STAI-II scores and 2^{nd}, 24^{th} hour, and 6^{th}-month VAS scores (p=0.04, p=0.002, p= 0.03 respectively).

In the postoperative period, the analgesia requirements of our patients are shown in Figure-1.

Table-1. Demographic data of the patients (mean ± SD of age, height, weight, body mass index, and duration of operation).

Age (years)	46.6 ± 13.4
Height (cm)	166.2 ± 0.9
Weight (kg)	75.1 ± 16.2
Body mass index (BMI) (kg/m^2)	26.9 ± 5.2
Duration of operation (min)	183.1 ± 57.6

Table-2. The distribution of the mean, median, SD, min, and max values of STAI-I and STAI-II scores according to the causes of preoperative anxiety in patients (%: percentages of patients).

		SURGERY 35.6%	ANESTHESIA 17.3%	LACK OF BEING INFORMED 11.5%	POSTOPERATIVE PAIN 3.8%
STAI-I	Mean± SD	48.3 ± 10.5	44.5 ± 10.8	42.7 ± 5.5	40.2 ± 10.7
	Median	49	45.5	43	42
	Min-Max	27-69	25-64	33-50	27-50
STAI-II	Mean ± SD	45 ± 9.4	46.4 ± 8	47.2 ± 7.9	39.5 ± 9.2
	Median	45	45	44.5	43
	Min-Max	29-70	34-63	37-64	26-46

Table-3. The number and percentages of patients with preoperative and postoperative acute-chronic pain.

	Number of patients with VAS ≥ 4 preoperatively N:63	Total number of patients with VAS≥ 4 N:104
Postoperative 0th minute	37 (58.7%)	54 (51.9%)
Postoperative 30th minute	45 (71.4%)	72 (69.2%)
Postoperative 1st hour	34 (53.9%)	57 (54.8%)
Postoperative 2nd hour	32 (50.7%)	46 (44.2%)
Postoperative 24th hour	24 (38.1%)	36 (34.6%)
Postoperative 48th hour	14 (22.2%)	23 (22.1%)
Postoperative 6th month	39 (61.9%)	53 (51%)

N: The numbers of patients, %: the percentages of the patients. (The number and percentages of patients, those whose pain is existed in the preoperative period and continued in the postoperative period, are given in the first column. In the postoperative period, 58.7% of them had pain in the postoperative 0th minute, 71.4% in 30th minute, 53.9% in 1st hour, 50.7% in 2nd hour, 38.1% in 24th hour, 22.2% in 48th hour and 61.9% of them had pain in 6th month. In the second column total number and percentages of patients with preoperative, acute, and chronic postoperative pain are given).

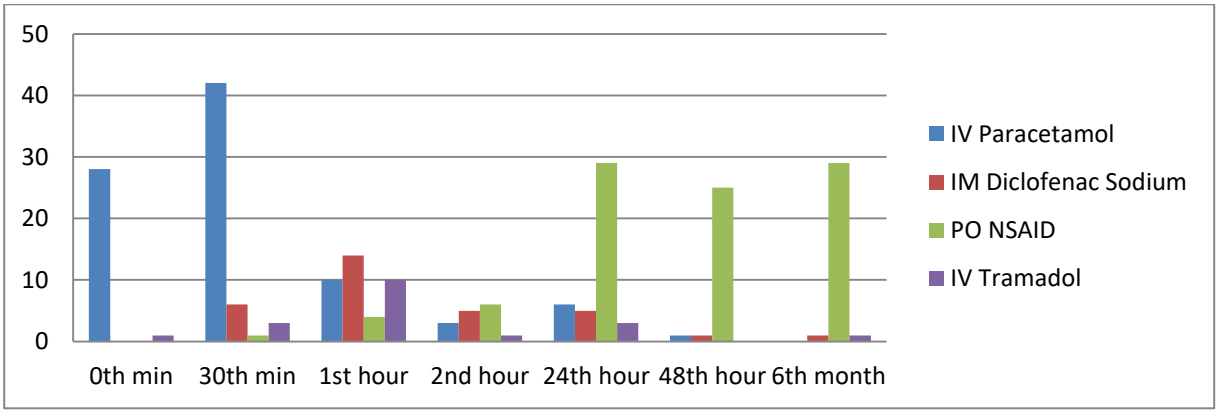

Figure-1. The number of patients who required analgesia in the 0th minute, 30th minute, 1st hour, 2nd hour, 24th hour, 48th hour, and 6th month. (Column in blue color: Intravenous (IV) Paracetamol, red color: Intramuscular (IM) Diclofenac Sodium, green color: Per oral Nonsteroidal Anti-Inflammatory Drugs (NSAID), and purple color: IV Tramadol)

DISCUSSION

In this study, we found that craniotomy patients mostly had moderate anxiety and moderate to severe pain before the operation, and moderate-severe acute and chronic pain developed after the operation. A significant correlation was found between preoperative anxiety and postoperative pain.

In a recent study including patients undergoing surgical treatment of cranial meningioma 67.7% of patients were found to have abnormal preoperative anxiety scores (15). For the determination of preoperative anxiety, The STAI is the most generally accepted test and is easily adapted in modern anesthesia practice. Both the state and the trait of anxiety were found to be in a good interrelation in patients (16). In one study, while the threshold for STAI-I, which is used for anxiety conditions accompanied by clinical symptoms of the disease, was set a 39-40, the anxiety threshold in the preoperative patients was found to be 44-46 (12, 17). For the classification of preoperative anxiety levels, Maranets et al. (18) suggested that the anxiety scores of patients should be stratified into three groups: low-anxiety (< 25), medium-anxiety (25-75), and high-anxiety (>75). In another study, STAI scores are classified as “no or low anxiety” (20-37), “moderate anxiety” (38-44), and “high anxiety” (45-80) (9). As the average STAI-I and STAI-II

anxiety scores were 44 ± 11.2 and 44.5 ± 9.4, respectively we concluded that our patients mostly belonged to the moderate-anxiety group based on the above classifications. In a study by Perks et al. (11), it was reported that anxiety in cases of neurosurgery was mostly about the outcome of the operation, and possible physical and mental damages. Patients who will undergo surgery, experience anxieties such as not being able to wake up normally after anesthesia, and having to deal with the risk of algophobia, disability, and death. In patients who had undergone an awake craniotomy, the most cause for complaint aspects of the procedure were anxiety provoked by a lack of information and long periods of immobility (18). In a study by Goebel et al. (19) the lack of being informed was the cause of preoperative anxiety in 76% of the intracranial tumor cases. When our patients were asked the cause of their anxiety, most patients cited the surgery itself as the cause (35.6%), followed by anesthesia (17.3%), lack of being informed (11.5%), and the possibility of postoperative pain (3.8%).

A patient's emotional condition is one of the most important components of pain. Patients' anxiety about their daily lives and the operation they will undergo affects the pain they feel. The assessment time of acute postoperative pain is variable from 2-10 days after surgery. In a retrospective study with patients undergoing elective craniotomy, De Benedettis et al. (22) determined that 60% of craniotomy patients complained of pain at the end of the operation and that two-thirds of these patients had moderate or severe pain. In the study of Suksompong et al (23), the incidence of moderate to severe pain was 75%. There was a meaningful relationship between preoperative pain and postoperative pain development and patients' complaints of pain were increased in the early postoperative period. Roca et al. (24) stated that nearly 60% of patients complained of pain in the first seven days of the postoperative period and 91.1% of patients complained of pain at least one time in the first 6 months of follow-up. We observed preoperative pain in 60.6% of our patients**.** In the postoperative period, 51.9% of patients had pain in the postoperative 0^{th} minute, 69.2% in the 30^{th} minute, 54.8% in the 1^{st} hour, 44.2% in the 2^{nd} hour, and 34.6% in the 24^{th} hour, and 22.1% of them had pain in 48^{th} hour. We found that existing headaches in the preoperative period in 37.5% of patients continued into the postoperative 6^{th} month. Additionally, we observed that in 13.5% of patients who did not complain of pain in the preoperative period, pain complaints started in the postoperative period. Kaur et al. (25) stated that 17.5% of patients experienced pain lasting more than 2 months and 11.9% of patients had pain lasting more than 1 year. This difference in post-craniotomy pain scores could be because the patient samples included in the studies are different, the surgery is performed by different surgical teams with different levels of experience, and sociocultural differences affect the development of pain, which is a subjective symptom.

Post-craniotomy pain can become chronic because of factors relating to both the patient and the surgery. To diagnose the chronic post-craniotomy pain, the pain should start following the surgical intervention, it should last more than two months, and other factors causing pain should be excluded (26, 27). Chronic post-craniotomy pain incidence is found to be 51% in our patients. Harner et al. (28) stated that, in the post-craniotomy period, 23% of patients had pain lasting three months, 16% had lasting one year, and 9% had lasting two years. The presence of preoperative pain complaints and severity of postoperative pain in patients undergoing cranial surgery can be counted among the factors affecting chronic post-craniotomy pain (24, 29-31). In our study, the rate of chronicity in the postoperative period was higher in those with high VAS scores in the preoperative period. We found that 54.1% of our patients with surgical anxiety and 66.7% of patients with anxiety about anesthesia, had pain in postoperative 30^{th} minute. Also, the percentage of these two groups of patients who developed chronic pain in the 6^{th} month was 51.4% and 50% respectively.

In the first measurement after the operation when our patients were completely cooperative, no analgesia was required for 72.1% of patients. In the postoperative 48^{th}-hour period, adequate analgesia control was achieved mostly with paracetamol. Although 51% of our patients' VAS scores were more than 4, we determined that only 29.8% of them required analgesics in the 6^{th} postoperative month. This is because patients undergoing cranial surgery sometimes cannot exactly express the pain they feel. Similar to cases of frontal lobe disorder, patients can be apathetic regarding the pain that's why the analgesic applications are insufficient (29). It is of great importance that postoperative pain of

moderate to severe intensity in craniotomy patients should not be overlooked and be treated properly. In one study, authors searched for whether opioids during the first 24 postoperative hours were significantly altered when receiving intravenous acetaminophen. Patients in the acetaminophen group seemed to have lower VAS scores upon ICU arrival and at 8 hours without opioid side effects (32). Walavan et al. (33) have attracted attention with narcotic-induced limbic desensitization which plays a role in the reduction of anxiety after craniotomy. In their elective supratentorial craniotomy patients, the addition of IV acetaminophen to treat postoperative craniotomy pain did not result in a significant reduction in narcotic use. A scalp block before the surgical incision, the use of dexmedetomidine, and pregabalin are therapies recently used for pain after craniotomy (34, 35). Also, alternative nonpharmacological pain management strategies are investigated like music therapy so, the best treatment options for pain after craniotomy is an issue to be researched.

Although it was stated in the studies that preoperative anxiety and pain scores were affected by gender, the most important limitation of this study is that the statistical analysis of the relationships between anxiety and pain scores was not performed according to gender.

CONCLUSION

Craniotomy patients mostly have moderate preoperative anxiety and moderate to severe postoperative acute and chronic pain is developed after surgery. The significant relationship between preoperative anxiety and postoperative pain in craniotomy patients is remarkable. To open new windows to prevent the pain to be chronic and serious, attention should be given to the determination of quality, quantity, and etiology of pain.

Conflict of interest: There is no conflict of interest in this issue.

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