J Anesth (2014) 28:222–227
DOI 10.1007/s00540-013-1712-7

ORIGINAL ARTICLE

The effect of preoperative anxiety on postoperative analgesia and anesthesia recovery in patients undergoing laparascopic cholecystectomy

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Received: 21 June 2013 / Accepted: 30 August 2013 / Published online: 29 September 2013
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Abstract
Purpose In patients who are hospitalized for surgery, anxiety disorders are frequently observed. Anxiety affects the patient's perception of postoperative pain and has a negative impact on recovery from anesthesia. This study attempted to compare the effect of preoperative anxiety on postoperative pain control and recovery from anesthesia in patients undergoing laparoscopic cholecystectomy.
Methods A total of 80 patients were enrolled who were undergoing laparoscopic cholecystectomy. Demographic characteristics of the patients were recorded. Beck's anxiety ınventory (BAI) was administered to the patients: patients with anxiety were included in the high-anxious patient group (group H) and patients without anxiety were enrolled in the low-anxious group (group L). Duration of surgery, duration of anesthesia, extubation time, and adverse effects were recorded. During the postoperative period, patient-controlled analgesia with tramadol was used for pain control. Visual analog scale (VAS) scores and tramadol consumption of all patients were recorded.
Results Among all patients, 31 (38.75 %) patients had preoperative anxiety, and significant correlation was found between the days of hospitalization and preoperative score of BAI. In group L, extubation time, the time for the modified Aldrete score to reach 9, was seen as significantly shorter and fewer postoperative side effects were determined. Also in group L, postoperative VAS score and tramadol consumption were significantly lower, and less tenoxicam was needed.
Conclusion A high preoperative anxiety level negatively affects recovery from anesthesia and control of postoperative pain. In this patient group, the increased need for postoperative analgesia must be adequately met.

Keywords Anxiety · Cholecystectomy · Recovery from anesthesia · Postoperative analgesia

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Introduction

In patients who are hospitalized for physical illness, disorders such as anxiety, depression, and somatoform are frequently observed [1–3]. A rate of postoperative anxiety and depression of approximately 30 % has been reported [4]. Surgical intervention, which is unrelated to the patient's illness, can cause anxiety and depression [4]. Patients hope that after surgery they will be free of pain and limitation. They may also have serious concerns about pain and suffering [5]. Doubts regarding surgical success, fear of anesthesia, and fear of loss of ability are the main causes of preoperative anxiety. Preoperative anxiety and depression is not just a psychiatric diagnosis. It has a negative impact on morbidity and the development of complications after surgery. A positive association has been found between preoperative anxiety and postoperative morbidity [5]. The most important concern of patients is usually postoperative pain control, which is also affected by the anxiety level [6]. Anxiety affects the patient's perception of postoperative pain and has a negative impact on recovery from anesthesia [7]. Previous studies have generally focused on major surgical procedures [1, 6]. In this study we investigated the adverse effects of preoperative

anxiety of uncomplicated surgical procedures. In contrast to many studies done on this topic, the type of operation, the method of anesthesia, and the effect of surgical complications were standardized to all patients. We also used Beck's Anxiety Inventory (BAI) differently. This test can be administered easily to patients, as compared to other anxiety tests.

This study attempted to compare the effect of preoperative anxiety on postoperative pain control and recovery from anesthesia in patients who were scheduled for laparoscopic cholecystectomy and who had no known history of psychiatric disorder.

Materials and methods

Ethical approval

The protocol and subsequent amendments to the protocol were approved by the Human Research Ethics Committee of Istanbul University Medical Faculty (Ref:2013/382 Date:05/04/2013). Written informed consent was obtained from the patients or their legally acceptable representatives.

Patients

The patients were aged 18–70 years and were scheduled for laparoscopic cholecystectomy. In total, 94 patients with American Society of Anesthesiologists status I or II were examined. Of these patients, 80 who agreed to participate in the study, who met the inclusion criteria, and who did not have any complications were studied (Table 1).

Study design

In this double-blind study, data were collected by two anesthesiologists. The first anesthesiologist assessed the patients using BAI, after which the results were recorded and the patients were grouped accordingly. The second anesthesiologist recorded the intraoperative and postoperative data. Data were not revealed until the end of the study.

Table 1 Inclusion criteria

1. The patient agrees to participate in the study
2. Reads and writes and can be said to have accurate information
3. Does not have previous psychiatric disorders
4. No drug or alcohol abuse
5. Stay in hospital at least 2 days
6. Surgery not postponed

Tests

Beck's Anxiety Inventory includes questions regarding 21 symptoms of somatic and cognitive anxiety. Responses are rated on a scale from 0 to 3, and the maximum score is 63. This test was translated into Turkish, and the validity and reliability of this test were approved by Ulusoy et al. [8]. A cutoff score of 17 was determined for anxiety [8].

A visual analog scale (VAS) was used to determine the level of pain in the patients. The words "No pain" were written at one end of a 10-cm-long ruler and the words "severe, unbearable pain" were written at the other end. Patients were asked to indicate their level of pain on the ruler. This test, which has been used for many years, was previously validated and its reliability was determined [9].

The modified Aldrete score (MAS) was used to evaluate patient consciousness, oxygenation, and hemodynamics. These parameters are scored on a scale of 0–2.

Clinical observations and procedure

All patients were observed at the surgical ward the day before surgery by the anesthesiologist. Demographic characteristics (gender, age, weight, and height) and the number of days in hospital were recorded. BAI was applied and the resulting values were recorded. According to the values obtained by BAI, patients were divided into two groups: a high-anxiety group (group H) and a low-anxiety group (group L). High-anxiety group patients' BAI scores are more than 17 and low-anxiety group patients' BAI scores are equal to or less than 17. All patients were administered an anxiolytic agent (0.5 mg; alprazolam tablets) the night before the surgery. All patients were informed regarding use of the patient-controlled analgesia (PCA) device (Provider®; Abbott Laboratories, Chicago, IL, USA) during the preoperative visit. Thirty minutes before surgery, 3 mg midazolam was administered intramuscularly to all patients. Heart rate (HR; three-channel electrocardiography), blood pressure, peripheral oxygen saturation (SpO_2), and end-tidal CO_2 (Datex-Ohmeda S/5TM Compact Critical Care Monitor) were monitored. For anesthesia induction, 1 μg/kg remifentanil, 2–2.5 mg/kg propofol (up to loss of eyelash reflex), and 0.1 mg/kg vecuronium bromide were used. Patients were intubated with an appropriate endotracheal tube. Fresh gas flow was adjusted to 4 l/min (O_2/air mix, 50 %/50 %) during surgery. The tidal volume was adjusted to 8 ml/kg with a ventilatory frequency of 12 beats/min by volume-controlled mechanical ventilation (Datex-Ohmeda S/5 Avance). End-tidal CO_2 was maintained at 30–40 mmHg. During anesthesia maintenance, 50 % O_2/50 % air mix, sevoflurane (0.5–2 %), and 0.05–0.45 μg/kg/min of remifentanil were used. All surgeries were performed by two

general surgeons experienced in laparoscopic cholecystectomy. Three ports (two 10-mm ports and one 5-mm port) were used for laparoscopic cholecystectomy. Surgical time and duration of anesthesia were recorded. During the skin suture process, remifentanil infusion was discontinued. When the surgical procedure was completed, sevoflurane was discontinued. Vecuronium was reversed with neostigmine 0.04 mg/kg and atropine 0.02 mg/kg. After adequate spontaneous ventilation resumed, and their eyes opened with verbal cuing, patients were extubated. Paracetamol (1 g i.v.) was administered to all patients within 10 min of discontinuation of anesthetic during the suturing process. The time from discontinuation of agents to extubation was considered as extubation time and recorded. After surgery, patients were taken to the recovery unit and observed. For adverse effects such as nausea, vomiting, agitation, and tremors, the patients were monitored in the recovery room. MAS and postoperative side effects checked every 3 min at the recovery unit. When MAS was 9 and above, patients were transferred to the ward. The time for MAS to reach 9 were recorded. Patients received i.v. tramadol via PCA, which was started when MAS reached 9 in the recovery room. The loading dose of tramadol was 50 mg, 5 mg/h basal infusion and a bolus of 20 mg (lockout, 30 min), with a maximum allowable dose being 200 mg for 4 h. In addition to PCA (VAS $\geq$4), 20 mg tenoxicam was administered and recorded as needed. Patients' VAS scores were evaluated at 0 h (first time of cooperation with patient) and at 1, 2, 4, 8, 12, and 24 h. Tramadol consumption was recorded at 6, 12, and 24 h. Side effects such as nausea, vomiting, itching, excessive sweating, headache, and dry mouth may occur in patients; these side effects were monitored for 24 h and recorded. After the operation, anxiety was evaluated using BAI (24 h after surgery) and the results were recorded.

Statistical analysis

Sample size was calculated in a pilot study including ten patients and was based on postoperative VAS score at 2 h with a type 1 error of 0.05 and a power of 0.8. The minimum number of patients needed for each group was calculated to be 30. All statistical analyses were carried out using SPSS for Windows version 15.0 (SPSS, Chicago, IL, USA). The *t* test was used for comparison of quantitative variants. Qualitative variants were compared using the chi-squared test. $p < 0.05$ was considered statistically significant. Results are expressed as mean $\pm$ standard deviation (SD).

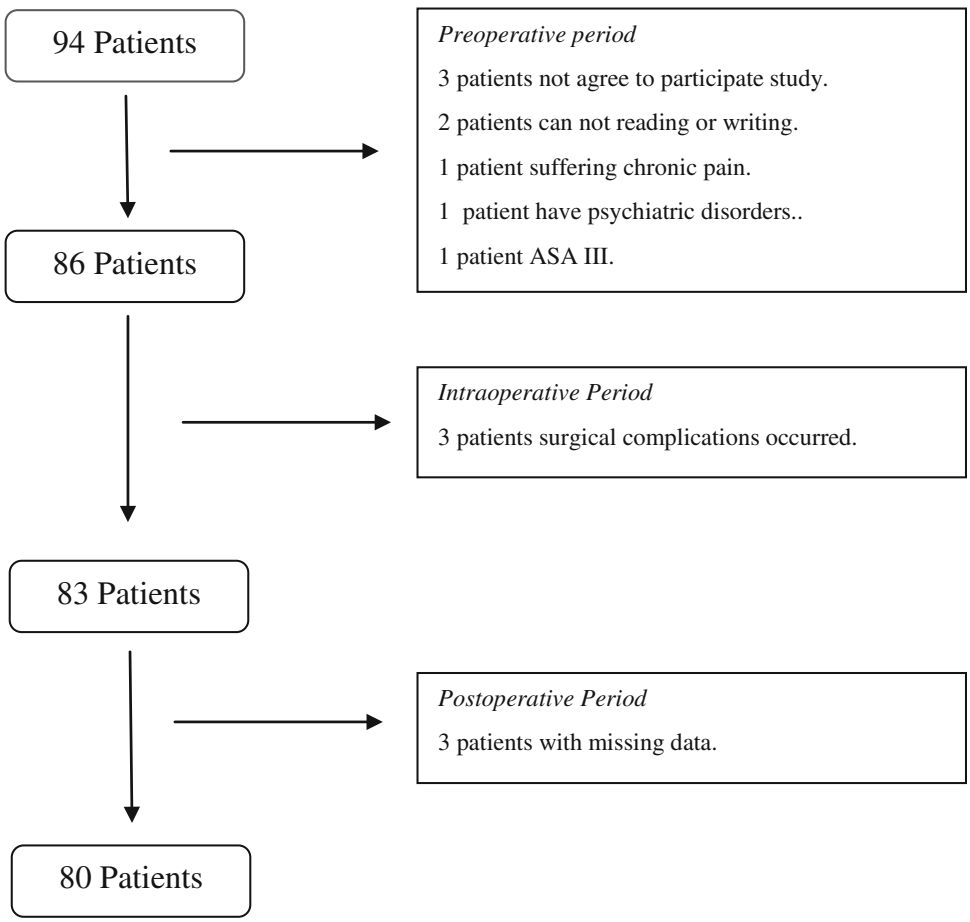

Fig. 1 Study flowchart

Results

Patient data excluded from the study

In total, 14 patients were excluded from the study. Reasons for exclusion are shown in Fig. 1.

Demographic characteristics and preoperative anxiety

Among all patients, preoperative anxiety was identified in 31 of the patients (38.75 %) (group H). No preoperative anxiety was found in the other 49 patients (61.25 %) (group L). No significant difference was observed between groups in terms of demographic characteristics, anesthesia time, surgical time, and remifentanil consumption. Hospital stay during the preoperative period was significantly longer and BAI scores were significantly higher in group H than in group L (Table 2). No correlation was found between age, height, weight, and BAI score in either group ($p > 0.05$). However, a significant positive correlation was found between the duration of hospitalization and BAI score ($r = 0.370$, $p = 0.001$).

Anesthesia recovery and side effects

The time for MAS to reach 9 and extubation time were significantly shorter in group L than in group H (Table 3). In the early postoperative period, nausea, tremor, vomiting, and agitation were the most common side effects. Agitation and tremor were more frequently observed in group H (Table 3).

Table 2 Demographic, preoperative, and intraoperative parameters

	Group H $n = 31$	Group L $n = 49$	p
Gender (M/F)	12/19	21/28	0.714
Age (years)	47.1 ± 12.6	46.2 ± 9.9	0.749
Height (cm)	165.4 ± 7.0	163.7 ± 6.7	0.29
Weight (kg)	74.0 ± 14.1	73.3 ± 10.4	0.808
BAI Score (pre.)	24.4 ± 4.6	10.5 ± 3.4	<0.001*
Preoperative DSH (day)	2.1 ± 0.8	1.7 ± 0.7	0.023*
Duration of anesthesia (min)	66.1 ± 9.1	64.2 ± 6.3	0.303
Duration of surgery (min)	59.1 ± 8.9	57.4 ± 6.7	0.379
Remifentanil consumption (μg/kg)	7.8 ± 1.1	7.5 ± 1.1	0.242

Data are mean ± SD or number of patients

M male, *F* female, *BAI* Beck's anxiety inventory, *pre* preoperative, *DSH* days of stay in hospital

* Statistically significant

Postoperative period

Significantly higher VAS scores were found at 2, 4, 8, and 12 h in group H. Tramadol consumption was significantly greater at all time points in group H. In addition, the need for tenoxicam was significantly greater in group H (Table 4). Side effects associated with the use of tramadol were observed less frequently and were similar between groups (Table 5). In group H and group L, postoperative BAI scores were 10.6 ± 4.6 and 8.9 ± 3.5, respectively. No significant difference in BAI score was found between the groups ($p = 0.085$). In each group, significant decreases were observed in BAI score after surgery (group H, $p < 0.001$; group L, $p = 0.034$).

Table 3 Postoperative recovery and side effects

	Group H $n = 31$	Group L $n = 49$	p
Extubation time (min)	6.1 ± 1.7	5.3 ± 1.6	0.03*
MAS 9 time (min)	16.4 ± 3.2	14.4 ± 3.6	0.014*
Nausea	9 (29 %)	12 (24.5 %)	0.653
Vomiting	5 (16.1 %)	7 (14.3 %)	0.822
Agitation	10 (32.3 %)	6 (12.2 %)	0.029*
Shivering	12 (38.7 %)	9 (18.4 %)	0.044*
Other	1 (hypotension)		

Data are mean ± SD or number of patients

MAS modified Aldrete score

* Statistically significant

Table 4 Postoperative analgesia

	Group H $n = 31$	Group L $n = 49$	p
VAS start	2.6 ± 1.4	2.3 ± 1.3	0.243
VAS 1 h	3.5 ± 1.4	2.9 ± 1.2	0.064
VAS 2 h	3.6 ± 1.0	2.8 ± 1.1	0.003*
VAS 4h	3.3 ± 1.1	2.7 ± 1.1	0.023*
VAS 8 h	3.1 ± 1.2	2.5 ± 0.9	0.034*
VAS 12 h	3.0 ± 1.2	2.5 ± 0.9	0.021*
VAS 24 h	2.2 ± 1.3	1.7 ± 1.0	0.067
Tramadol consumption 6 h	139.5 ± 17.4	117.9 ± 20.9	<0.001*
Tramadol consumption 12 h	227.0 ± 35.9	182.0 ± 32.2	<0.001*
Tramadol consumption 24 h	264.5 ± 29.9	220.8 ± 29.7	<0.001*
Tenoxicam requirement (number of patients)	10 (32.3 %)	6 (12.2 %)	0.029*

Data are mean ± SD or number of patients

VAS visual analog scale, *h* hour

* Statistically significant

Table 5 Side effects associated with the use of tramadol

	Group H $n = 31$	Group L $n = 49$	p
Nausea or vomiting	4 (12.9 %)	5 (10.2 %)	0.710
Itching	2 (6.5 %)	3 (6.1 %)	0.953
Sweating	2 (6.5 %)	2 (4.1 %)	0.636
Dry mouth	3 (9.7 %)	4 (8.2 %)	0.815
Headache	3 (9.7 %)	4 (8.2 %)	0.815

Data are number of patients

Discussion

In this study in patients with preoperative anxiety, recovery from anesthesia was prolonged and side effects and postoperative pain increased. As stated in many similar studies, preoperative anxiety is frequently observed before elective surgery [4, 10]. Reported preoperative anxiety rates vary between 80 % and 20 %, depending on the type of surgery undergone [11, 12]. In this study, a preoperative anxiety rate of 38.75 % was identified before elective cholecystectomy. This result is therefore comparable to those of previous studies. Surgery is not the only cause of preoperative anxiety; anesthesia is also a very important cause of anxiety [13]. Mavridou et al. [12] found that fear of postoperative pain and fear of anesthesia are the most frequent causes of preoperative anxiety. In other studies, to evaluate preoperative anxiety, the Amsterdam Preoperative Anxiety-Information Scale and Spielberger's State-Trait Anxiety Inventory were used. In the context of this study, BAI was chosen because of its proven reliability and suitability in our country [8]. Some studies have found relationships between age, gender, and preoperative anxiety [12, 14]. However, no connection between preoperative BAI and demographic data was found in the present study. In the present study, prolonged hospital stay has been identified as a cause of increased preoperative anxiety scores. Laparoscopic cholecystectomy is not a life-threatening procedure. However, prolonged hospitalization before surgery may still have a negative effect on patients, causing an increased probability of development of preoperative anxiety. According to the results of this study, in patients with preoperative anxiety, recovery from anesthesia was prolonged and postoperative side effects were more frequent. In our study, postoperative tremor and agitation was >30 % in patients with preoperative anxiety. In both groups of patients, the type of anesthesia, surgical procedures, and surgical duration were identical. This finding suggests that this difference is entirely caused by preoperative anxiety. Evaluating a single surgical procedure allowed us to evaluate the effects of preoperative anxiety more objectively.

In some studies, preoperative anxiety increases the anesthetic need intraoperatively and prolongs recovery from anesthesia [15, 16]. Van Den Bosch et al. [17] showed an increased incidence of postoperative nausea and vomiting depending on the level of preoperative anxiety. Pain is an extremely complex process that involves interactions among an array of neurotransmitters as well as various neuromodulators at the level of the neuraxis [18]. Patient psychology affects this complex structure seriously. Previous studies report and suggested that anxiety may potentiate pain because patients become more attentive to pain. Fear of postoperative pain and surgery may be a stressor that stimulates a heightened anxiety response and, thereby, contributes to the continuity of the cycle of pain ± anxiety [19, 20]. This question may be answered by comparing anxiety and non-anxiety patients as in our study. As indicated in many studies, control of postoperative pain is more difficult and analgesic consumption is increased in patients with preoperative anxiety [20, 21]. In our study, except at 1 and 24 h, VAS scores were significantly higher in patients with anxiety. In the first postoperative hour, pain levels were similar in both groups, depending on the first dose of tramadol. Postoperative pain scores influenced by the type of surgery and anesthesia. In present study, we have standardized the type of surgery and anesthesia. In this way, we could eliminate misleading effects. Kain et al. [22], in a study similar to ours, identified a negative effect of preoperative anxiety on postoperative pain scores in female patients after hysterectomy. Cho et al. detected anxiety in 23.4 % of patients after rotator cuff repair. A positive correlation was found between preoperative anxiety and postoperative VAS scores in patients in that study [23]. Increases in postoperative pain scores indicate a need for increased analgesic therapy in patients with anxiety. Geha et al. [24] showed a positive correlation between morphine administration and preoperative anxiety after orthognathic surgery. In our study, tramadol consumption was significantly higher in patients with preoperative anxiety. The use of anxiolytic agents before surgery was insufficient to prevent the negative effects of postoperative anxiety. Therefore, standard postoperative analgesic protocols may not be sufficient for patients with high anxiety. For this reason, preoperative anxiety must be identified. In patients with high anxiety, postoperative pain must be controlled very carefully. In the current study, pain control was sufficiently balanced in both groups. Use of the PCA device and ongoing evaluation of pain severity may have contributed to our success in pain control.

In conclusion, preoperative anxiety is frequently observed before elective surgery. Therefore, anxiety should be evaluated before surgical procedures. High anxiety has a negative effect on recovery from anesthesia and on

postoperative pain control. Also, high preoperative anxiety increases postoperative analgesia requirement. This requirement should be addressed.

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

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