

The clinical application of preoperative self-anticipated pain score and the correlation with surgical pain after elective surgery - a prospective observational study

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Abstract

Background: Current principles of postoperative pain management are primarily based on the types and extent of surgical intervention. This clinical study measured patient's self-anticipated pain score before surgery, and correlated the scores with the pain levels and analgesic requirements after surgery.

Methods: This prospective observational study recruited consecutive patients who received elective surgery in the E-Da Hospital, Taiwan from June to August 2018. Patients were asked to subjectively rate their highest anticipated pain level (numerical rating scale, 0-10) for the scheduled surgical interventions during their preoperative anesthesia assessment. After the operation, the actual pain intensity (NRS 0-10) experienced by the patient in the post-anesthesia care unit and the total dose of opioids administered during the perioperative period were recorded. Pain scores ≥ 4 on NRS were regarded as being unacceptable levels for anticipated or postoperative pain.

Results: A total of 996 patients were included in the study. Most of the patients (86%) received general anesthesia and 73.9% of them had a history of previous operation. Female anticipated significantly higher overall pain intensities than the male patients (adjusted odd ratio 1.532, 95% confidence interval 1.125-2.086; $P=0.007$). Patients who took regular benzodiazepine at bedtime ($P=0.040$) and those scheduled to receive more invasive surgical procedures were most likely to anticipate for higher pain intensity at the preoperative period ($P<0.001$). Although higher anticipated pain scores (NRS ≥ 4) were associated with higher postoperative pain levels ($P=0.021$) and higher total equivalent opioid dose ($P=0.001$) for acute pain management during the perioperative period, these surgical patients actually experienced less pain than they anticipated at the post-anesthesia care unit.

Conclusion: This observational study found that patients who are female, use regular benzodiazepines at bedtime and scheduled for more invasive surgeries anticipate significantly higher surgery-related pain. Therefore, appropriate preoperative counseling for analgesic control and the management of exaggerated pain expectation in these patients is necessary to improve the quality of anesthesia delivered and patient's satisfaction.

Background

Inadequate postoperative pain management can lead to physical and psychological distress in patients as well as impact surgical wound healing [1-5] and increase the risk of developing postoperative delirium [6] and cardiopulmonary and thromboembolic events [7]. Severe postoperative pain can also result in the development of chronic pain, which in turn can lead to prolonged opioids use and increased health-care costs [8]. Although numerous clinical pathways and strategies have been recently implemented, such as the introduction of the enhanced recovery after surgery (ERAS) program and multimodal analgesia (MMA), rates of inadequate postoperative pain management remain as high as 40-56.4% in the general surgical population [9-12]. and the prevalence rates of persistent pain after major operations can reach up to 50% [1].

Several perioperative factors such as age, catastrophizing pain scores, gender, psychological distress and operation type have been suggested to be closely associated with the postoperative pain intensity and analgesic usage [13-15]. In patients who received mastectomy or conserving surgery for breast cancer, the expectations of higher postoperative pain and high preoperative distress actually predict more intense postoperative pain [16]. A prospective observational study conducted in females undertaking hysterectomy also showed that pre-surgical fear of immediate consequences of surgery was associated with increased requirement of postoperative rescue analgesia (odd ratio, 1.306; 95% confident interval, 1.031-1.655) [17]. However, very few large scale clinical studies have investigated the relationship between surgical patient's preoperative anticipated pain intensity and the actual pain intensity experienced after operations in general surgical population. Therefore, this clinical observational study aimed to determine the patient characteristics and perioperative factors influencing the subjective anticipated pain intensities in a larger number of patient population who were scheduled for common elective surgical procedures. The anticipated pain scales were also correlated with the actual pain intensity experienced and analgesic required by the patients after surgery.

Methods

Study population and study protocol

This prospective observational study was approved by the ethics committee and the institutional review board of E-Da Hospital, Taiwan (approval number EMRP107018). Consecutive patients who received elective surgery under general or regional anesthesia during June 2018 to August 2018 were included in this study and patients scheduled for emergency operations or those who required postoperative intensive care were excluded (Figure 1). Patients were invited to voluntarily respond to a quantitative question during their preoperative anesthesia assessment. The patients were asked to rate their highest subjective anticipated postoperative pain intensity (numeric rating scale (NRS) 0-10). After their operations, patients were admitted to the postoperative care unit (PACU). The nurse specialists in the PACU recorded the pain levels by asking the patient's subjective NRS (1-10) at 15-minute intervals. Severity of postoperative pain assessed in the PCAU was defined as mild (NRS 1-3), moderate (NRS 4-6) and severe (NRS 7-10). The total analgesic dosages administered in the operating room and in the PACU were also recorded. All anesthetic and surgical interventions administered in this study, including procedures and medications, followed standard clinical practice protocol or physician's decision. The equivalent doses of opioids used during the perioperative period was calculated according to the updated practical opioid rotation and equianalgesic tables [18]. A culturally relevant depression screening questionnaire, the Taiwanese Depression Questionnaire (TDQ), was used to assess for depression in patients who were admitted to the surgical wards [19]. This 18-item screening tool has a reported sensitivity of 0.89 and a specificity of 0.92 at a cutoff score of 19 for depression screening in the general Taiwanese public [19].

Statistics

An anticipated pain intensity (NRS) of ≥ 4 during preoperative assessment was defined as a significantly high pain level, and a pain intensity (NRS) ≥ 4 measured at PACU is commonly defined as an unacceptable pain level that required analgesic intervention [20], and patients who had an expected NRS >4 at preoperative period were associated with significantly increased risk of postoperative pain up to postoperative day 4 [21]. The associations between patients' anticipating pain intensity and their demographical data, anesthesia-related factors and types of operation were analyzed. Types of surgical procedures that associated with different levels of expected postoperative pain intensity were graded according to a clinical prediction rule established by Jessen et al [22]. The risk of developing severe postoperative pain was graded by the surgical invasiveness, clinical observation, current practice and opinions of surgeons and anesthesiologists (supplementary table 1). The values of continuous variables were compared using an independent two-sample t test, one-way ANOVA or Wilcoxon rank-sum test, as appropriate. Categorical variables were compared using chi-square or Fisher's exact test. A conditional logistic regression model was adopted to evaluate the factors of interest (patient demographic and clinical variables) and the preoperative anticipated pain scales. Statistical significance was accepted at a level of $P < 0.05$. All statistical analyses were performed using the SAS software, version 9.1 (SPSS software, version 24.0 (IBM, Armonk, NY)).

Results

General outcomes

A total of 996 eligible patients were included in the study, as one patient was excluded due to incomplete data (Figure 1). The mean time interval between preoperative and postoperative pain assessment was 1.7 ± 5.8 (range 0-108) days. The mean age of the study population was 50.9 ± 15.6 years and 50.9% of the patients were male (Table 1). Most of these patients (86%) received general anesthesia for their procedures and 73.9% of them had at least one previous surgery (Table 1). Types of operation are listed in Table 1. The mean anticipated pain intensity (NRS) before surgery was 4.9 ± 2.6 (range 0-10) and 71.1% of the patients anticipated to develop high pain intensity (NRS ≥ 4) after their operations (Table 1).

Patient characteristics and anesthesia-related factors

Female patients anticipated significantly higher overall pain levels than male patients (5.4 ± 2.5 vs 4.4 ± 2.5 for NRS, respectively; $P < 0.001$). Compared to male patients, the adjusted odds ratio (AOR) for females to anticipate higher pain levels (NRS ≥ 4) was 1.978 (95% confidence interval (CI) 1.492-2.622, $P < 0.001$) (Table 2). Patients over 41 years of age had significantly lower overall anticipated pain levels than those younger than 40 years (Table 2, $P < 0.001$). Patients who were taking regular benzodiazepines at bedtime reported significantly higher anticipated pain levels (NRS ≥ 4) (AOR 1.614, 95% CI 1.023-2.546, $P = 0.039$) (Table 2). Patient's medical condition (defined as the ASA status), history of previous operations, education level and depression did not affect anticipated pain scores (Table 2). Compared with general anesthesia, procedures performed under regional techniques (neuraxial or peripheral nerve blocks) for

perioperative anesthesia or analgesia care significantly reduced patients' anticipated pain scale (AOR 0.674; 95% CI 0.462-0.983, P=0.04) (Table 2).

Types of operation

A total of 27 groups of surgical procedures were classified into 5 levels, as lowest, low, moderate, high and highest expected pain (Table 3 and supplementary table 1) [22]. Patients scheduled for lowest expected pain procedures anticipated of a mean NRS of 3.3 ± 2.5 ; while the anticipated NRS for those scheduled for highest expected pain procedures were 5.3 ± 2.5 (P<0.001), with a significantly higher risk of anticipating severe postoperative pain (NRS³⁴) (AOR 4.421, 95% CI 2.776-7.040, P<0.001). (Table 3). There was a linear relationship of increasing intensity of anticipated pain with different classifications of surgical procedures (Table 3 and Figure 2).

Association between preoperative anticipated pain and postoperative pain

The NRS recorded by PACU nurses showed that 58.2% of patients had adequate pain control (highest NRS<4) within one hour after surgery (Table 4). Before surgery, 41.6% and 24.3% of patients anticipated moderate (4-6) and high (³ 7) pain intensity, respectively (Table 4). However, only 1.0% of patients actually experienced high pain intensities (highest postoperative NRS³ 7) in PACU, and 40.8% of patients experienced moderate surgical pain in PACU (highest postoperative NRS 4-6) (Table 4). Equivalent opioid doses administered during surgery and at PACU was used as an alternative indicator of postoperative pain level. Patients who anticipated higher pain intensity before surgery received significantly higher total equivalent opioid doses during surgery and in PACU (P=0.001) (Table 5).

Conditional logistic regression analysis of perioperative factors for preoperative anticipated pain intensity (NRS³⁴)

Anticipated pain levels ³⁴ on NRS were considered as a predictor of unacceptable high pain intensities during postoperative period. Following a conditional multivariate logistic regression analysis, female gender was associated with significantly higher anticipated pain intensity with an odds ratio of 1.532 (95% CI 1.125-2.086, P=0.007) (Table 6). Furthermore, patients who took regular benzodiazepines at bedtime reported significantly higher anticipated pain intensities (AOR 1.661; 95% CI 1.023-2.697, P=0.040) (Table 6). Compared to the lowest expected pain procedures, patients scheduled to receive surgical procedures with low to highest expected pain were more likely to anticipate for higher pain intensity at preoperative period (P<0.05) (Table 6).

Discussion

A major limitations in postoperative pain management has been the fact that a patient's personal perception of pain may not always be taken into account during preoperative pain counseling. Acute postoperative pain is a subjective and multidimensional experience that is extremely hard to measure and manage optimally. The results of this study demonstrated that female patients, younger patients, patients

took regular benzodiazepine at bedtime, and patients scheduled for invasive surgical procedures without regional blocks are more likely to concern about inadequate pain control after surgery.

Gender is commonly considered as a strong predictor for pain perception and analgesic requirements after surgery [23 ,24]. However, some systematic reviews have not found gender to be an independent predictor for postoperative pain levels or analgesic requirements [15]. The results of our survey suggest that female patients anticipated significantly higher pain levels preoperatively than male patients, the difference remained statistically significant following a multivariate regression analysis with an odds ratio of 1.532 (95% CI 1.125-2.086). These results support the findings of numerous previous studies [25-27]. Our univariate analysis also found that older patients (>40 years) anticipated a lesser degree of surgery-related pain during their preoperative assessments as compared to those who were younger. We suggest that this observation may be due to the elderly being associated with less preoperative anxiety and that they do not request for as much information concerning their operations [28-30]. Our results are also consistent with a previous prospective observational study which showed that older patients reported lower anxiety scores and expected pain scores before operations [31]. Since a history of previous surgery is usually associated with decreased preoperative anxiety [32 ,33], it was not surprising to find that previous surgery had a diminishing effect on preoperative anticipated pain levels.

Previous studies have suggested that patients with psychosomatic and behavioral disorders (*e.g.* major depression, insomnia, and catastrophizing pain) can have a decreased tolerances for postoperative pain [34-37]. Our study has found that regular benzodiazepine use at bedtime is an independent risk factor for high anticipated postoperative pain intensity during preoperative assessments. In addition to hypnosis, benzodiazepines are also commonly used to manage anxiety and other anxiety-related disorders. However, our study did not specify the clinical indications for the regular use of benzodiazepines for individual patients. According to our questionnaire design, the use of benzodiazepines at bedtime was more likely considered as hypnotic agents to improve sleeping quality at night, rather than surrogate indicators for anxiety or other psychosomatic disorders. Furthermore, no differences were found in preoperative pain anticipation between surgical patients with and without depression, which was screened by the Taiwanese Depression Questionnaire during preoperative assessment. This study also did not find significant effects of other patient characteristic variables, such as educational levels, marital and socioeconomic status on the anticipation of surgical pain intensity.

Classification of type of surgery has been shown as a clinical meaningful predictor for prediction of acute postoperative pain, as the invasiveness and incision size of surgical procedure correlate with the anticipated pain intensity [22]. We used the clinical prediction rule established by Janssen et al., in which types of surgery were graded from the lowest to the highest expected pain procedures [22]. Our analysis showed a clear positive correlation between type of operation and patient's anticipated pain intensity, suggesting that the invasiveness and complexity of procedure affects patients' anticipated perception of surgical-related pain in the preoperative period [15 ,22]. Previous studies also indicate that anesthetic techniques play a major role in the risk of developing severe acute postoperative pain, as the odds ratio of NRS>4 was significantly higher in patients receiving only general anesthesia without regional block

techniques immediately after operation and on postoperative day 2 [21]. Consistently, our univariate analysis demonstrated that the proposed administration of regional blocks significantly reduced patient concerns regarding postoperative pain.

Preoperative anticipated pain intensity was compared with the highest postoperative pain intensity recorded in PACU, and the total equivalent dose of opioids prescribed perioperatively. Our analysis found that patients anticipated significantly more pain preoperatively than they actually experienced after surgery. This was particularly evident in patients who anticipated severe pain (NRS³ 7) preoperatively, these patients were actually more likely to report a lower pain intensity in PACU. Although there was a positive relationship between preoperative anticipated pain intensity and perioperative total equivalent dose of opioid administered (during surgery and in PACU), the correlation coefficient was extremely low. These observations suggest that patients tend to overestimate surgery-related pain levels. In current practice, anesthesiologists are more likely to prescribe postoperative analgesics based on the type and duration of the operation rather than the patient's subjective perception of pain [38,39], which may be responsible for the discrepancy between patient's anticipated pain and the actual pain intensity experienced during postoperative period.

After extensively reviewing 48 studies, Ip *et al.* identified several independent perioperative factors for predicting actual levels of postoperative pain and analgesic usage [15]. These predictive factors include the presence of preoperative pain, anxiety, age, and type of surgery (*i.e.* major joint, thoracic, and open abdominal surgery) and are associated with higher postoperative pain scores. Surgery type, age, and psychological distress were found to be significant predictors of analgesic usage. Ip and colleagues' systematic review found that gender had a neutral effect on postoperative pain levels and analgesic requirements, but the results of our study indicated that females anticipated more postoperative pain preoperatively. This major discrepancy could be due to the general understanding that female patients can react more emotionally to physical distress, but the distress is no less authentic and they are not less ill than the male patients [40-42].

The results of this study must be interpreted in light of several limitations. Firstly, patients were invited to voluntarily rate the anticipated pain intensity during their preoperative anesthesia assessment. Therefore, the knowledge, educational levels and motives of the individual patient might impact the response to the quantitative question. Secondly, patients' preoperative psychological conditions are routinely assessed using a culturally relevant depression screening questionnaire, the Taiwanese Depression Questionnaire (TDQ) in our hospital. This short questionnaire were designed to be simple and practical so that it could be applied to the general population in a time-efficient manner. The comprehensive versions for diagnosing depression and chronic insomnia were not used in this study. Therefore, this study may have been underpowered to isolate depression as an independent risk factor for the anticipation of severe postoperative pain. Thirdly, several potential predicting factors, such as patient's pain catastrophism, pain sensitivity, preoperative opioid intake, full history of past surgeries and traumas, and ethnicity were not determined in this study. Although total equianalgesic doses of opioid administered during perioperative period were calculated, the use of non-opioid analgesics were not taken into account for the overall

surrogate indicator for postoperative pain. Lastly, our results were not generalized to critically ill patients who were scheduled for postoperative intensive care or emergent surgery.

Conclusion

Our study demonstrated that female gender, regular benzodiazepine use at bedtime, and more invasive surgical procedure without regional blocks are the significant risk factors for the anticipation of more severe pain before surgery. Therefore, these patients may require additional assessments and pain management counseling during their pre-anesthesia consultation. Appropriate preoperative counseling for analgesic control (especially the introduction of multimodal analgesia) and the management of unnecessary anticipated pain levels could improve the quality of anesthesia delivery and patient perioperative satisfaction.

Abbreviations

AOR: adjusted odds ratio; ASA PS: American Society for Anesthesiologist physical statuses; BMI: body mass index; CI: confidence interval; ERAS: enhanced recovery after surgery; MMA: multimodal analgesia; NRS: numeric rating scale; PACU: postanesthesia care unit; TDQ: the Taiwanese Depression Questionnaire; VAS: visual analogue scale

Declarations

Ethics approval and consent to participate: The study protocol was approved by the institutional review board of the E-Da Hospital, Kaohsiung, Taiwan (EMRP107018). Written informed consents were obtained from the patients or their legal representatives.

Consent for publication: not applicable

Availability of data and material: The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: WSC, SCC, CFL and YCT designed the study. WSC, YTH, MCC, and YCC collected the questionnaires and data acquisition. WSC, TSC, CFL and YCT contributed to the statistical analysis and interpretation of data. WSC, YTH, MCC, CFL and YCT contributed to drafting the manuscript. All authors read and approved the final version of manuscript. CFL and YCT contributed equally to the work.

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Tables

Table 1. Patient demographical data

Characteristics	n (%) or mean±SD
Age (years, mean)	50.9±15.6
Age groups (years)	
<40	262 (26.3%)
40~60	438 (44%)
60~80	271 (27.2%)
>80	25 (2.5%)
Gender	
Male	507 (50.9%)
Female	489 (49.1%)
Body height (cm)	162.1±11.3
Body weight (kg)	68.6±16.4
Body mass index (kg/cm ²)	
<24.5	441 (44.3%)
≥24.5	555 (55.7%)
Educational levels	
Illiteracy	41 (4.1%)
< College or high school	634 (63.7%)
□ University	321 (32.2%)
Depression (yes)	104 (10.5%)
Surgical history (yes)	736 (73.9%)

Table 2. Analysis of the relationships between patient's anticipated pain intensity and the characteristic or anesthesia-related factors

	Mean NRS	n	P value	Anticipated severe pain (NRS≥4)		
				AOR	95% CI	P value
Gender			<0.001			
Male	4.40±2.50	507		Ref		
Female	5.40±2.51	489		1.978	1.492-2.622	0.001
Age (years)			<0.001			
0-40	5.48±2.52	262		Ref		
41-60	4.69±2.56	438		0.609	0.425-0.874	0.007
> 61	4.66±2.50	296		0.542	0.369-0.796	0.002
Prior surgical history			0.116			
No	5.10±2.58	260		Ref		
Yes	4.81±2.47	736		0.823	0.598-1.134	0.233
BMI			0.331			
<18.5	5.00±2.55	41		Ref		
18.5~24.9	5.02±2.46	439		1.042	0.506-2.148	0.911
>24.9	4.77±2.64	516		0.816	0.399-1.669	0.577
Regular benzodiazepine use at bedtime			0.206			
No	4.85±2.58	870		Ref		
Yes	5.16±2.39	126		1.614	1.023-2.546	0.039
Depression*			0.891			
No	4.91±2.56	891		Ref		
Yes	4.87±2.60	105		1.016	0.990-1.042	0.228
Educational levels			0.11			
Illiteracy	5.00±3.178	41		Ref		
< High school	4.71±2.49	634		1.074	0.545-2.119	0.836
□ University	5.23±3.18	321		1.376	0.680-2.782	0.375
ASA physical status			0.208			
I-II	4.93±2.51	831		Ref		
III-V	4.66±2.76	165		0.742	0.519-1.059	0.100
Types of anesthesia			0.167			
General anesthesia	4.61±2.85	857		Ref		
Regional anesthesia	4.93±2.50	139		0.674	0.462-0.983	0.040

Table 3. Analysis of the relationships between types of the scheduled surgery and patient's anticipated pain

Type of surgery [†]	n	Mean NRS	Anticipated severe pain (NRS≥4)		
			AOR	95% CI	P value
Lowest expected pain		3.30±2.47	Ref		
Low expected pain		4.69±2.50*	2.387	1.452-3.922	0.001
Moderate expected pain		4.85±2.43*	3.010	1.687-5.373	<0.001
High expected pain		5.18±2.47*	3.757	2.373-5.948	<0.001
Highest expected pain		5.27±2.51*	4.421	2.776-7.040	<0.001

[†]Surgical procedures graded by a clinical prediction model established by Jassen et al, in which the expected pain intensities measured during preoperative period are ordered by increasing incidence of severe acute postoperative pain.²² Please refer to the supplementary table 1 for details of surgical procedures. Anticipated NRS≥4 was defined as high pain intensity. AOR: adjusted odd ratio; CI: confidence interval; NRS: numeric rating scale. *P<0.001 compared with the lowest expected pain using Wilcoxon rank-sum test, followed by the Dunn's post-hoc test for multiple comparisons.

Table 4. Comparison between patient's preoperative self-anticipating pain and postoperative pain score measured in PACU

Highest pain score at PACU	Preoperative self-anticipating pain score			P value =0.021
	NRS ≤3	NRS 4-6	NRS 7-10	
NRS ≤3	184 (18.6%)	260 (26.3%)	130 (13.2%)	574(58.2%)
NRS 4-6	97 (10.0%)	201 (20.4%)	105 (10.6%)	403(40.8%)
NRS 7-10	1 (0.1%)	4 (0.4%)	5 (0.5%)	10(1.0%)
Total patients (n=987)*	282(28.6%)	411(41.6%)	240(24.3%)	

NRS: numerical rating scale; PACU: post-anesthesia care unit. *A total of 987 datasets were analyzed due to missing of the NRS in the PACU

Table 5. Comparison between patient's preoperative self-anticipating pain and total equivalent opioid dose administered during perioperative period (n=996)

	Preoperative self-anticipating pain score			P value
	NRS 1-3	NRS 4-6	NRS 7-10	
Equivalent dose of opioid (mg) in OR	10.5±7.0	12.0±8.0	12.3±8.0	0.012
Equivalent dose of opioid (mg) at PACU	2.3±3.0	3.0±3.5	3.3±7.1	0.023
Equivalent dose of opioid (mg) during perioperative period	12.8±8.2	15.0±9.2	15.3±9.1	0.001

NRS: numerical rating scale; OR: operating room, PACU: post-anesthesia care unit.

Table 6. multiple variation analysis for patient demographic, surgical and anesthesia predicting factors for inadequate pain control after operation (preoperative anticipating pain scale NRS ≥4)

	AOR	95% CI	P value
Gender			
Male	Ref		
Female	1.532	1.125-2.086	0.007
Age (years)			
0-40	Ref		
>40	0.749	0.512-1.096	0.137
Prior surgical history			
No	Ref		
Yes	0.858	0.609-1.208	0.380
Body mass index (kg/m²)			
<18.5	Ref		
18.5~24.9	1.341	0.641-2.808	0.436
>24.9	1.160	0.558-2.409	0.691
Regular use of benzodiazepines at bedtime			
No	Ref		
Yes	1.661	1.023-2.697	0.040
Depression			
No	Ref		
Yes	1.141	0.680-1.914	0.618
Educational levels			
Illiteracy	Ref		
< College or high school	1.332	0.639-2.776	0.444
□ University	1.395	0.636-3.058	0.406
American Society of Anesthesiologists (ASA) physical class			
I-II	Ref		
III-V	0.799	0.542-1.178	0.258
Types of surgery			
Lowest expected pain	Ref		
Low expected pain	2.092	1.238-3.533	0.006
Moderate expected pain			

	2.460	1.344-4.502	0.004
High expected pain	3.359	2.041-5.530	<0.001
Highest expected pain	3.374	2.023-5.625	<0.001
Types of anesthesia			
General anesthesia	Ref		
Regional anesthesia	1.036	0.678-1.583	0.870

Figures

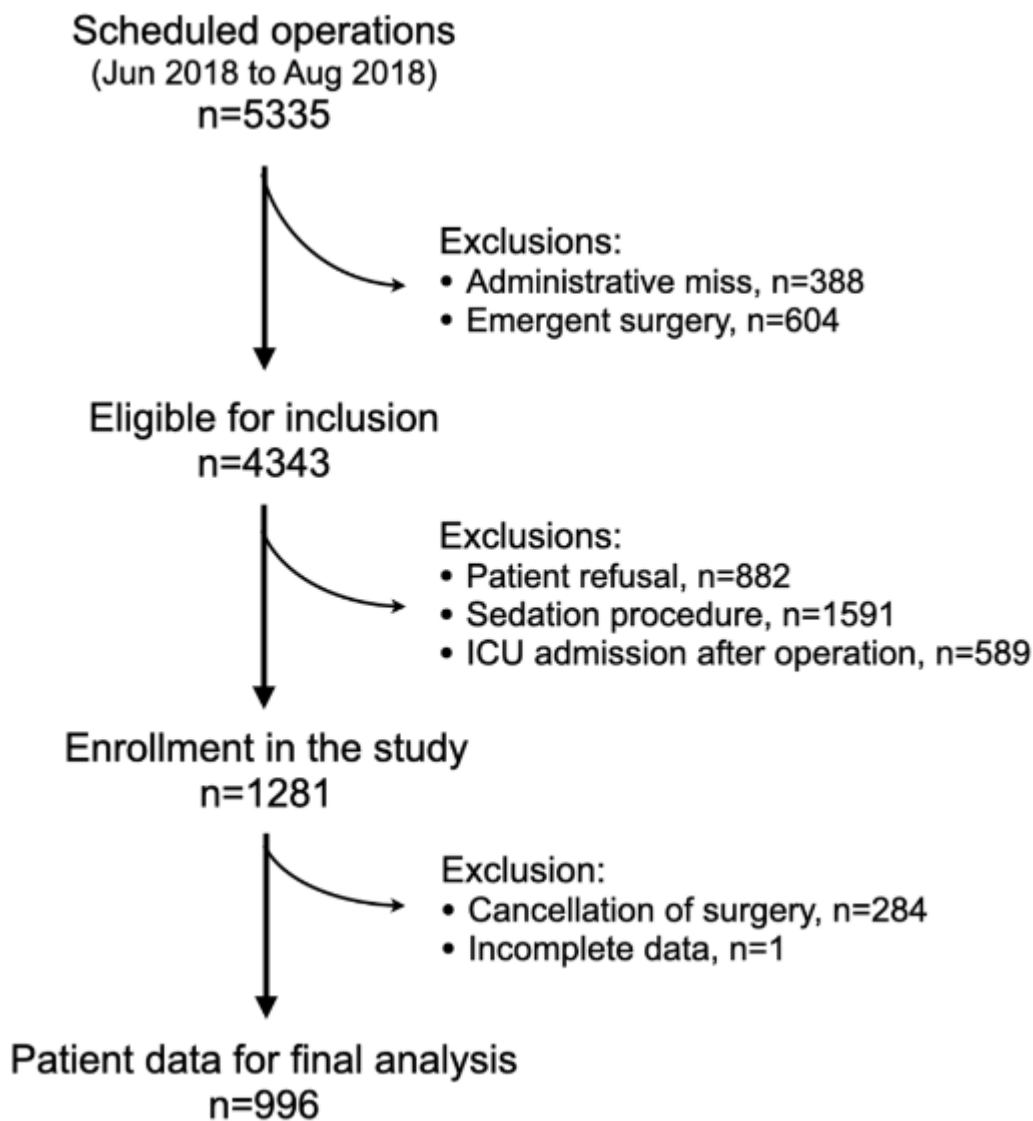


Figure 1

Study flow diagram.

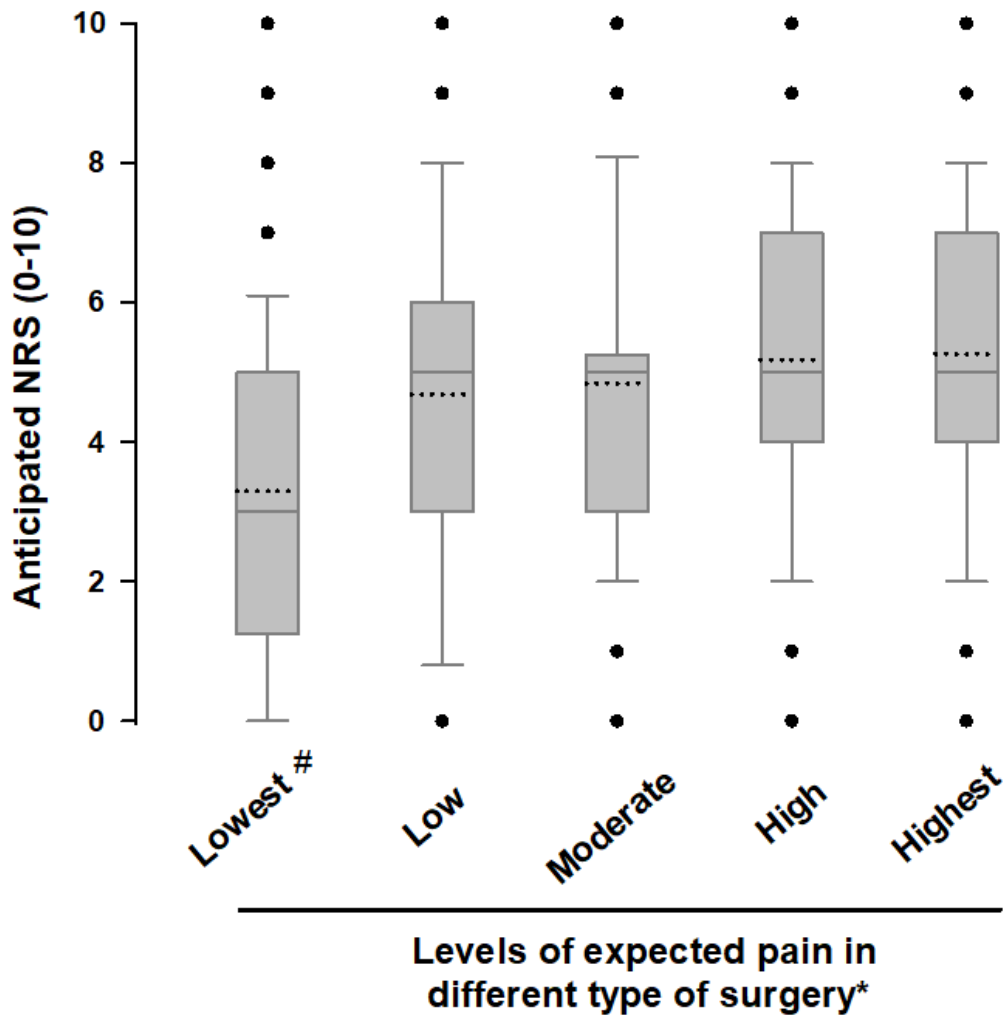


Figure 2

Graphical presentation of relationships between types of the scheduled surgery and patient’s anticipated pain. The invasiveness of surgical procedures graded by a clinical prediction model established by Janssen et al[22], as types of operation were grouped into the lowest, low, moderate, high and highest expected pain surgery.* †The median value of anticipated numerical rating scale (NRS) in the lowest expected pain surgery group was significantly increased in comparison to the other 4 groups ($P < 0.001$; as analyzed using the Wilcoxon rank-sum test, followed by the Dunn’s post-hoc test). Results are presented as box-and-whisker plots, in which the horizontal solid lines of boxes indicate the 75th percentile, median and 25th percentile of the distribution, and the upper and lower whiskers indicate the maximal and minimal values. Dotted lines indicate the mean values. Number of patients in each group are stated in Table 3.

Supplementary Files

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- [Supplementarytable1.docx](#)
- [Typesofsurgery.tif](#)