



Development of a New and Simple Postoperative Pain Fear Scale for Elective Surgeries in Adults Patients

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Abstract

Aim: To develop and test the psychometrics of an instrument to evaluate the fear of postoperative pain.

Methods: This methodological study was conducted at four surgical clinics including general surgery, orthopedics and traumatology, neurosurgery, heart and vessel surgery of a university hospital between 28 March and 19 October, 2018. Totally, 150 patients who were scheduled for elective surgery and at their preoperative day were included. This scale contained 10 items related to the postoperative pain sources and aimed to identify the pain fear of patients preoperatively. To measure the sampling adequacy, Kaiser-Meyer-Olkin index and Bartlett's test of sphericity was used. Explanatory and confirmatory factor analyses were conducted to evaluate the construct validity. The internal consistency of the scale was evaluated by Cronbach's alpha calculation. All hypotheses were tested in two directions.

Results: The total variance explained 55.5% of the variance for one factor structure consisting of 10 items. The model fit index values through the confirmatory factor analysis were found to support this structure.

Conclusion: The scale is appropriate to be used in clinical settings to quickly evaluate the elective surgical patients' fear level of postoperative pain preoperatively.

Keywords: Postoperative pain fear scale, postoperative pain, scale development, surgical patient, Turkish

Introduction

Fear is defined as an emotional response to traumatic events such as surgical interventions (1,2). Patients waiting for an upcoming surgery may describe the fear and this may be related to many conditions (3,4). In the previous studies, fear of anesthesia, surgical procedure and unknown were reported as the factors of surgical fear (5,6). Many studies have found that surgical fear is related to fear of postoperative pain and reported that preoperative predictors of postoperative pain, fear were associated with postoperative pain (4,7).

Pain-related fear is identified to be an important target of pain treatment and with reducing pain fear, improvement in the pain management outcomes is evidenced to be possible (8). Fear-avoidance beliefs are evidenced to play a significant role in pain experience, and psychological well-being, so that assessing the fear beliefs with standardized

instruments is recommended for the first step of patients who present with a pain condition (9,10). Clinical nurses and physicians are the primary professionals in taking care of patients and evaluating their pain levels. Screening patients preoperatively to identify their pain fear helps to reduce unwanted pain expectations and increase the pain coping abilities of patients (11,12).

Fear of pain is possible to be measured with some assessment tools including Fear of Pain Questionnaire III (13), Parent Fear of Pain Questionnaire (14) and Pain Catastrophizing scale (15). However, they are not specific for surgical pain fear, complex and not practical to be used at the busy surgical clinics for preoperative evaluation. Therefore, there is a need for a simple, timesaving and appropriate tool to assess pain fear levels at the clinic preoperatively or before transferring to the operating room.

Preoperative investigation of postoperative pain fear among surgical patients for planning an effective pain management regimen is essential. Knowing the predictors of postoperative pain may be helpful for making decisions about optimal pain management techniques. Unfortunately, there is not any tool to evaluate surgical pain fear. The development of this will fill the gap in the literature and help health professionals to evaluate the fear of postoperative pain before surgical interventions of the patients. With the evaluation of the pain fear levels of the surgical patients, it is intended to decrease the postoperative pain and anxiety by providing interventions on patient care and medical treatments. The purpose of this study was to develop and test the psychometrics of an instrument to evaluate the fear of postoperative pain.

Methods

Ethical Considerations

This study was approved by the ethical review board of the university Ethics Committee of the Trakya University Medical Faculty (date: 19.02.2018 decision number: 03/24) and permission to conduct the study was obtained from the hospital directory. Before the interviews start, the aim and context of the study was explained to the patients and they were asked to sign an informed consent form if they are volunteered.

Research Design and Sample

The study was designed as a methodological study and included the development and validation of the postoperative pain fear scale. The study took place at the four common surgical clinics (general surgery, orthopedics and traumatology, neurosurgery and heart and vessel surgery) at a university hospital in Turkey between 28.03.2018-19.10.2018 with 150 patients. While the reliability and validity studies require a sample size at least 5-10 times of the total number of scale items, the sample size is calculated as 150, fifteen times the 10 items of the present study (16). Inclusion criteria were being voluntary, scheduled for elective surgery, being at the preoperative day, able to communicate in Turkish, had no mental problem.

Data Collection

For data collection, a data collection form with three parts is used. In the first part, questions about age, gender, clinic, and previous surgery history were included; in the second part, the Postoperative Pain Fear scale (POPFS), was included to develop within this research; in the third part, the Surgical Fear Questionnaire (SFQ) and Fear of Pain Questionnaire-III (FPQ-III) were included to evaluate criterion validity.

The SFQ was developed by Theunissen et al. (4) in 2014 and the Turkish adaptation was conducted by Bagdigen and Ozlu (17) in 2018. It consists of 8 items based on an 11-point Likert type scored 0 "I have no fear at all" to 10 "I have a very great fear". It has two sub-scales. Items 1 to 4 assess the source of fear caused by short-term results of the surgery and items 5 to 8 assess long-term results. The higher scale score indicates a higher level of surgical fear. Cronbach's alpha internal consistency coefficient was found as 0.95 in the Turkish version (17).

The FPQ-III was developed by McNeil and Rainwater (13) in 1998 and the Turkish adaptation was conducted by Unver and Turan (18) in 2018. It consists of 30 items based on a 5-point Likert type scored 1 "not at all" to 5 "extreme". It has three sub-scales. Items 1,3,5,6,9,10,13,18,25,27 assess the severe pain fear, items 2,4,7,12,19,22,23,24,28,30 assess the minor pain fear and items 8,11,14,15,16,17,20,21,26,29 assess the medical pain fear. The higher scale score indicates the higher fear. Cronbach's alpha internal consistency coefficient was found as 0.92 in the Turkish version (18). In this study, the cross-validation of this scale was also completed, and the results supported that this scale is valid, reliable and can be used in surgical patients.

The data collection form was administered to the patients in their rooms at the clinic before their surgery via face-to-face interviews by the same researcher. It took approximately 10 to 15 minutes to complete.

Scale Development

The scale development was completed following three steps. The first step included item generation. In this step, a pool of items was prepared by literature review to shape the draft of the scale. Within the context, the studies conducted national and international were examined in terms of postoperative pain and fear, and the expressions that could be used in the scale were determined (3,4,17,19). It was noted that these expressions were related to the fear experienced by the patients who were planned to undergo surgery. It was also aimed that each of the items will be directed towards the fear of pain that are easy to be understood by patients. Totally 13 items were identified which specifically focus on the postoperative pain sources (such as wound-related pain, suture related pain, moving related pain, dressing changing related pain, deep breathing-related pain, coughing related pain, getting out of bed related pain, feeding-related pain, urinary drain related pain, nasogastric drain related pain, intra-abdominal gas-related pain, medical treatment-related pain).

The second step included the expert consultation. In this step, draft scale items were sent to the experts via e-mail to evaluate their opinions. Ten experts in the field of

anesthesiology (1 medical doctor), psychology nursing (1 academician), surgery (4 academicians - working at general surgery service), surgeon (2 medical doctors), surgical nursing (2 academicians). They were asked to control if the scale items related to the fear of pain after surgery, to express their opinions about each item, to check the items according to grammar and word suitability, cultural compatibility, clear to understand and a need for another item to add.

The third step included the psychometric tests. In this step, psychometric tests of the 10 items were conducted to evaluate the validation of POPFS.

Statistical Analysis

In the analysis of data, the package program IBM Corp. Released 2010 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) was used. To evaluate the data distribution, Shapiro-Wilk test was used. Arithmetic mean \pm standard deviation, median (minimum-maximum) values were given as descriptive statistics. Correlation between nonparametric variables was determined by the correlation coefficient of Spearman rho.

To measure the sampling adequacy, Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity was used. Principal component analysis (PCA) was assessed for the construct validity and confirmatory factor analysis (CFA) was used to confirm the factor structure. For confirmatory factor analysis, LISREL 9.30 for Windows (Scientific Software International, Inc.) was used. In calculating the scope validity ratio, the content validity ratio (CVR) formula that was developed by Lawshe (20) to calculate how much each item was required was used. The internal consistency (reliability) of the scale was evaluated by Cronbach's alpha calculation. $p < 0.05$ was considered statistically significant and all hypotheses were tested in two directions.

Results

Sample Characteristics

The mean age of the patients was 54.13 ± 16.36 years and 51.3% of them were male. The percentage of the patients that will have a surgery at general surgery clinic was 45.3% and 72% of them had previous surgery history. The demographic characteristics are shown in Table 1.

Cross-Validation of FPQ-III

The cross-validation of this scale was completed with the 150 patients waiting for surgery analyzed using the Cronbach's alpha reliability coefficient, KMO measure of sampling adequacy and Bartlett's test of sphericity. As a result of the analysis, the total variance was found as 58.21% for three-factor structure. According to the explanatory factor analysis (EFA) test, the KMO sampling adequacy was found as 0.918 and Bartlett's test score

Table 1. Demographic characteristics of the patients (N=150)

Demographic Characteristics	Value
Age (years) (mean \pm SD)	54.1 \pm 16.3
Gender (n)	
Female	73 (48.7%)
Male	77 (51.3%)
Clinic (n)	
General surgery	68 (45.3%)
Orthopedics and traumatology	25 (16.7%)
Neurosurgery	32 (21.3%)
Heart and vessel surgery	25 (16.7%)
Previous surgery history (n)	
Yes	108 (72%)
No	42 (28%)
Descriptive statistics (n, %, mean \pm SD, min, max), SD: Standard deviation	

Table 2. Responses of the experts

POPFS Items	Appropriate	Quite appropriate	Inappropriate	Total expert number
POPFS Item 1	10	0	0	10
POPFS Item 2	10	0	0	10
POPFS Item 3	10	0	0	10
POPFS Item 4	10	0	0	10
POPFS Item 5	10	0	0	10
POPFS Item 6	9	1	0	10
POPFS Item 7	10	0	0	10
POPFS Item 8	8	2	0	10
POPFS Item 9	8	2	0	10
POPFS Item 10	10	0	0	10
The responses of the experts according to the suitability of the items. POPFS: Postoperative pain fear scale				

was found as $\chi^2=3210,226$, $p < 0.001$. The factor loads of the scale ranged between 0.352-0.876. The Cronbach's alpha coefficient for the total scale was 0.955, and 0.938 for the severe pain fear subscale, 0.895 for the minor pain fear subscale, 0.889 for the medical pain fear subscale.

Scale Development

Draft scale form with 13 items was formed by gathering the determined items according to the expressions. Selected items were about fear of pain-related to wound, sutures, walking, breathing, coughing, feeding, intestinal gas, the tubes and drains. Numeric rating was used from 0-2 (0=no fear, 1=a little fear, 2=so much fear) for each item. According to the experts' comments and opinions, two items about pain while walking and getting out of bed were picked up in one item; two items about pain-related with tubes in the stomach and urinary were picked up in one item; two items about pain-related sutures and

wound were picked up in one item and the numeric rating was changed from 0-2 to 0-10 and all items were scored ranging from 0 (not at all afraid) to 10 (very afraid) on a Numeric Rating scale. After completing these changes, opinions of experts were derived to the same experts for the second time to conduct the content validity. The responses of the experts are shown in Table 2.

Before the content validity, the relationship between the scale items and the total scale was evaluated. The correlation coefficients between the POPFS total score and all the items that make up the scale ranged from 0.691 to 0.869 and were strongly and statistically significant (Table 3).

After the responses of the experts, content validity ratios (CVR) were calculated for each item and as a result, the items of the scale were 10. The content validity index (CVI) value was calculated as well and as a result, for each item it was found as +1.00.

Validity

To evaluate the construct validity of the scale, the KMO test was used to analyze the sample size sufficiency for the EFA. The calculated KMO for 150 samples was found as 0.88. Bartlett's test was applied for the suitability of the data set and it was found significant ($\chi^2= 807.616$, $p<0.000$). A PCA was used and as a result, the significant factor loadings of each item were found greater than 0.45. Table 4 showed the communalities from the single factor analysis.

Table 3. Scale total score and correlation between scale items

POPFS Items	Total scale score	
	r	p
POPFS Item 1. I am afraid that I will have pain due to wounds and sutures in the operation area.	0.790	0.000
POPFS Item 2. I am afraid that I will have pain during dressing change.	0.725	0.000
POPFS Item 3. I am afraid that I will have pain when getting out of bed and walking.	0.691	0.000
POPFS Item 4. I am afraid that I will have pain while breathing deeply.	0.755	0.000
POPFS Item 5. I am afraid that I will have pain when coughing.	0.869	0.000
POPFS Item 6. I am afraid that I will have pain while eating meal.	0.722	0.000
POPFS Item 7. I am afraid that I will have pain due to a stomach/urinary catheter.	0.755	0.000
POPFS Item 8. I am afraid that I will have pain due to drains/inserted tubes.	0.809	0.000
POPFS Item 9. I am afraid that I will have pain due to gas in my intestines.	0.694	0.000
POPFS Item 10. I am afraid that I will have pain during medication (intramuscular, intravenous).	0.700	0.000

The Spearman rho test. The correlation coefficients between the total score and all the items were found to be strongly and statistically significant. POPFS: Postoperative pain fear scale

Table 4. Communalities from the single factor analysis

Communalities		
POPFS Items	Initial	Extraction
POPFS Item 1	1.000	0.608
POPFS Item 2	1.000	0.555
POPFS Item 3	1.000	0.471
POPFS Item 4	1.000	0.582
POPFS Item 5	1.000	0.730
POPFS Item 6	1.000	0.522
POPFS Item 7	1.000	0.508
POPFS Item 8	1.000	0.626
POPFS Item 9	1.000	0.450
POPFS Item 10	1.000	0.477

Extraction Method: Principal Component Analysis. The significant factor loadings of each item were found greater than 0.45. POPFS: Postoperative pain fear scale

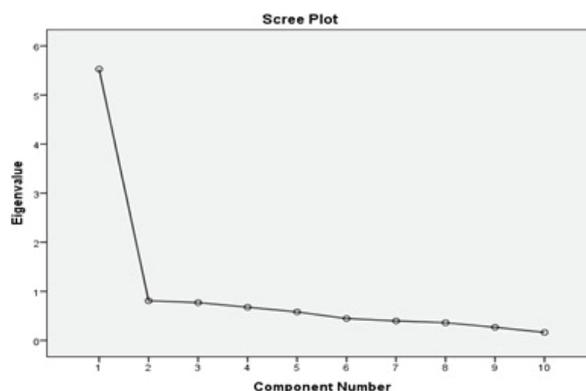


Figure 1. The scree plot (exploratory factor analysis)

After evaluating the sample size sufficiency, EFA was conducted to evaluate the construct validity. The total variance explained 55.5% of the variance for one factor. The one-factor structure was also confirmed by the scree plot (Figure 1).

After the EFA was performed, CFA was used to check if the model defined by EFA was working in a new sample. According to the model fit indexes, the chi-square/df ratio (3.15), and goodness of fit indexes [Root Mean-Square Error of Approximation (RMSEA)=0.120, Standardized Root Mean-Square Residual=0.050, Comparative Fit index (CFI)=0.907] showed that the model of the scale was fit with the data and POPFS was able to be used (Figure 2 and Table 5).

The structural elements (standardized factor loads, t-values, and R²) of the model were examined to fit the indexes. The R² values ranged between 0.40% and 0.73% indicating that the variability in the scale model was mostly explained by POPFS item 5, while the rarely explained POPFS item 10 (Table 6). The mean score of the

Statistics	Value	Recommended value	Fitness
X2/df	3.15	$2 \leq X2/df \leq 3$	Marginal fit
RMSEA	0.120	$0.05 \leq RMSEA \leq 0.08$	Marginal fit
CI	0.09-0.14	close to RMSEA	Marginal fit
SRMR	0.050	$0.05 \leq SRMR \leq 0.10$	Good fit
NFI	0.871	$0.90 \leq NFI \leq 0.95$	Marginal fit
NNFI	0.881	$0.95 \leq NNFI \leq 0.97$	Marginal fit
CFI	0.907	$0.95 \leq CFI \leq 0.97$	Marginal fit
GFI	0.884	$0.90 \leq GFI \leq 0.95$	Marginal fit
AGFI	0.817	$0.85 \leq AGFI \leq 0.90$	Marginal fit

* Measures of goodness of fit (Schermelele-Engel, Moosbrugger and Müller, 2003), RMSEA: root mean-square error of approximation, CI: Confidence interval, SRMR: Standardized root mean-square residual, NFI: Normed fit index, NNFI: Non-normed fit index, CFI: Comparative fit index, GFI: Goodness of-fit index, AGFI: Adjusted goodness-of-fit index Confirmatory, Factor Analysis showed the model was fit and the scale was able to be used.



Figure 2. Path diagram of the postoperative pain fear scale POPFS: Postoperative Pain Fear scale, RMSEA: Root Mean-Square Error of Approximation

items was 3.24 ± 2.37 for total scale items (Table 7). To measure the reliability, internal consistency was concerned and Cronbach's alpha for the 10-item postoperative pain scale was found as 0.91.

Discussion

Surgical pain is unavoidable in surgery patients and fear is an expected response to pain. Healthcare professionals should be aware of patients' pain fear to reduce such fear and implement supportive strategies to improve the patient surgical care quality. In the literature, numerous studies reported that patients experience significant levels of anxiety and fear before undergoing surgical procedures

POPFS Items	Standardized factor loads	t	R2
POPFS Item 1	0.76	10.63	0.58
POPFS Item 2	0.71	9.78	0.51
POPFS Item 3	0.65	8.73	0.43
POPFS Item 4	0.77	10.83	0.59
POPFS Item 5	0.85	12.73	0.73
POPFS Item 6	0.71	9.83	0.51
POPFS Item 7	0.69	9.43	0.48
POPFS Item 8	0.75	10.51	0.56
POPFS Item 9	0.64	8.54	0.41
POPFS Item 10	0.63	8.40	0.40

R2= squared multiple correlations. Standardized factor loads, t-values, and R2 values of the final model items obtained from confirmatory factor analysis. POPFS: Postoperative pain fear scale

POPFS Items	Mean \pm SD'	Median (Min-Max)
POPFS Item 1	3.82 ± 3.15	4.00 (0.00-10.00)
POPFS Item 2	2.87 ± 3.11	2.00 (0.00-10.00)
POPFS Item 3	2.95 ± 2.84	2.50 (0.00-10.00)
POPFS Item 4	2.98 ± 2.94	2.00 (0.00-10.00)
POPFS Item 5	4.00 ± 3.57	3.50 (0.00-10.00)
POPFS Item 6	2.43 ± 2.98	1.00 (0.00-10.00)
POPFS Item 7	3.58 ± 3.51	3.00 (0.00-10.00)
POPFS Item 8	4.11 ± 3.48	4.00 (0.00-10.00)
POPFS Item 9	3.03 ± 3.14	2.00 (0.00-10.00)
POPFS Item 10	2.64 ± 3.22	1.00 (0.00-10.00)
Total scale	3.24 ± 2.37	3.30 (0.00-9.90)

'SD: Standart deviation descriptive statistics (mean \pm SD, median, min, max), POPFS: Postoperative pain fear scale

(6,21,22). It was also reported that, preoperative fear was associated with acute and long-term postoperative pain (4,23). Expecting fear was reported as one of the strong psychological factors that influence the postoperative pain (7,24). Although preoperative pain fear is so important and affects patients' postoperative pain levels, there is not a valid scale to evaluate the fear of postoperative pain.

According to the cross-validation results of the FPQ-III scale, the three factors accounted for 58.21% of the total variance and it was between the expected values of 40-60% (25). The KMO (expected to be >0.5) and Bartlett's test scores (expected to be $p < 0.05$) showed that the sampling was adequate for the factor analysis (26). In the literature, the Cronbach's alpha coefficient value was reported to be >0.70 for the internal reliability of a scale (27,28), and in this scale, the total and subscale Cronbach's alpha values were over 0.80.

Additionally, the present study met the goal of developing the POPFS. In this scale, the correlation

coefficients between the POPFS total score and all the items were strongly and statistically significant ($p < 0.001$). The existence of a relationship between the items of the scale was related to the validity of the scale. The scale items were to be understood and appropriate to the sample to be applied. These results showed the content validity of the scale.

For the analysis of sampling adequacy, the KMO index for 150 samples was found as 0.88 to be close to perfect for factor analysis. In the literature, it was reported to be > 0.50 (26-29). Also for the suitability of the data set the Bartlett's test of sphericity showed the sample was coming from a multivariate normal scatter and was found significant with values of ($\chi^2 = 807.616$, $p = 0.000$). In the literature, it was reported that, Bartlett's sphericity test should be significant ($p < 0.05$) (26). It is also important to test the range sufficiency and partial correlations whether they are small or large. These parameters showed the sampling was appropriate to conduct factor analysis (25,26,29).

Construct validity was proven using EFA and CFA. There are many studies that both factor analysis were conducted on the same data (30,31). In this study, according to the total variance explained, EFA was analyzed for one factor and examination of the screen plot also suggested the factor structure with one factor. The obtained model fit index values through the CFA, including RMSEA, Normed Fit index, Non-normed Fit index, CF, Goodness-of-Fit index and Adjusted Goodness-of-Fit index, were close to the acceptable values. In the literature, it is reported that the model fit cutoff indexes are arbitrary and they are affected by many reasons such as estimation methods, sampling fluctuations, small sample size, etc (32,33). For this reason, although one or more fit index values are not highly acceptable, this model may fit the data. In this study, the sample included patients from four different surgical clinics, and this may have affected the model fit index values.

The Cronbach's alpha coefficient value of the scale was 0.91 and it met the recommended value for the development of an instrument (27,28). In the literature, the Cronbach's alpha values of the developed Experience of Cognitive Intrusion of Pain scale was 0.94 and of the developed Daily Pain Catastrophizing scale was 0.892 for the total score (34,35). The Cronbach's alpha coefficient values of these pain scales were resembled to the present study.

With this sufficiently validated scale POPFS, evaluation of the fear of postoperative pain will be possible preoperatively. This instrument will provide health professionals particularly surgery nurses and guidance in knowing the predictors of postoperative pain to make decisions about optimal pain management techniques.

With the evaluation of the pain fear levels of the surgical patients, it is intended to decrease the postoperative pain and anxiety by providing interventions on patient care and medical treatments.

Study Limitations and Strengths

One of the limitations of the study is that the study data was collected from four different surgical clinics and this may differ the pain fear levels of the patients. So that, this may affect the model fit index values of this scale. The second limitation is that the scale was about the fear of postoperative pain and it is not possible to test-retest the fear preoperatively. The third limitation is that patients who had previous surgery were also included in the study. However, pain fear levels of patients may be affected by whether they are having surgery for the first time or have had a previous surgery history. Despite these limitations, this study gains a valid and reliable POPFS to the literature. With this scale, it will be able to evaluate the surgical patients' postoperative pain fear at the preoperative period.

Conclusion

The POPFS is a reliable and valid instrument to measure the fear level of postoperative pain. The scale is appropriate to be used in clinical settings to quickly evaluate the surgical patients' fear level of postoperative pain preoperatively. For future studies, we recommend researchers to use this scale for larger samples and specific surgical patient groups. Further external validation studies are needed to fully appreciate the generalizability of this suggested scale.

Authorship Contributions

Concept: S.U., F.N.T., Design: S.U., F.N.T., Data Collection or Processing: S.U., Analysis or Interpretation: F.N.T., Literature Search: S.U., F.N.T., Writing: S.U., F.N.T.,

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