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Relationship Between Psychological Variables and Postoperative Pain in Children

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Abstract

Background: Despite advances in pediatric pain management, postoperative pain remains a significant concern. By recognizing the multifaceted nature of pain and its susceptibility to various factors, there is a growing need to identify risk factors for postoperative pain and effective pain coping strategies.
Objectives: This study aimed to investigate the relationship between psychological variables and postoperative pain in children.
Methods: A descriptive-correlational study was conducted with a sample of 171 children aged 6 - 13 years, conveniently selected from a children's hospital in Tehran, Iran, based on specific inclusion criteria. The data were collected through a demographic questionnaire, the Child Pain Anxiety Symptoms Scale (CPASS), Spielberger's State-Trait Anxiety Inventory (STAI), and the Coping Strategies Questionnaire (CSQ). Statistical analysis was performed using SPSS software (version 21).
Results: The majority of the 171 participants were male (65.5%), with an average age of 9.58 years. Abdominal surgery was the most common procedure (53.2%), with an average duration of 134.29 minutes. Regression analysis revealed a statistically significant association between psychological variables and postoperative pain. Specifically, for each point increase in children's and parents' mean anxiety scores, postoperative pain increased by 0.31% and 0.30%, respectively. Conversely, for each point increase in children's mean coping score, postoperative pain decreased by 0.14%.
Conclusions: Child and parental anxiety and coping strategies were linked to postoperative pain. Accordingly, higher levels of anxiety in children and their parents were associated with an increased likelihood of postoperative pain; nevertheless, better coping skills in children correlated with reduced postoperative pain. Therefore, implementing psychological interventions might prove effective in managing postoperative pain in children.

Keywords: Anxiety, Coping, Postoperative Pain, Children, Parents

1. Background

Surgery is a painful, stressful, and traumatic experience for children (1). Postoperative pain is a common issue in pediatric surgical cases (2), with reported incidence rates ranging from 40% to 84% (3). Despite advancements in pain management technology and preoperative care, the level of acute postoperative pain remains high (2). In Iran, pain has been identified as the most frequent postoperative complication (4).

Pain is described as an unpleasant sensory-emotional experience associated with actual or potential injuries, which can range from mild to severe (5). It is well-established that children can experience pain, and its effects can persist from childhood into adulthood (6). Prior to surgery, postoperative pain is a major concern for patients (7). Pediatric pain is often underestimated and overlooked due to myths, beliefs, and challenges in assessment and treatment (6). Numerous factors influence postoperative pain, and there are additional risk factors for experiencing high levels of pain after surgery. Preoperative psychological factors, such as catastrophizing, depression, anxiety, and pain expectations, are significant predictors of acute postoperative pain intensity (7). Various studies have identified factors that impact pain perception.

Knoetze et al. discovered a significant correlation between preoperative caregiver anxiety and postoperative pain in children undergoing elective ambulatory surgery (with a moderate correlation) (8). Rabbitts et al. found preoperative sleep disorders and parental pain catastrophizing (2), and Horn-Hofmann et al. identified preoperative pain-related anxiety as influential in postoperative pain in children (9). The evidence suggests that negative emotional reactions are a critical factor in postoperative pain and can have significant physiological and psychological consequences if not effectively managed (10).

Postoperative acute pain disrupts various bodily systems, triggering a cascade of physiological events, such as increased postoperative pain, the development of chronic and enduring pain, and psychological events, such as restlessness, fatigue, difficulty concentrating, irritability, disturbed sleep, and maladaptive behaviors (11). These complications prolong the recovery and wound-healing process, increase the length of hospital stays and associated costs, and reduce patient satisfaction (12). Therefore, identifying predictors of preoperative pain can assist the healthcare team in effectively managing postoperative pain.

2. Objectives

The aim of this study was to investigate the relationship between psychological variables and postoperative pain in children.

3. Methods

This study was conducted following a descriptive-correlational study design. The study determined psychological variables related to postoperative pain in children aged 6 - 13 years hospitalized in the selected children's hospital in Tehran, Iran. Samples were selected conveniently from the children hospitalized for elective surgery. The number of samples was calculated by considering the average effect size of 0.3 and the chi-square test statistic.

$$x^2 = N \sum_{j=1}^{2} \sum_{i=1}^{6} \frac{(P_{1ij-} P_{0ij})^2}{P_{0ij}}$$

With α = 0.05 and the probability type II error β = 0.1, the number of required samples was 171 subjects.

$$N = \frac{X^2}{W^2} = 171$$

The inclusion criteria encompassed children who met the following conditions: Admission solely for surgery, ages between 6 and 13 years, absence of physical or mental disorders according to records and parental statements, and placement in surgeon services utilizing the same pain management protocol. The exclusion criteria included the occurrence of a stressful incident during the study, a child becoming unwell to the extent of necessitating life-saving measures, and incomplete questionnaire responses. Initially, 200 children were considered for the study; however, ultimately, 171 children were selected based on the specified inclusion and exclusion criteria.

The utilized tools included four questionnaires. The demographic characteristics questionnaire comprised two parts, one relating to parental characteristics (e.g., age, gender, occupation, family monthly income, and educational level) and the other to child characteristics (e.g., age, gender, type of surgery, surgery duration, and prior pain experience). Pain severity was evaluated using the Numerical Rating Scale (NRS) (ranging from 0 = no pain to 10 = most severe pain). Consistent with previous studies, moderate to severe pain was defined as a score equal to or greater than 4 (13). The Numerical Rating Scale is a recognized method for assessing the severity of acute postoperative pain, with its validity and reliability validated in various studies (14).

The Child Pain Anxiety Symptoms Scale (CPASS) was designed for individuals aged 6 to 18 years, consisting of 20 items rated on a 6-point Likert scale ranging from 0 (never) to 5 (always). The total score ranges from 0 to 100, with higher scores indicating greater pain anxiety. The questionnaire's validity and reliability have been established through various studies (15).

The Spielberger's State-Trait Anxiety Inventory (STAI) comprises 2 components: The state component, which consists of 20 items expressing state anxiety that characterizes an individual's feelings at the moment of response, and the trait component, which measures a more enduring disposition to anxiety. The trait component comprises 20 items that assess trait anxiety, representing individuals' general feelings. Each item is rated on a 4-point Likert scale, ranging from 1 (almost never) to 4 (almost always). Scores for each part range from 20 to 80, with higher scores indicating greater anxiety. The Persian version of this tool has been utilized in previous studies, confirming its validity and reliability (16).

The Coping Strategies Questionnaire (CSQ) encompasses 50 items designed for patients to self-assess cognitive and behavioral strategies for coping with pain. The questionnaire includes 2 dimensions: Cognitive strategies with 6 subscales, including ignoring pain sensations, reinterpreting pain sensations, diverting attention, coping self-statements, catastrophizing, and

praying or hoping, and behavioral strategies with two subscales, encompassing increasing activity level and increasing pain behavior. Additionally, there are two items at the end of the questionnaire to evaluate the effectiveness of pain control and the ability to reduce pain. Responses are rated on a 7-point Likert scale, ranging from 0 (never do) to 6 (always do). The total score ranges from 0 to 300, with higher scores indicating enhanced pain coping. The instrument exhibits satisfactory reliability and validity (17).

Face validity and content validity were evaluated to assess the validity of the instruments in this study. Ten faculty members from Shahid Beheshti University of Medical Sciences, Tehran, Iran, reviewed the tools for relevance and simplicity, with necessary modifications made. Face validity was further assessed by distributing the tools to 10 children and their parents to evaluate item simplicity and comprehensibility. Following the collection of feedback and appropriate adjustments, the final versions were approved. In this study, internal consistency reliability and stability were employed to assess instrument reliability; nevertheless, the inter-observer correlation coefficient was used to assess the visual analog scale (VAS) (Table 1).

Table 1. Calculating the Internal Consistency of Instruments Using Cronbach's Alpha Coefficient and Calculating the Tool Stability Reliability Using Intraclass Correlation Coefficient

Tools	Cronbach's Alpha	ICC
CSQ	0.95	0.95
CPASS	0.91	0.92
STAI	0.94	0.93

Abbreviations: CSQ, Coping Strategies Questionnaire; CPASS, Child Pain Anxiety Symptoms Scale; STAI, Spielberger's State-Trait Anxiety Inventory; ICC, intraclass correlation coefficient.

Data collection was carried out by the researcher after obtaining ethical approval (IR.SBMU.PHARMACY.REC.1399.215). The samples were collected based on the inclusion criteria, then they were completed consent form and this process spanned approximately 3 months.

Data analysis was conducted using SPSS software (version 21). Initially, the variables were described in terms of frequency and mean. Subsequently, the correlation between independent and dependent variables was determined, and variables significant at a level less than 0.05 were subjected to linear regression analysis.

4. Results

In the study, a total of 171 children who met the inclusion criteria participated. Among these participants, 112 (65.5%) and 59 (34.5%) were male and female, respectively, with an average age of 9.58 years. The most common type of surgery was abdominal surgery, accounting for 91 cases (53.2%), followed by genitourinary surgery in 51 cases (29.8%) and other surgeries in 29 cases (17%). The average duration of surgeries was 134.29 minutes. A total of 87 children (50.8%) reported experiencing preoperative pain, with 38 of them (22.2%) describing it as moderate and 31 (18.1%) as severe; however, the remaining cases reported mild pain.

The mothers participating in the study had a mean age of 34.3 years, with the majority being housewives (80.1%) and having a bachelor's degree (45%). On the other hand, the fathers had an average age of 39.6 years, with the majority being self-employed (48.5%) and having an educational level below a high school diploma (76%) (Table 2).

Table 2 shows information on the mean preoperative anxiety levels, with children having a mean preoperative anxiety score of 53.66 ± 21.28 and parents exhibiting state and trait anxiety scores of 47.85 ± 14.15 and 30.15 ± 12.43, respectively. Additionally, the mean scores for cognitive and behavioral coping strategies in children were 127 ± 14.93 and 84.30 ± 18.54, respectively.

The analysis of Table 3 revealed no significant correlations between demographic factors such as age, gender, type of surgery, and preoperative pain with postoperative pain. However, Table 4 shows correlations between child anxiety, parent anxiety, and child coping mechanisms with acute postoperative pain. Specifically, for each point increase in the mean anxiety score of children and parents, there was a corresponding 0.31% and 0.30% increase in postoperative pain, respectively. Conversely, for each point increase in the mean coping score of children, there was a 0.14% decrease in postoperative pain. The odds ratio (OR) was 0.47, with a 95% confidence interval (CI) of 0.023, and the P-value was 0.001.

5. Discussion

The aim of this study was to determine the psychological variables related to postoperative pain in children hospitalized at the selected children's hospital in Tehran. The results of the present study revealed that most children experienced moderate to severe postoperative pain, and those children and their parents with higher anxiety levels were more likely to experience postoperative

Table 2. Frequency Distribution of Demographic Variables in Children Admitted to the Surgical Wards of Mofid Hospital in Tehran, Iran, Within 2017 - 2018

Variables	No. (%) or Mean ± Standard Deviation
Child's age (y)	8.58 ± 2.233
Gender	
Female	59 (34.5)
Male	112 (65.5)
Type of surgery	
Abdominal	91 (53.2)
Genitourinary urine	51 (29.8)
Other surgeries	29 (17)
Experience of pain	
Mild	102 (59.7)
Medium	38 (22.2)
Severe	31 (18.1)
Duration of surgery (min)	134.29 ± 68.58
Mother's age	34.38 ± 6.663
Father's age	39.63 ± 6.342
Mother's job	
Housewife	137 (80.11)
Manual worker	7 (4.09)
Employee	16 (9.36)
Freelance job	11 (6.44)
Father's job	
Unemployed	8 (4.67)
Manual worker	54 (31.5)
Employee	26 (15.21)
Freelance job	83 (48.54)
Mother's education	
Illiterate	9 (5.26)
High school	55 (32.16)
Diploma	30 (17.58)
Bachelor	77 (45)
Father's education	
Illiterate	16 (9.35)
High school	65 (38.02)
Diploma	65 (38.02)
Bachelor	25 (14.61)
Child Pain Anxiety Symptoms Scale	53.66 ± 21.284
Spielberger's State-Trait Anxiety Inventory	
Manifest	47.85 ± 15.11
Latent	30.15 ± 12.43
Coping Strategies Questionnaire	
Cognitive	127 ± 14.93
Behavioral	84.30 ± 18.54

Table 3. Correlation Between Physiological Variables and Postoperative Pain

Variables	Correlation	P-Value
Demographics variables		
Age	-0.066	0.63
Gender (male)	-0.024	0.66
Physiological variables		
Type of surgery		
Abdominal	0.058	0.86
Genitourinary urine	-0.059	0.66
Facial and skull	-0.003	0.70
Orthopedic	0.021	0.69
History of surgery	0.124	0.03

pain; nevertheless, children with higher coping abilities were less likely to experience postoperative pain.

Postoperative pain is a common complication in children (2, 18), influenced by various factors, including mental status (19). The results of this study demonstrated that children with high levels of preoperative anxiety reported experiencing more postoperative pain. Similarly, several previous studies have shown that child anxiety is a potential contributor to postoperative pain (2, 20), affecting both acute (21-23) and chronic (20) postoperative pain. Therefore, it can be stated that preoperative anxiety, as a psychological factor, can trigger a cascade of physiological events, including increased postoperative pain, depression, and prolonged opioid use (7). These findings align with the results of the present study.

Pain anxiety, representing cognitive, emotional, behavioral, and physiological responses in predicting or experiencing pain, significantly predicts postoperative acute pain (9). Therefore, pain anxiety, as a psychological component, is projected to be a predictor of postoperative pain in children.

Furthermore, postoperative pain is not only influenced by child anxiety; the evidence has shown that parent anxiety and postoperative pain are also positively correlated. Parents with high levels of anxiety tend to report more pain in their children (1, 24, 25). The results of the present study further confirmed that parental anxiety serves as a predictor of postoperative pain in children.

Based on the evidence, parental anxiety might manifest in two types: state anxiety or trait anxiety. Anxiety is a temporary emotional state characterized by tension, conflict, and a sense of losing control of the situation (26). In the present study, the parents predominantly exhibited state anxiety, reporting feelings such as anger, nervousness, fear, hesitation, restlessness, and unrest. These findings are consistent with numerous studies indicating that parental anxiety tends to be of the state anxiety type, particularly when a procedure or painful event occurs involving the child (26). In clinical settings, the majority of children are accompanied by caregivers who can directly or indirectly influence anxiety and pain levels. Children often mirror the emotional regulation demonstrated by their parents or caregivers, affecting their own emotional and physiological responses (6). In a similar vein, Frank et al. (27) demonstrated that 53% of the variation in child distress during immunization was related to parenting behavior.

In addition to the above-mentioned factors, coping is another psychological variable that plays a role in pain management as a coping mechanism. The results of this study indicated that most children had lower coping scores, and those with high coping strategies were less likely to experience postoperative pain. These findings are consistent with previous studies that have also confirmed this correlation (28, 29).

Various emotional and psychological factors can influence a child's perception of pain and trigger their response (27). Therefore, it is essential to prioritize pain management, particularly during acute painful procedures (30).

A good pain assessment is an initial step in preventing or early detecting pain, leading to effective pain management. Several factors must be considered, such as the assessment skills of the medical staff, changes in children's age and gender, their level of development and communication abilities, their individual personalities and moods, their unique clinical conditions, personal responses to painful stimuli, and the presence of the patient's parents, caregivers, or relatives (27). Additionally, trained children showed better engagement in breathing techniques, resulting in significantly lower distress levels in this group (31).

The results of the study on children's coping behaviors in both cognitive and behavioral dimensions revealed that the highest scores were related to pain assessment and an increase in pain behaviors. This could explain the lower level of coping strategies in children. Since surgery is an unforeseen event in children, it is challenging to develop a coping strategy for this condition, and a low level of adaptation seems reasonable.

5.1. Conclusions

The research findings indicate that most children experience moderate to severe postoperative pain. Child anxiety and parental anxiety are positive predictors of postoperative pain; nevertheless, coping strategies are

Table 4. Results of Linear Regression Analysis of Postoperative Pain with Predictive Psychological Factors

Model	Unstandardized Coefficients		Standardized Coefficients, Beta	*t*	Sig.	F	r^2
	B	Standard Error					
Constant	3.489	1.014		3.442	0.001	18.215	0.28
Child Pain Anxiety Symptoms Scale	0.009	0.002	0.311	4.271	0.000		
Spielberger's State-Trait Anxiety Inventory	0.040	0.009	0.311	4.271	0.000		
Coping Strategies Questionnaire	-0.047	0.023	-0.147	-2.082	0.039		

negative predictors of postoperative pain. Therefore, identifying children at risk and providing psychological interventions can be effective in managing postoperative pain in children and improving their comfort.

One limitation of this study is the small sample size, which limits the generalizability of the results. Therefore, further studies in larger populations are recommended. Additionally, it is suggested to explore the relationship between other psychological variables and child pain beyond those measured in this study.

The authors note that several modalities are used to decrease postoperative pain in children. The improper management of postoperative pain not only increases the morbidity of infants but is also unethical. Guidelines can provide a way to reduce postoperative pain. These guidelines can help pediatric surgeons properly manage postoperative pain, as has been described in guidelines for antibiotic use in various infectious diseases.

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Footnotes

Authors' Contribution: SGH developed the original idea and wrote the manuscript. LKH, the corresponding author, guided the conducting of research and revised the manuscript. MR, ASHF, and ND revised the manuscript.

Conflict of Interests: The authors have no conflict of interest.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication.

Ethical Approval: This study was approved under the ethical approval code of IR.SBMU.PHARMACY.REC.1399.215.

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References

1. Yayan EH, Zengin M, Duken ME, Suna Dag Y. Reducing Children's Pain and Parents' Anxiety in the Postoperative Period: A Therapeutic Model in Turkish Sample. *J Pediatr Nurs*. 2020;**51**:e33–8. [PubMed ID: 31324415]. https://doi.org/10.1016/j.pedn.2019.07.004.
2. Rabbitts JA, Groenewald CB, Tai GG, Palermo TM. Presurgical psychosocial predictors of acute postsurgical pain and quality of life in children undergoing major surgery. *J Pain*. 2015;**16**(3):226–34. [PubMed ID: 25540939]. [PubMed Central ID: PMC5137504]. https://doi.org/10.1016/j.jpain.2014.11.015.
3. Walker SM. Pain after surgery in children: clinical recommendations. *Curr Opin Anaesthesiol*. 2015;**28**(5):570–6. [PubMed ID: 26280822]. [PubMed Central ID: PMC4617604]. https://doi.org/10.1097/ACO.0000000000000227.
4. Rassouli M, Salmani N, Mandegari Z, Dadgari A, Fallah Tafti B, Bagheri I. Challenges of palliative care for children with cancer in Iran: a review. *Iran J Ped Hematol Oncol*. 2019;**9**(1):48–62. https://doi.org/10.18502/ijpho.v9i1.296.
5. Pak Nodehi F, Sadeghi N, Mohammadi M. [Investigation of the effect of aromatherapy with orange essential oil on pain in children after tonsillectomy]. *Zanko J Med Sci*. 2021;**21**(71):59–68. Persian.
6. Pancekauskaite G, Jankauskaite L. Paediatric Pain Medicine: Pain Differences, Recognition and Coping Acute Procedural Pain in Paediatric Emergency Room. *Medicina (Kaunas)*. 2018;**54**(6):94. [PubMed ID: 30486427]. [PubMed Central ID: PMC6306713]. https://doi.org/10.3390/medicina54060094.
7. Doan LV, Blitz J. Preoperative Assessment and Management of Patients with Pain and Anxiety Disorders. *Curr Anesthesiol Rep*. 2020;**10**(1):28–34. [PubMed ID: 32435161]. [PubMed Central ID: PMC7222996]. https://doi.org/10.1007/s40140-020-00367-9.
8. Knoetze R, Lachman A, Moxley K, Chetty S. Caregiver anxiety and the association with acute postoperative pain in children undergoing elective ambulatory surgery in a lower-middle-income country setting. *Paediatr Anaesth*. 2020;**30**(9):990–7. [PubMed ID: 32592506]. https://doi.org/10.1111/pan.13954.
9. Horn-Hofmann C, Scheel J, Dimova V, Parthum A, Carbon R, Griessinger N, et al. Prediction of persistent post-operative pain: Pain-specific psychological variables compared with acute post-operative pain and general psychological variables.

Eur J Pain. 2018;**22**(1):191–202. [PubMed ID: 28940665]. https://doi.org/10.1002/ejp.1115.
10. Fortier MA, Kain ZN. Treating perioperative anxiety and pain in children: a tailored and innovative approach. *Paediatr Anaesth*. 2015;**25**(1):27–35. [PubMed ID: 25266082]. [PubMed Central ID: PMC4261033]. https://doi.org/10.1111/pan.12546.
11. Jenkins BN, Fortier MA, Kaplan SH, Mayes LC, Kain ZN. Development of a short version of the modified Yale Preoperative Anxiety Scale. *Anesth Analg*. 2014;**119**(3):643–50. [PubMed ID: 25010821]. https://doi.org/10.1213/ANE.0000000000000350.
12. Mojen LK, Rassouli M, Eshghi P, Sari AA, Karimooi MH. Palliative Care for Children with Cancer in the Middle East: A Comparative Study. *Indian J Palliat Care*. 2017;**23**(4):379–86. [PubMed ID: 29123342]. [PubMed Central ID: PMC5661338]. https://doi.org/10.4103/IJPC.IJPC_69_17.
13. Beltramini A, Milojevic K, Pateron D. Pain Assessment in Newborns, Infants, and Children. *Pediatr Ann*. 2017;**46**(10):e387–95. [PubMed ID: 29019634]. https://doi.org/10.3928/19382359-20170921-03.
14. Lee RR, Rashid A, Ghio D, Thomson W, Cordingley L. Chronic Pain Assessments in Children and Adolescents: A Systematic Literature Review of the Selection, Administration, Interpretation, and Reporting of Unidimensional Pain Intensity Scales. *Pain Res Manag*. 2017;**2017**:7603758. [PubMed ID: 28912638]. [PubMed Central ID: PMC5585620]. https://doi.org/10.1155/2017/7603758.
15. Page MG, Fuss S, Martin AL, Escobar EM, Katz J. Development and preliminary validation of the Child Pain Anxiety Symptoms Scale in a community sample. *J Pediatr Psychol*. 2010;**35**(10):1071–82. [PubMed ID: 20430838]. https://doi.org/10.1093/jpepsy/jsq034.
16. Khanipour H, Mohammadkhani P, Tabatabaei S. [Thought control strategies and trait anxiety: predictors of pathological worry in non-clinical sample]. *Int J Behav Sci*. 2011;**5**(2):173–8. Persian.
17. Abbott A. The coping strategy questionnaire. *J Physiother*. 2010;**56**(1):63. [PubMed ID: 20500144]. https://doi.org/10.1016/s1836-9553(10)70061-8.
18. Stevens BJ, Yamada J, Estabrooks CA, Stinson J, Campbell F, Scott SD, et al. Pain in hospitalized children: Effect of a multidimensional knowledge translation strategy on pain process and clinical outcomes. *Pain*. 2014;**155**(1):60–8. [PubMed ID: 24021861]. https://doi.org/10.1016/j.pain.2013.09.007.
19. Buffel C, van Aalst J, Bangels AM, Toelen J, Allegaert K, Verschueren S, et al. A Web-Based Serious Game for Health to Reduce Perioperative Anxiety and Pain in Children (CliniPup): Pilot Randomized Controlled Trial. *JMIR Serious Games*. 2019;**7**(2):e12431. [PubMed ID: 31199324]. [PubMed Central ID: PMC6592396]. https://doi.org/10.2196/12431.
20. Rabbitts JA, Fisher E, Rosenbloom BN, Palermo TM. Prevalence and Predictors of Chronic Postsurgical Pain in Children: A Systematic Review and Meta-Analysis. *J Pain*. 2017;**18**(6):605–14. [PubMed ID: 28363861]. [PubMed Central ID: PMC5457338]. https://doi.org/10.1016/j.jpain.2017.03.007.
21. Dehghan F, Jalali R, Bashiri H. The effect of virtual reality technology on preoperative anxiety in children: a Solomon four-group randomized clinical trial. *Perioper Med (Lond)*. 2019;**8**:5. [PubMed ID: 31171963]. [PubMed Central ID: PMC6549331]. https://doi.org/10.1186/s13741-019-0116-0.
22. He HG, Zhu L, Chan SW, Liam JL, Li HC, Ko SS, et al. Therapeutic play intervention on children's perioperative anxiety, negative emotional manifestation and postoperative pain: a randomized controlled trial. *J Adv Nurs*. 2015;**71**(5):1032–43. [PubMed ID: 25561079]. https://doi.org/10.1111/jan.12608.
23. Bandeira RA, de Oliveira Gomes L, Bezerra AJC, Duarte JA. Correlation between preoperative anxiety and acute postoperative pain in elderly patients submitted to transvesical prostatectomy. *Rev Dor*. 2017;**18**(4):291–7. https://doi.org/10.5935/1806-0013.20170118.
24. Oommen S, Shetty A. Does parental anxiety affect children's perception of pain during intravenous cannulation? *Nurs Child Young People*. 2020;**32**(3):21–4. [PubMed ID: 31657172]. https://doi.org/10.7748/ncyp.2019.e1187.
25. Rosenberg RE, Clark RA, Chibbaro P, Hambrick HR, Bruzzese JM, Feudtner C, et al. Factors Predicting Parent Anxiety Around Infant and Toddler Postoperative and Pain. *Hosp Pediatr*. 2017;**7**(6):313–9. [PubMed ID: 28512138]. [PubMed Central ID: PMC5469249]. https://doi.org/10.1542/hpeds.2016-0166.
26. Mahdizadeh M, Nejat Mohammad A, Behnam Vashani H, Reyhani T. Effects of Supportive Educational Program on Anxiety of Mothers of Children Undergoing the Lumbar Puncture (LP). *Evid Based Care*. 2016;**6**(2):29–38. https://doi.org/10.22038/ebcj.2016.7313.
27. Frank NC, Blount RL, Smith AJ, Manimala MR, Martin JK. Parent and staff behavior, previous child medical experience, and maternal anxiety as they relate to child procedural distress and coping. *J Pediatr Psychol*. 1995;**20**(3):277–89. [PubMed ID: 7595816]. https://doi.org/10.1093/jpepsy/20.3.277.
28. Safari N, Kavosi A, Jouybari L, Sanagoo A, Mohammadi G. [The Relationship Between Catastrophizing,Pain-related Anxiety and Coping Strategies in Cancer Patients]. *J Nurs Educ*. 2015;**3**(2):31–42. Persian.
29. Ma'arefvand M, Khatamsaz Z. [Coping Strategies of the Parents of the Children with Cancer]. *Q J Soc Work*. 2014;**3**(3):3–9. Persian.
30. Kristensen HN, Lundbye-Christensen S, Haslund-Thomsen H, Graven-Nielsen T, Elgaard Sorensen E. Acute Procedural Pain in Children: Intervention With the Hospital Clown. *Clin J Pain*. 2018;**34**(11):1032–8. [PubMed ID: 29727302]. https://doi.org/10.1097/AJP.0000000000000625.
31. Blount RL, Bachanas PJ, Powers SW, Cotter MC, Franklin A, Chaplin W, et al. Training children to cope and parents to coach themduring routine immunizations: Effects on child, parent, and staff behaviors. *Behav Ther*. 1992;**23**(4):689–705. https://doi.org/10.1016/s0005-7894(05)80229-1.