



Preoperative Anxiety and Postoperative Pain in Pediatric Burn Patients and Their Correlation Analysis

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Received 2022 December 13; **Revised** 2022 December 27; **Accepted** 2023 February 22.

Abstract

Background: The incidence and mortality rates of burns have decreased dramatically with the advancement of medical technology; however, it is still challenging.

Objectives: This study aimed to investigate the status of preoperative anxiety and postoperative pain in pediatric burn patients and analyze the correlation between preoperative anxiety and postoperative pain.

Methods: This cross-sectional study was conducted on pediatric burn patients who underwent burn surgery under general anesthesia in Qinghai Provincial People's Hospital, Xining, China, from October 2020 to August 2021. For the evaluation of postoperative pain, the patients were tested at the post-anesthesia care unit, 2 h, 24 h, 48 h, and 72 h after surgery, and burn time before operation, burn location, burn area, and burn depth were assessed. Face, Legs, Activity, Cry, Consolability Behavioral Tool, and Facial Expression Pain Scale were used to evaluate the pain of the children, and State-Trait Anxiety Inventory and Yale Preoperative Anxiety Scale were used to evaluate the anxiety of the children. The correlation was used to analyze the effect of preoperative anxiety on postoperative pain in burned children.

Results: In total, 108 pediatric patients were included in this study. Preoperative anxiety and severe anxiety accounted for more than 50% of burned children. Moreover, there was a statistically significant difference between 1-3-year-old and 4-12-year-old children in terms of preoperative anxiety and postoperative pain. Parental trait anxiety, showed that each influencing factor has a significant influence on postoperative pain in children ($P < 0.05$). Based on the analysis of the correlation between preoperative anxiety and postoperative pain in children with burns, preoperative anxiety in children aged 1-3 years had a significant impact on postoperative pain in children. Moreover, the correlation analysis showed that there was a positive correlation between anxiety score and postoperative pain in children with burns ($r = 0.479$, $P = 0.001$).

Conclusion: Incidence rate of preoperative anxiety in pediatric burn patients is high. Besides, the postoperative pain scores are different in various age groups. In addition, there is a positive correlation between preoperative anxiety and postoperative pain in pediatric burn patients; accordingly, the higher the anxiety score of the patient, the more intense their postoperative pain.

Keywords: Burn, Children, Correlation, Preoperative anxiety, Postoperative pain

1. Background

Burn is a kind of skin tissue damage under the influence of heat sources, which is currently a common type of accidental injury. The incidence rate of burns in China is 1.5-2% and pediatric burns account for 30% of them. Therefore, the treatment of pediatric burns is very important in the current clinical practice (1). With the gradual advancement of medicine, the incidence and mortality rates of burns have been significantly reduced; however, the burn treatment rate in children is still difficult to improve (2).

According to the current clinical treatment, the burn treatment of children often requires surgical intervention. However, it should be noted that although surgical treatment can cure the existing skin damage in children, the psychological trauma caused by the burn will have a great impact on their later rehabilitation. Affected by burns, children will have extremely significant anxiety before surgery, and the preoperative anxiety will slow down their healing process after surgery and easily arouse their extreme personality traits (3).

Brady et al. analyzed the impact of burns on the

mental health of children and the changes in children with burns through parental descriptions. They found that burns would seriously deteriorate the psychological emotions of children and have a serious impact on their development (4). In addition, during the process of their surgical treatment, due to the high number of operations, the pain experienced during the operation will affect the body of the children and their treatment development after the operation.

In the process of burn treatment in children, their preoperative anxiety can affect the pain after surgery. Results of many studies have shown that the treatment of children is similar to the treatment of adults; accordingly, reducing their anxiety score can improve the effects of postoperative analgesics (5,6). Khadra et al. believed that the pain of children with burns could be relieved by an increase or decrease in the outpatient treatment plan. They believed that outpatient treatment could treat children with burns as soon as possible, thereby reducing the psychological anxiety of children with burns (7). However, there is no in-depth analysis of the correlation between preoperative anxiety and

postoperative pain in patients who receive burn treatment.

2. Objectives

In order to improve the effect of burn treatment on children, this study aimed to analyze the preoperative anxiety of children after burns and their postoperative pain. Moreover, it aimed to analyze the correlation between the two groups, in order to propose treatment measures to reduce the incidence of burns in children.

3. Methods

This cross-sectional study was conducted on pediatric patients who underwent surgical treatment for their burn under general anesthesia in Qinghai Provincial People's Hospital, Xining, China from October 2020 to August 2021. It must be mentioned that all the selected children were below 12 years old.

3.1. Inclusion and exclusion criteria

Inclusion criteria were being a child with a burn disease, literacy of all the family members of the child, and barrier-free communication of the family members of the child. Children with large burn areas and severe infection, children with shock after burn, mechanical ventilation lung injury during hospitalization, cognitive impairment, and severe mental illness, such as cognitive impairment, were excluded from the study.

3.2. Research methods

3.2.1. Surgical anesthesia method

Regarding the surgical anesthesia of the children, midazolam, propofol, cisatracurium, and sufentanil were used for the induction of anesthesia. All the children received the same drug dose to reduce the interference caused by the anesthetic dose. The drugs included midazolam 1.5 mg, propofol 2 mg/kg, cisatracurium 2 mg/kg, and sufentanil 0.3 µg/kg. All patients underwent tracheal intubation, and the respiratory rate was adjusted to 20 breath/min. In the maintenance phase of anesthesia, the total amount of sevoflurane, remifentanil, sufentanil, and other drugs was used, each at 80-100%, 0.08-0.15 µg/kg·min⁻¹, and 0.7-1.0 µg/kg.

3.2.2. Evaluation methods of anxiety and pain in children

In this study, the anxiety and pain of burned children were evaluated. First, the pain behavior scale (Face, Legs, Activity, Cry, Consolability Behavioral Tool [FLACC]) was used to evaluate the postoperative pain of burned children (8). In addition, in order to understand the pain status of the children after surgery more accurately, the pain scale of the facial expression was used to evaluate the pain

of the children (9). In the evaluation of preoperative anxiety in children with burns, the State-Trait Anxiety Inventory (STAI) and the Yale Preoperative Anxiety Scale (YPAS) were used to assess preoperative anxiety in children with burns evaluation (10,11).

In the course of data collection, on the first day before the operation, the STAI scale was used to evaluate the anxiety of the parents of children. Moreover, before the induction of anesthesia, the anxiety of the parents was evaluated again with the STAI scale, and the anxiety of the children was evaluated with the YPAS scale. Finally, after the operation, FLACC and facial expression pain scales were used in the post-anesthesia care unit (PACU) to assess the pain of the children at 4, 24, 48, and 72 h after the operation.

3.2.3. Observation indicators

In the selection of the general data of children, their age, gender, body mass index (BMI), residence, preoperative burn time, burn site, burn area, and burn depth were analyzed. The operation method, operation time, and preoperative heart rate were also evaluated. Regarding the evaluation of the pain of children, there are 15 evaluation items in the evaluation of FLACC with a total score of 0 to 10 points. The higher scores indicate a stronger pain felt by children; accordingly, 0, 1-3, 4-6, and more than 6 points indicate a lack of pain, mild pain, moderate pain, and severe pain, respectively.

In the evaluation of the Facial Expression Pain Scale, the pain is described based on the different expressions of the children, and the total score is 10 points. The higher the score, the stronger the pain in the child. In the preoperative anxiety evaluation of children, the evaluation of STAI included trait anxiety and state anxiety, with a total of 40 questions, including 20 anxiety and depression, with a total score of 80 points. An evaluation score higher than 46 points indicates that the anxiety of children presents a severe anxiety state.

In the YPAS evaluation, there are a total of 22 evaluation items. The anxiety of children is assessed by observing five indicators, namely preoperative movement, language, emotion, state, and parental behavior. The total score is 100 points, and higher scores indicate more anxiety in the child. The patients who achieved scores higher than 40 were considered to have high anxiety.

3.3. Ethical considerations

Children and their families were aware of the experimental content and procedures and signed the informed consent form. This study was approved by the Ethics Committee of Qinghai Provincial People's Hospital. In the judgment process of the Ethics Committee, the social effects of the experiment and the rights and interests of the research object were

fully considered.

3.4. Statistical analyzes

The statistical analysis was performed in SPSS software (version 26.0). Data were expressed by the number of cases and percentages or mean±SD. Independent sample t-test and one-way analysis of variance were used for data analysis. The correlation between preoperative anxiety and postoperative pain was analyzed by the Spearman test. Furthermore, multivariate analysis was performed by using a generalized linear model. It should be noted that a *p* value of less than 0.05 was considered statistically significant.

4. Results

4.1. General data analysis

The subjects of the study were 108 children who were admitted to our hospital. As summarized in Table 1, the analysis of the baseline data showed no significant difference between the baseline data of

the children in different groups. The surgical methods adopted by all the children were scar plastic surgery, scabbing surgery, and wound expansion skin grafting.

4.2. Evaluation and analysis of preoperative anxiety in children with burns

Figure 1(a) illustrates the proportion of children with severe anxiety based on the STAI score. It can be seen that 68.33% (n=41) and 54.17% (n=26) of children with severe anxiety were within the age ranges of 1-3 and 4-12 years old, respectively. Figure 1(b) shows the number of children with severe anxiety and the proportion of likes based on the YPAS evaluation. It can be seen that 70.00% (n=42) and 52.08% (n=25) of the children within the age ranges of 1-3 and 12 years old suffered from severe anxiety, respectively. According to the comparison of the evaluation results of anxiety in children with burns, it can be said that there is no significant difference between the degree of anxiety in children with burns based on the two evaluation methods, and there is a high consistency between their results.

Table 1. Characteristics of the patients

		n(%) / (mean±SD)	
Age	1-3	60 (56%)	
	4-12	48 (44%)	
Gender	Male	55 (51%)	
	Female	53 (49%)	
BMI		17.38±2.26	
Place of residence	City	52 (48%)	
	Countryside	56 (52%)	
Burn time before operation (d)	<10	21 (19%)	
	11-150	41 (38%)	
	>150	46 (43%)	
Burn location	Limb	58 (54%)	
	Trunk (front and rear)	18 (17%)	
	Head, face, and neck	13 (12%)	
	Multiple parts	19 (18%)	
Burn area (%)	<5	62 (57%)	
	6-20	31 (29%)	
	>20	15 (14%)	
Burn depth	II	40 (37%)	
	III	35 (32%)	
	II, III	33 (31%)	
Operation mode	Scar plastic surgery	58 (54%)	
	Escharectomy	18 (17%)	
	Expanded skin grafting	32 (30%)	
Operation time (min)		82.6±23.97	
Preoperative heart rate (Times/min)		116.01±21.59	
STAI	Age	1-3	64.37±3.39
		4-12	51.02±3.41
	Gender	Male	56.17±3.24
		Female	57.69±3.03
YPAS	Age	1-3	58.58±4.15
		4-12	50.06±4.03
	Gender	Male	53.77±4.17
		Female	55.25±4.04

Note: burn degree I: burn area is less than 10%; Burn degree II: burn area is 11%~29%; Burn degree III: the burn area is greater than 30%. STAI: State-Trait Anxiety Inventory, YPAS: Yale Preoperative Anxiety Scale

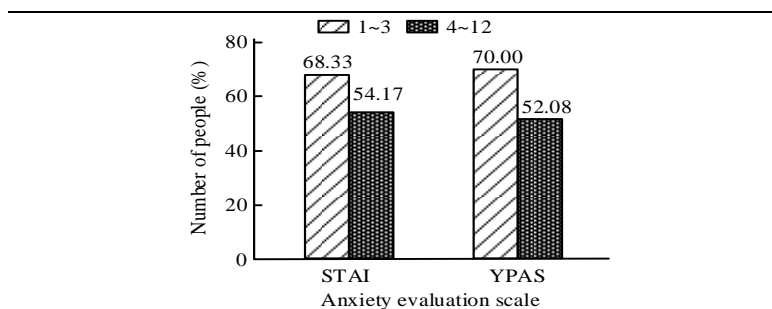


Figure 1. Analysis of preoperative anxiety in burned children of different ages

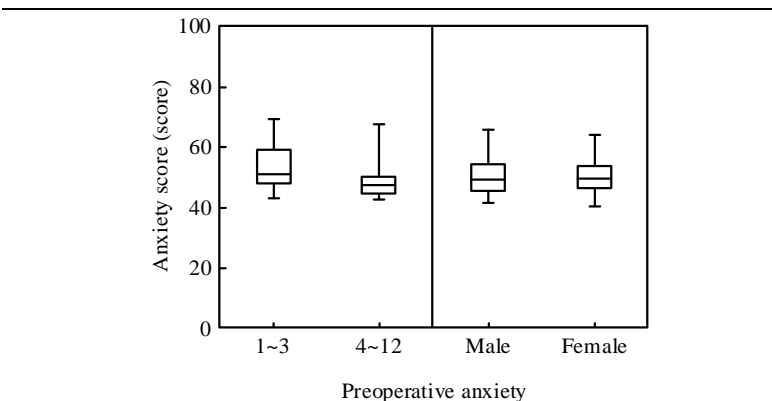


Figure 2. Evaluation of preoperative anxiety in burned children of different ages

Figure 2 shows that the preoperative anxiety scores of children in different age ranges are different. The average anxiety score of children within the age range of 1-3 years old was 50.07 points, while that of the children within the age range of 4-12 years old was 50.07 points. The average anxiety score of children was 47.29 points, and there was a statistically significant difference between the anxiety scores of the two age ranges ($P < 0.05$). Regarding the comparison of anxiety scores of children based on gender, there was no significant difference between the anxiety scores of male and female children ($P < 0.05$).

4.3. Evaluation and analysis of postoperative pain in children with burns

In the evaluation of postoperative pain, the patients were tested at PACU, 2 h, 24 h, 48 h, and 72 h after surgery. The final calculated burn evaluation of the child is illustrated in Figure 3, which shows a downward trend in the overall postoperative pain evaluation of the child. In Figure 3, it can be seen that the highest postoperative pain score of children with burns appeared at 2 h after surgery, and the average values of children aged 1-3 and 4-12 reached 3.82 and 5.47, respectively. Comparison of the pain scores of children aged 1-3 and 4-12 years old indicates no significant difference between the pain scores of the two groups in PACU; however, there are significant differences between the pain scores at the rest of the time points, and there are statistical differences. academic significance ($P < 0.05$).

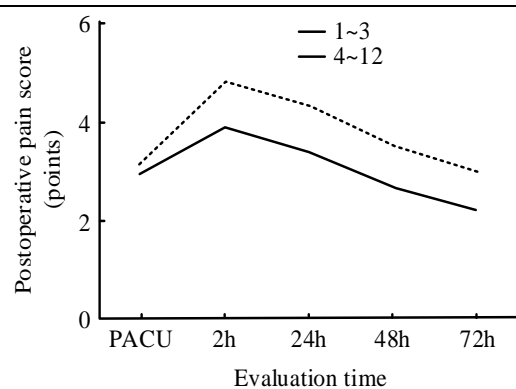


Figure 3. Analysis of the changes and differences in postoperative pain scores in burned children

Pain assessment was used to analyze the postoperative pain in children with burns, and when the pain exceeded 3 points, it was considered severe pain. According to Figure 4, the incidence of severe pain in all burned children underwent an initial increase followed by a decrease, and the incidence of pain was the highest 2 h after the surgery.

Comparison of the occurrence of severe pain between children aged 1-3 years and 4-12 years old revealed that the change of severe pain in children aged 4-12 years is more significant, and the number of patients with severe pain 72 h after surgery accounts for more. This rate decreased to less than 20%, and the difference between the two groups was statistically significant ($p < 0.05$).

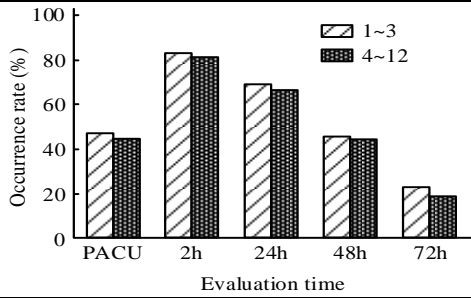


Figure 4. Analysis of postoperative severe pain in burned children

4.4. Analysis of factors influencing postoperative pain in children with burns

Based on the analysis of the general data of children with burns, the correlation between the general data indicators of children and their postoperative pain scores was evaluated and summarized in Table 2. As can be seen in Table 2, most of the baseline differences in burned children showed a high correlation with postoperative pain. Based on the univariate analysis of multiple indicators, it can be said that the burn area, burn depth, and previous surgical history have an impact on postoperative pain in children with burns. The effect of different burn depths on postoperative pain in children with burns is reflected in the 24 h and 48 h after surgery, and the test results show that the *p*

values at these two time points are 0.047 and 0.042, respectively.

The effect of previous surgical history on postoperative pain in children with burns was reflected in the PACU, and the *p* value was 0.016. In addition, the gender, residence, preoperative burn time, burn site, and surgical method of burn of children did not affect their postoperative pain. The *p* value of the pain score in children with burns within 3 days after the operation was greater than 0.05.

In addition, the impact of each variable on postoperative pain was evaluated by analyzing the continuous variables of the burned children during the treatment process. Continuous variables included age, BMI, preoperative heart rate, operation time, preoperative anxiety, and morbidity of burned children.

4.5. Parental trait anxiety and state anxiety

In Table 3, it can be seen that the age, BMI, operation time, preoperative anxiety, and parental trait anxiety of burned children will have an impact on the pain of children, with a *p* value of less than 0.05. Other factors, such as preoperative heart rate and parental state anxiety had no significant effect on the postoperative pain of burned children.

Table 2. Analysis of the degree of the impact of related factors of postoperative pain in burned children (*P* values of independent sample t-test of one-way analysis of variance)

		Inspection results				
		PACU	2 h	24 h	48 h	72 h
Gender	Male					
	Female	0.468	0.853	0.541	0.416	0.635
Place of residence	City					
	Countryside	0.254	0.563	0.354	0.813	0.348
Burn time before operation (d)	<10					
	11-150					
	>150	0.134	0.062	0.118	0.092	0.137
Burn location	Limb					
	Trunk (front and rear)					
	Head, face, and neck					
	Multiple parts	0.769	0.075	0.164	0.349	0.341
Burn area (%)	<5					
	6-20					
	>20	0.645	0.085	0.243	0.027	0.011
Burn depth	II					
	III					
	II, III	0.258	0.291	0.047	0.042	0.187
Operation mode	Scar plastic surgery					
	Escharectomy					
	Expanded skin grafting	0.504	0.171	0.917	0.693	0.484
History of previous surgery	No					
	Yes	0.016	0.205	0.113	0.647	0.321

PACU: post-anesthesia care unit

Table 3. Effect of continuous variables on postoperative pain of burned children (*p* value of spearman correlation test)

	PACU	2 h	24 h	48 h	72 h
Age	0.051	<0.001	<0.001	<0.001	<0.001
BMI	0.122	<0.001	<0.001	<0.001	<0.001
Preoperative heart rate	0.334	0.780	0.491	0.137	0.075
Operation time	0.030	0.076	0.195	0.258	0.173
Preoperative anxiety of children	0.023	0.254	0.523	0.233	0.183
Parental trait anxiety of children	0.671	0.185	0.037	0.044	0.324
Parental state anxiety	0.187	0.073	0.114	0.441	0.098

PACU: post-anesthesia care unit, BMI: body mass index

After that, a multivariate analysis was carried out on the influencing factors of postoperative pain in children with burns, as tabulated in Table 4. The influencing factors involved in the analysis included age, BMI, area of burns, depth of burns, surgical methods, preoperative anxiety, history of previous surgery, and parental trait anxiety. According to Table 4, the test results of the three influencing factors of BMI, previous surgical history, and parental trait anxiety on the pain of children with burns were 0.178, 0.362, and 0.819, respectively. The three influencing factors of trait anxiety had no significant effect on postoperative pain in children with burns. Variables, such as age, burn area, burn depth, preoperative anxiety of children, and parental trait anxiety had significant effects on postoperative pain in children with burns, and the significance test results were all below 0.05.

4.6. Correlation analysis of preoperative anxiety and postoperative pain in children with burns

The preoperative anxiety and postoperative pain of children with burns were significantly affected by age. Therefore, the correlation between preoperative

anxiety and postoperative pain in children with burns at different ages was analyzed (Table 5). Based on Table 5, it was found that in the 1-3 years age range, the correlation coefficient between the preoperative anxiety and the postoperative pain of the children with burns was higher than 0.3.

The gender test showed that the effect of preoperative anxiety on children with burns within the age range of 1-3 years old on PACU, postoperative pain at 24 h, 48 h, and 72 h after surgery was less than 0.05. In the 4-12 years age range, the preoperative anxiety of burned children had a low correlation with postoperative pain, and only had a significant effect on postoperative pain in the PACU stage ($P=0.01$).

Finally, the correlation between preoperative anxiety and postoperative pain in all burned children was analyzed, as shown in Figure 5. As the preoperative anxiety score of the burned children increased, their postoperative pain score also underwent an increase. In addition, when the preoperative anxiety score of burned children reached 60 points or more, their pain score reached 6 points or more.

Table 4. Multivariate analysis of influencing factors of postoperative pain in burned children

	OR	95% confidence interval		Z	P
		Lower limit	Upper limit		
Age	2.385	2.027	3.309	4.816	0.000
Body mass index	2.026	1.911	2.212	1.357	0.178
Burn area	1.997	1.345	2.014	2.075	0.035
Burn depth	-1.997	-2.437	-1.069	-3.024	0.006
Operation mode	1.023	0.998	1.574	0.933	0.351
Preoperative anxiety of children	2.504	2.020	3.275	3.092	0.002
Previous surgical history	2.049	1.994	2.214	0.922	0.362
Parental trait anxiety	1.985	1.781	2.027	0.187	0.819

Table 5. Influence of preoperative anxiety on postoperative pain in burned children at different ages

Index	1-3 years old		4-12 years old	
	Spearman Correlation coefficient	P	Spearman Correlation coefficient	P
PACU pain	0.484	0.021	0.451	0.001
2 h pain	0.301	0.173	0.179	0.261
24 h pain	0.394	0.044	0.154	0.548
48 h pain	0.437	0.032	-0.032	0.634
72 h pain	0.452	0.027	0.216	0.229

PACU: post-anesthesia care unit

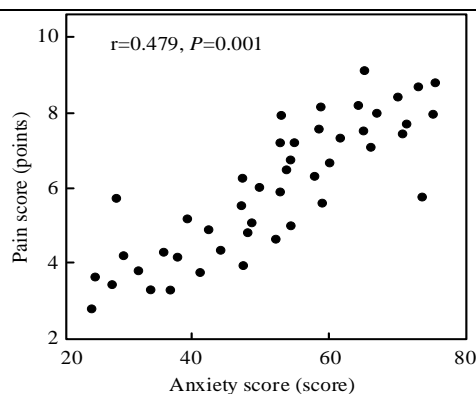


Figure 5. Correlation analysis of preoperative anxiety and postoperative pain in burned children

5. Discussion

Burn is a kind of trauma that seriously affect the physical and mental health of individuals. It is known from clinical practice that burns will not only cause skin damage to individuals, but also lead to significant anxiety in burn patients to a certain extent (12,13). In the present study, in order to reduce postoperative pain in children with burns, the related factors affecting preoperative anxiety and postoperative pain in them were analyzed. Moreover, the correlation between preoperative anxiety and postoperative pain was calculated to improve burn injuries. Outcomes of surgical treatment in children.

Since the brains of pediatric patients are still immature, after they experience burn, they will have significant anxiety symptoms, showing an emotional state of anxiety or fear. In the treatment of burns, the current medical methods mainly use surgery to repair the skin of individuals. During the treatment process, children with burns will have significant preoperative anxiety, which has a significant impact on their surgical process and postoperative recovery. Negative effects (14,15).

Based on previous studies, the preoperative anxiety of burned children is different from that of adults. The incidence rate of preoperative anxiety in children with burns exceeds 60%, while that of adults is much lower than 60% (16-18). In addition, according to a large number of clinical practices, the preoperative anxiety of children with burns will also have a certain impact on their postoperative pain (19,20). Pain after burn surgery is a factor that seriously affects postoperative rehabilitation. Difficulty in the elimination of postoperative pain in children will cause both physical and mental damage to children after surgery, which will eventually lead to longer postoperative recovery time in children with burn injuries (21-23).

The analysis of preoperative anxiety in children with burns showed that among the children with burns included in this study, the children aged 1-3 years old had the highest level of postoperative pain. Moreover, their average pre-anxiety score was higher than that of children aged 4-12 years old, and the difference was statistically significant. Regarding the reasons for the differences in preoperative anxiety scores at different ages, it can be seen from previous studies that with the increase of age, the psychological endurance of individuals is continuously improved, and the psychological emotions expressed in medical operations are also significantly different. This confirms the lower anxiety scores of older children in the present study (24,25).

The analysis of the postoperative pain status of children with burns showed that in different age groups, the pain evaluation scores of children with burns were significantly different. Pain scores of 12-year-old children indicate that the increase in age

reduces postoperative pain in children with burns. In addition, it was observed that with the passage of time, the incidence of severe pain in children undergoes a decrease. The changes in severe pain in children aged 4-12 years are more significant, and the proportion of severe pain in children 72 h after surgery has decreased to 20% the following.

In previous studies, it was shown that with the increase in the age of the patient, their physical and mental tolerance gradually improved. Regarding skin trauma, elderly patients are more likely to bear the skin pain caused by it and are also more susceptible to skin trauma. It is easy to adapt to the pain after surgery, which is consistent with the results of the present research (26,27).

Based on the results of the analysis, the influencing factors of postoperative pain in children with burns included burn area, depth of burn, and previous surgical history. This makes the burned children experience more intense postoperative pain. In addition, the findings also revealed that continuous variables, such as age, BMI, operation time, preoperative anxiety of children, and parental trait anxiety of burned children had an impact on postoperative pain.

Multivariate analysis showed that age, burn area, burn depth, preoperative anxiety of children, and parental trait anxiety indicators were the key factors affecting postoperative pain, preoperative anxiety, and parental trait anxiety to predict and prevent in children with burns. It can be seen from the research results that in the multivariate analysis, the preoperative anxiety of children can be controlled by medical means. Therefore, analysis of the specific correlation between preoperative anxiety and postoperative pain in children can improve the effectiveness of treatment of children with burns. important value (28).

5.1. Study limitations

This study was limited by the small number of participants; therefore, it is difficult to deeply analyze the mechanism of preoperative anxiety in children with burns at different ages.

6. Conclusion

Children with burns frequently experience anticipatory anxiety, and different age groups experience different levels of postoperative pain. Additionally, there is currently evidence that preoperative anxiety and postoperative pain are positively connected in children who have had burns. This means that the greater the anxiety score of patients, the more severe their postoperative pain will be. Therefore, for the treatment and rehabilitation of children with burns, preoperative anxiety can be relieved to reduce postoperative pain, thereby improving the therapeutic effect.

Acknowledgments

None.

Footnotes

Conflicts of Interest: The author declares that there is no conflict of interest.

Author's Contributions: The author did all the work alone.

Funding/Support: None

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