

Original Article

Effect of implementing enhanced recovery after surgery principles in the perioperative period of pediatric inguinal hernia

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Received December 5, 2020; Accepted January 21, 2021; Epub May 15, 2021; Published May 30, 2021

Abstract: Objective: We aimed to investigate the effect of implementing enhanced recovery after surgery (ERAS) principles in the perioperative period of pediatric inguinal hernia (IH). Methods: In this prospective study, 98 children undergoing surgery for IH in our hospital were randomly divided into the control group (n=49, routine nursing) and the study group (n=49, nursing care with ERAS principles). The anesthesia recovery period, time from end of surgery to first ambulation and to first anal exhaust, length of hospital stay, mental state before and after the intervention, pain level, incidence of complications, and family satisfaction with the nursing care were compared between the two groups. The recurrence rate of IH within half a year was recorded. Results: Compared with the control group, the time from the end of surgery to first ambulation and to first anal exhaust and the length of hospital stay were shorter in the study group (all $P < 0.05$). After the nursing intervention, both groups achieved better scores in mental state and pain level, and the improvement in the study group in mental state and pain level was greater than that in the control group (all $P < 0.05$). Compared with the control group, the study group had higher family satisfaction with the nursing care and lower incidence of complications during hospitalization (both $P < 0.05$). During the half-year follow-up, no recurrence was observed in both groups. Conclusion: The implementation of ERAS principles in the perioperative period of pediatric IH can help to relieve postoperative pain, reduce psychological discomfort, reduce the incidence of complications, and promote postoperative recovery in children.

Keywords: Enhanced recovery after surgery, inguinal hernia, pediatrics, complication

Introduction

Inguinal hernia (IH) is a common disease in pediatric surgery. The major cause of IH in men is the potential cavity formed during the gradual lowering of testicle to scrotum in embryonic period. The cavity can lead to IH when the baby's abdominal pressure increases or the baby cries continuously, and lump in groin is the main clinical manifestation [1, 2]. IH can be divided into oblique hernia and direct hernia, and the former one is more common than the latter one [3]. Currently, the main method for treating pediatric IH is laparoscopic surgery [4].

In recent years, the concept of enhanced recovery after surgery (ERAS) has been introduced

into the nursing care for children during the perioperative period of laparoscopic surgery, so as to improve the postoperative recovery of children and reduce the incidence of complications [5]. ERAS is a multidisciplinary approach to the care of surgical patients, and this multimodal strategy is safe and highly efficient. The core of ERAS is to reduce surgical trauma, relieve the perioperative psychological discomfort of patients, reduce the incidence of complications, and facilitate recovery of patients [6]. In recent years, ERAS has been widely applied in the perioperative nursing care for patients with cancer such as lung cancer, gastric cancer, and colorectal cancer, and good therapeutic effects have been obtained. Bu et al. reported

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Table 1. Baseline data in the two groups ($\bar{x} \pm sd$)

Baseline data	Study group (n=49)	Control group (n=49)	χ^2/t	P
Gender (n)			0.211	0.646
Male	46	47		
Female	3	2		
Age (years)	3.9±1.0	4.0±1.3	0.382	0.703
Hernia site (n)			1.036	0.309
Left side	30	25		
Right side	19	24		
Operation duration (min)	33.29±5.86	34.13±5.33	0.742	0.460
Intraoperative bleeding volume (mL)	2.44±0.74	2.70±0.63	1.873	0.064

4) children who participated in other research projects.

The study was approved by the Ethics Committee of Guangrao Hospital of Traditional Chinese Medicine, and the families of the participants signed the informed consent.

Methods

that the application of ERAS in the nursing care for patients with gastric cancer during the perioperative period reduced the incidence of postoperative complications and shorten the hospital length of stay [7]. In the present study, we aimed to investigate the effect of implementing ERAS principles in the perioperative period of pediatric IH, in an effort to provide some guidance for the nursing care for children with IH and promote the postoperative recovery of the children.

Materials and methods

Participants

A total of 98 children undergoing surgery between March 2019 and April 2020 in Guangrao Hospital of Traditional Chinese Medicine were selected for this prospective study. According to the random number table, the participants were divided into two groups: the control group (n=49, routine nursing) and the study group (n=49, nursing care with ERAS principles).

The inclusion criteria were: 1) children aged 1-12 years; 2) children with unilateral oblique hernia; 3) children who would undergo laparoscopic high ligation of the hernial sac; 4) children with grade I IH classified by the American Society of Anesthesiologists.

The exclusion criteria were: 1) children with strangulated hernia, incarcerated hernia, or large hernia; 2) children with congenital heart disease; 3) children with severe diseases including digestive system disorders, immune system disorders, and blood system disorders;

In the control group, the patients received routine nursing care during the perioperative period. The patients underwent routine medical examinations after hospital admission; the children's families received health education about the disease; and the children were given dietary and medication guidance after operation.

In the study group, the ERAS principles were incorporated into the nursing care of the patients as follows:

Preoperative nursing

Health education: Health education was provided to the patients' families using easy-to-understand language to help them have a better understanding of the disease, treatment method, and postoperative precautions.

Preoperative psychological intervention: The nurses performed good communication with the children and played games with the children based on their preferences, in an effort to reduce the preoperative tension and anxiety and help the children stay calm before going into surgery [8].

Fasting: The children were abstained from food and water 6 h before the operation and were allowed to take a small amount of liquid glucose 2 h before the operation to avoid postoperative hunger.

Intraoperative nursing

The nurses kept the children warm during the operation. The flushing fluid and disinfectant were warmed to 37°C before use. The infusion

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Table 2. Clinical markers in the two groups

Group	Anesthesia recovery period (min)	Time to first ambulation (d)	Time to first anal exhaust (h)	Length of hospital stay (d)
Study group (n=49)	33.94±5.40	1.09±0.70 [#]	10.94±3.22 [#]	2.36±0.93 [#]
Control group (n=49)	34.43±4.90	1.72±0.81	12.89±3.05	3.04±1.04

Note: Compared with the control group, [#]P<0.05.

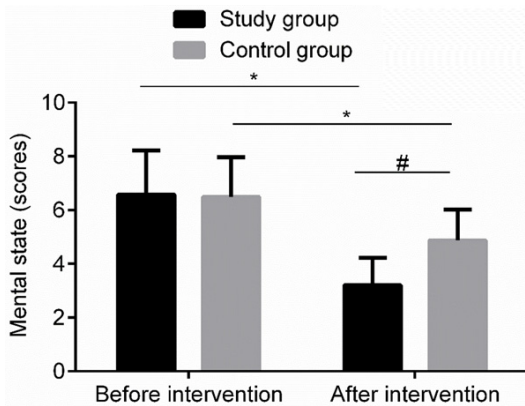


Figure 1. Mental state scores before and after intervention in the two groups. Compared with pre-intervention, *P<0.05; compared with the control group, [#]P<0.05.

volume and rate were properly controlled to avoid discomfort in children. The vital signs of the children were closely monitored during the operation.

Postoperative nursing

Postoperative dietary guidance: If the children had no nausea or vomiting after anesthesia recovery, the family members could give the children a small amount of liquid food 6 h after the operation. Gradually, the liquid diet was transitioned to a semi-liquid diet and finally a normal diet. The children were instructed to eat little and often to prevent a burden on the stomach and intestines.

Postoperative counseling: If the young children were restless and kept crying after surgery, pacifiers were used to pacify them; the restlessness of the older children was relieved through language communication [9].

Postoperative pain management: After the operation, the nurses played cartoons and music to divert children's attention from the

pain. Patients who experienced severe pain could be given pain medications [10].

Postoperative exercise rehabilitation: The family members were instructed to help the children have early ambulation based on their recovery progress. The children were allowed to walk slowly on the second day after the operation, and the ambulation should be progressed gradually.

Outcome measures

Main outcome measures: The clinical markers including anesthesia recovery period, the time from the end of surgery to first ambulation and to first anal exhaust, and the length of hospital stay were compared between the two groups.

Before and after the intervention, the children's mental state including anxiety and irritability level was evaluated by observing their facial expressions [11]. The total score ranged from 0-10; with higher scores indicating greater severity of anxiety and irritability of the patient.

Before and after the intervention, the children's pain levels were evaluated using the Face, Legs, Activity, Cry, and Consolability (FLACC) scale [12]. The scale was comprised of five measurement categories (face, legs, activity, cry, and consolability) with 2 points for each category. The higher the score, the stronger the pain.

Secondary outcome measures: A survey was employed for evaluating the family satisfaction with the nursing care in the two groups [13]. Satisfaction rate = sum of satisfied and basically satisfied cases/total cases * 100%. The survey was completed by the family members of the children.

The incidence of the complications during the hospitalization were compared between the two groups. The complications included nau-

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Table 3. FLACC scores in the two groups before and after the intervention ($\bar{x} \pm sd$, points)

Item	Before or after the intervention	Study group (n=49)	Control group (n=49)
Face	Pre-intervention	1.56±0.34	1.50±0.40
	Post-intervention	0.94±0.38* [#]	1.23±0.30*
Cry	Pre-intervention	1.40±0.44	1.43±0.47
	Post-intervention	0.90±0.37* [#]	1.09±0.40*
Legs	Pre-intervention	1.47±0.51	1.50±0.49
	Post-intervention	0.78±0.30* [#]	1.02±0.30*
Activity	Pre-intervention	1.44±0.50	1.48±0.48
	Post-intervention	0.67±0.29* [#]	0.94±0.39*
Consolability	Pre-intervention	1.50±0.47	1.52±0.40
	Post-intervention	0.78±0.24* [#]	1.03±0.29*

Note: Compared with pre-intervention, *P<0.05; compared with the control group after the intervention, [#]P<0.05. FLACC: Face, Legs, Activity, Cry, and Consolability.

sea, vomiting, restlessness during the anesthesia recovery, incision infection, abdominal distension, etc.

The follow-up period was half year, and the recurrence rate during this period was recorded and compared between the two groups.

Statistical methods

SPSS 20.0 was used for statistical analysis. Count data are presented as number or percentage and were examined by the chi-square test. Measurement data are presented as mean \pm standard deviation ($\bar{x} \pm sd$). Paired t-test was performed for comparison between pre-intervention and post-intervention within a group, and independent samples t-test was used for comparison between two groups. P<0.05 indicated a statistically significant difference.

Results

Baseline data

As shown in **Table 1**, there were no intergroup differences in the baseline data (all P>0.05), so that the study results were comparable between the two groups.

Clinical markers

There was no difference in the anesthesia recovery period between the two groups (P>0.05).

Compared with the control group, the study group had shorter period from the end of surgery to first ambulation and to first anal exhaust and shorter length of hospital stay (all P<0.05). See **Table 2**.

Mental state

Before the nursing intervention, the scores for the mental state were similar between the study group and the control group (6.57±1.64 vs. 6.49±1.48, P>0.05). After the intervention, the scores decreased significantly in both groups (both P<0.05), and the score in the study group was lower than that in the control group (3.20±1.03 vs. 4.87±1.14, P<0.05). See **Figure 1**.

Pain level

After the nursing care, the FLACC scores decreased in both groups (all P<0.05), and the study group had lower scores in each category of the FLACC scale than the control group (all P<0.05). See **Table 3**.

Family satisfaction

The family satisfaction with the nursing care in the study group was higher than that in the control group (P<0.05). See **Table 4**.

Complications

The total complication rate during the hospitalization in the study group was lower than that in the control group (P<0.05). See **Table 5**.

Recurrence rate

No recurrence was observed during the half-year follow-up in the two groups.

Discussion

IH is a common disease in pediatric surgery and is mainly treated by laparoscopic surgery. It has been found that the quality of postoperative nursing care can directly affect the recovery of children after IH surgery [14]. ERAS refers to a set of evidence-based nursing measures implemented in the perioperative period to reduce the physiological and psychological stress, reduce the risks of complications, improve the prognosis, and promote the recovery.

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Table 4. Family satisfaction with the nursing care in the two groups (n, %)

Group	Satisfied	Basically satisfied	Dissatisfied	Satisfaction rate
Study group (n=49)	24 (48.98)	23 (46.94)	2 (4.08)	47 (95.92) [#]
Control group (n=49)	17 (34.69)	24 (48.98)	8 (16.33)	41 (83.67)

Note: Compared with the control group, [#]P<0.05.

Table 5. Complication rates in the two groups (n, %)

Group	Nausea and vomiting	Subcutaneous emphysema	Incision infection	Abdominal distension	Total incidence rate
Study group (n=49)	2 (4.08)	0 (0.00)	0 (0.00)	1 (2.04)	3 (6.12) [#]
Control group (n=49)	4 (8.16)	2 (4.08)	2 (4.08)	3 (6.12)	11 (22.45)

Note: Compared with the control group, [#]P<0.05.

ery of patients [15]. In the present study, we found that the patients that received ERAS nursing care had shorter time from the end of surgery to first ambulation and to first anal exhaust as well as shorter hospital length of stay than the patients who received routine nursing care, indicating that implementing ERAS principles in the perioperative period of pediatric IH can help to promote postoperative recovery and shorten the hospital length of stay. Yip et al. also pointed out that conducting ERAS protocols in the perioperative period of IH can help to reduce the hospitalization period of patients [16]. The improved outcome achieved by ERAS may be due to that the approach emphasizes health education and psychological counseling before the operation and emphasizes analgesia and rehabilitation after the operation, thereby facilitating the recovery [17].

Children who suffer from IH for a long term can experience a repeated onset of IH. The onset of IH can cause unbearable pain and thus making children have poor mental state and increased frequency of crying. Moreover, surgical stress can cause children with IH to become irritable and restless [18, 19]. In the present study, we found that after the intervention, the mental state scores and FLACC scores decreased in both groups, and the magnitude of decrease in the study group was greater than that in the control group, suggesting that the implementation of the ERAS concept in the perioperative period of pediatric IH can help to alleviate postoperative anxiety, irritability, and other psychological discomfort and reduce postoperative pain. Charalambous et al. reported that the application of ERAS in the perioperative period of pediatric indirect IH can achieve marked out-

come, as it can effectively reduce the postoperative pain and incidence of complications as well as promote postoperative recovery [20]. This effect may be due to that ERAS has an emphasis on psychological counseling for patients. In this study, considering that young children have some limitations in language understanding, the nurses reduce children's tension by playing games with them instead of verbal counseling. After operation, the nurses play cartoons and music to divert children's attention in order to reduce their postoperative pain [21].

The core of ERAS is to reduce the risk of postoperative complications and promote the recovery of patients [22]. In this study, we found that the implementation of ERAS principles in the perioperative period of pediatric IH can greatly reduce the incidence of postoperative complications. This finding is consistent with many previous studies. Also, our results reveal that ERAS principles can increase family satisfaction with nursing care.

In conclusion, the implementation of ERAS principles in the perioperative period of pediatric IH can help to relieve postoperative pain, reduce psychological discomfort, reduce the incidence of complications, and promote postoperative recovery of children, which can be recommended for clinical application. However, since the sample size of this study was small, children with direct IH were not enrolled in the study, and the follow-up period was relatively short, more studies need to be carried out in the future to verify the effect of this nursing approach on children with direct IH and postoperative recurrence rate.

Disclosure of conflict of interest

None.

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