

# Observation on the Effect of Rapid Rehabilitation Nursing with Integrated Medical Care in Perioperative Period of Laparoscopic Appendicitis in Children

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**AIM:** Acute appendicitis is one of the most common causes of acute abdomen in pediatric surgery. The purpose of this study was to observe the effects of integrated rapid rehabilitation nursing in children with laparoscopic appendectomy (LA) during the perioperative period.

**METHODS:** A total of 200 children with appendicitis who underwent LA in our hospital from January 2022 to January 2023 were retrospectively selected as the study subjects. According to the nursing mode, they were divided into a control group (n = 100) and an observation group (n = 100). The control group was treated with routine nursing intervention, and the observation group was treated with an integrated rapid rehabilitation nursing intervention. Perioperative indices (operation time, first postoperative exhaust time, length of hospital stay) were recorded and compared between the two groups. The visual analog scale (VAS) was used to score the two groups at 6 h, 12 h, 24 h, and 48 h after surgery, and the pain degree of the children was quantitatively evaluated. The levels of serum stress response indices (cortisol (Cor), norepinephrine (NE), and adrenocorticotrophic hormone (ACTH)) in the two groups were measured. The incidence of postoperative complications, improvement of postoperative quality of life, and nursing satisfaction were compared between the two groups.

**RESULTS:** The operation time, first postoperative exhaust time, and hospitalization time in the observation group were significantly shorter than those in the control group ( $p < 0.05$ ), and the VAS scores of the patients in the observation group were lower than those in the control group at each time point of 6 h, 12 h, 24 h, and 48 h after surgery ( $p < 0.05$ ). One hour after surgery, the serum Cor, NE, and ACTH levels of the two groups of patients were significantly higher than those before surgery, and the levels for the observation group were significantly lower than those of the control group ( $p < 0.05$ ). After treatment, the quality of life scores of patients in both groups was significantly higher than before treatment, and the quality of life scores of patients in the observation group was significantly higher than that of the control group ( $p < 0.05$ ). The postoperative complication rate of the observation group was 3.00% (3/100), which was significantly lower than that of the control group (13.00% (13/100)) ( $\chi^2 = 6.793, p = 0.009$ ). The nursing satisfaction of the observation group was 95.00% (95/100), which was significantly higher than that of the control group (79.00% (79/100)) ( $\chi^2 = 11.317, p = 0.001$ ).

**CONCLUSIONS:** The integrated rapid rehabilitation nursing management mode is an intervention that can effectively alleviate the effects of LA on stress reactions and pain in children with appendicitis. It can effectively reduce the incidence of postoperative complications and improve the patient's nursing satisfaction, allowing children with appendicitis to recover as soon as possible after surgery, and can improve patients' quality of life. It helps to improve the overall clinical efficacy, and the treatment process is simple to operate, relatively safe and reliable, has high use value, and is worthy of further promotion in clinical treatment.

**Keywords:** rapid rehabilitation nursing management mode of medical integration; pediatric appendicitis; laparoscopic surgery; perioperative period; application effects

## Introduction

Acute appendicitis is one of the most common causes of acute abdomen in pediatric surgery, with the highest inci-

dence in children over ten years of age [1]. Appendicitis in children often has a rapid onset and, if not treated promptly and effectively, it may lead to diffuse peritonitis, appendix perforation, and other complications. After the onset of the disease, children often have symptoms such as right lower abdominal pain, diarrhea, nausea, and vomiting, which often last for a long time, so timely treatment is required after the condition is diagnosed.

Conservative treatment of appendicitis in children has poor outcomes. Laparoscopic appendectomy (LA) has become

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the preferred treatment because of its low trauma, rapid recovery and low risk of complications [2, 3]. Clinical studies have found that fear and resistance to surgery and pain are more severe in children because of their poor autonomy and tolerance [4]. Coupled with the insufficient organ reserve function of the pediatric population, the risk of surgical and postoperative complications is higher than for adults [5]. The pain experienced after appendectomy has a serious impact on the children's daily diet and quality of life, and is not conducive to the children's postoperative recovery [6]. Therefore, perioperative nursing intervention is essential to improve the effect of surgical treatment and shorten the postoperative recovery process. Previous studies have found that strengthening the nursing cooperation of children during appendicitis operation can significantly improve children's rehabilitation, reduce the stress caused by surgery, and improve the sleep quality [7,8,9]. Integrated rapid rehabilitation is a new nursing model which is recognized at home and abroad, and can effectively contribute to the process of disease rehabilitation [10].

On the basis of previous studies, this study utilized LA to treat children with appendicitis, and observed and analyzed the effects of different nursing modes on perioperative indices, pain degree, stress response, and quality of life of children with appendicitis. The purpose was to provide a reference for the clinical treatment of appendicitis in children, and to adopt personalized nursing plans according to different conditions, so as to reduce the occurrence of postoperative complications and improve recovery speed.

## Materials and Methods

### Research Subjects

Children who underwent LA in Children's Hospital, Zhejiang University School of Medicine from January 2022 to January 2023 were retrospectively selected, their clinical data were analyzed, and 200 cases were finally included. They were divided into a control group (n = 100) and an observation group (n = 100) according to different perioperative nursing modes. The control group was treated with routine nursing intervention, and the observation group was treated with an integrated rapid rehabilitation nursing intervention. This study was approved by the Children's Hospital, Zhejiang University School of Medicine Medical Ethics Committee (KY-2024-0149), and the families provided informed consent regarding all aspects of the study. This study adhered to the principles outlined in the Helsinki Declaration.

Inclusion criteria were: ① Children who met the diagnostic criteria for appendicitis in "Practical Pediatrics". ② Patients who were diagnosed with acute appendicitis by clinical computed tomography (CT) and X-ray abdominal plain films. ③ All patients had different degrees of fever, abdominal pain, nausea, vomiting, and other clinical symptoms on admission. ④ Children with indications for surgery that underwent LA. ⑤ At the time of the first onset, the clinical data

of the child were complete. ⑥ The children have normal intelligence and language functions. ⑦ All children and their families voluntarily participated in this study and signed the informed consent form.

Exclusion criteria: ① Children with malignant lesions of the appendix. ② Preoperative examination of cardiovascular, kidney, and other important organ functions, excluding routine blood coagulation function abnormalities. ③ Children suffering from autoimmune diseases. ④ Children with other contraindications for surgery. ⑤ Children with mental illness, cognitive impairment, or hearing impairment. ⑥ Children with a history of abdominal surgery. ⑦ Children with malignant tumors.

### Nursing Methods

The control group received routine nursing intervention during the perioperative period. This included answering their questions, informing them of the need to take medication on time and in moderation, and explaining daily precautions. While in the hospital, they received dietary guidance, blood pressure monitoring, health education guidance, and psychological counseling.

In addition to routine nursing intervention, children in the observation group received integrated rapid rehabilitation nursing management mode intervention. The management mode of rapid rehabilitation nursing is mainly divided into five parts: preoperative nursing, operating room management, intraoperative management, postoperative management, and activity guidance management. Doctors in charge of children and medical staff in surgery, nutrition, rehabilitation, psychology, and other departments form a cooperative team to implement integrated medical intervention. Team members systematically learn relevant information and complete an assessment. Training is implemented to improve the nursing staff's comprehensive nursing ability and awareness of work responsibilities.

### Rapid Rehabilitation Nursing Management Mode of Medical Intervention

(1) Preoperative care: Preoperative nursing staff should strengthen communication with children and collect general information regarding the family situation, condition, and other information about the children. They should evaluate the clinical characteristics, existing risk factors, and psychological status of children with appendicitis, cooperate with doctors to evaluate the condition of children, and develop targeted nursing management plans. During the preoperative interview, the attending physician and the medical staff jointly conduct health education for the children and their families, so that the children and their families can understand the disease, explain the operation method and treatment purpose in detail, and adopt the current advanced medical methods and safety measures, so as to reduce the negative emotions of the children and their families about the operation, such as tension, excessive anxiety, and

panic. Encourage the children to actively face the disease, promote confidence of the children and their families in the treatment of the disease, and improve the treatment compliance of the children and the cooperation of their families, so that the operation can be carried out smoothly and quickly. Before operation, the children should take an appropriate amount of glucose solution orally to reduce hunger.

(2) Operating room management: Before the operation, the nursing staff introduce the operating room environment to the children to alleviate their uneasiness and fear of unfamiliar environments. Keep the room temperature in the operating room at 22 to 24 °C and heat the liquids to be used to avoid hypothermia in children. Autoclave and disinfect surgical instruments. Before the anesthesia takes effect, the nursing staff continue to smile at the child, and give appropriate encouragement and praise, and constantly communicate with the child. Soothe the children's emotions and reduce their discomfort in unfamiliar environments. Cover the child's non-surgical area with a blanket, and place a hot water bottle on the child's distal limbs.

(3) Intraoperative management: Play beautiful light music for the children, guide them to breathe deeply, improve their pain tolerance, and help the children face the surgery with a more rational and stable state of mind. During the anesthesia, the use of opioids for analgesic and sedative effects should be avoided as far as possible to reduce the stress response of children. During the operation, the nursing staff use their nursing skills to cooperate with the surgeon to accurately and quickly deliver surgical tools, drugs, and instruments. Pay attention to the blood stains and disinfectant residue during the operation, and wash in time to prevent wound infection. Minimize operation time and reduce surgical trauma. Postoperative rehabilitation care: After the child wakes up, praise the child's strong courage to cooperate with the operation, and pay close attention to the changes in the vital signs of the child.

(4) Postoperative management: ① Environmental management: Disinfect the ward environment regularly, ensure that the temperature and humidity of the ward are appropriate, and create a clean and comfortable sterile ward environment for children. ② Wound care: Strengthen communication with children and family members, and invite family members to participate in care work. The attending physicians and nursing staff monitor and record the physical signs of the children together with the family members of the patients, and explain the health knowledge related to acute appendicitis and surgery, including common complications and common influencing factors of surgery, to ensure that the children and their families understand the condition and have a clear understanding of the information related to surgery. Incision care is provided for the children, and anti-infection and other related drugs are given according to the doctor's advice. Pay attention to collecting the child's reactions and feedback, and provide appropriate treatment as soon as possible when abnormalities oc-

cur. The frequency, dosage, signs, and incision recovery are recorded. ③ Emotional management: Storybooks and children's books can be properly prepared for the children to relieve their nervous crying and improve their compliance. Encourage and comfort children in time, divert children's attention by watching cartoons, reading children's books, etc., to reduce postoperative pain. For children with obvious local pain after surgery, cold compresses and hot compresses can be used alternately to relieve the pain. ④ Diet management: After the operation, children are instructed to eat a healthy diet, given liquid food and semi-liquid food, and gradually progress to a normal diet. Ensure that the child has a balanced diet. Eat more nutrient-rich, easily absorbed foods, eat more foods containing crude fiber, increase the proportion of vegetables and fruits; a reasonable diet structure combined with the nursing mode will provide better results. ⑤ Rehabilitation management: According to the condition of the child, the medical and nursing staff work out the activity plan together. The rehabilitation nurse encourages the child to turn over frequently, and encourages the child to carry out activities according to the wound healing of the child. First, they should have proper activities in bed. Second, children with good recovery can get out of bed as soon as possible, increase the exhaust speed, promote the recovery of intestinal peristalsis, and reduce the symptoms of abdominal distension and pain. Let the children and their families know the benefits of getting up early after surgery, such as promoting the recovery of gastrointestinal function and incision healing, and reducing the occurrence of intestinal adhesion and other complications. Patiently explain to the patient's family that the following bed movements will not cause the incision to split or increase the risk of bleeding but prevent complications. ⑥ Medication care: Guide the daily medication of the children after surgery, reasonably control the infusion speed of the children, and inform the family members of the children not to adjust the infusion speed at will, so as not to cause adverse reactions and affect the treatment effect. At the same time, the children's adverse reactions and condition improvement after medication should be closely monitored. If there is abnormal discomfort after taking the drug, the doctor should be notified in time for effective treatment.

(5) Activity guidance: Unless there are special circumstances, children should be kept in a semi-recumbent position under the supervision of a nurse. If there is no discomfort such as dizziness and incision pain, the child should be assisted to stand at the head of the bed for 5~10 minutes. Use protective devices while standing to prevent accidental falls due to low blood pressure. At the beginning of the activity, walk around the ward first, and limit the time to 20 minutes. There should be no palpitations, shortness of breath, cold sweat, or other symptoms. Gradually increase the amount of activity every 4 to 6 hours, and the amount of activity should be tolerated by the child. When walking, press with hand to protect the incision, but do not exert force

on the abdomen. Watch child's expression carefully. If the child is pale or the exudate is visibly increased and bright red, stop the activity and report it to the doctor. Timely evaluation of children's activity performance: Nurses evaluate children's activity performance, provide timely feedback to doctors, analyze the reasons for poor program performance, and jointly develop improvement measures, such as further health education on the lack of awareness of the importance of early activity. Provide psychological counseling for children with fear, analgesia for children with severe pain, correction for children with incorrect walking style; also attempt to improve the children's nutritional intake and activity endurance.

#### *Perioperative Indicators*

Perioperative indicators: Perioperative indicators such as operation time, first post-operative exhaust time and hospitalization time were recorded to measure the effects of the different nursing modes between the two groups. The shorter the time for each indicator, the better the patient's recovery.

#### *Assessment of Pain Level*

The visual analog scale (VAS) [11] produced by the Chinese Medical Pain Society was used to evaluate the pain degree of the two groups at 6 h, 12 h, 24 h, and 48 h after surgery. Instructions for the VAS are as follows: Get a piece of white paper and draw smooth lines on it, preferably long straight lines. The two ends of the line are marked with 0 points and 10 points respectively, and the specific points within the line are 1–9 points. According to the child's subjective expression and personal subjective feelings, determine the position of the point on the line, and indicate the corresponding score. Choose an appropriate number from 0 to 10 to represent the intensity of pain in the affected area. 0 means no pain; less than 3 means mild pain; a score of 4–6 indicates obvious pain; a score of 7–10 indicates that the patient's pain is quite severe; a score of 10 indicates extreme pain. The higher the scores, the more intense the pain.

#### *Stress Index Level Detection*

5 mL of peripheral venous blood was collected from the children on an empty stomach before surgery and 1 h after surgery, and centrifuged for 15 min at 3000 r/min and a centrifugal radius of 10 cm. Serum was separated and stored in the refrigerator at  $-80^{\circ}\text{C}$ . Before measurement, the enzyme-linked immunosorbent assay (ELISA) kit and serum were removed and equilibrated to room temperature. Based on the instructions, the ELISA kit was used to measure the levels of stress response indicators [cortisol (Cor) (EPX010-12190-901, Invitrogen, Carlsbad, CA, USA), norepinephrine (NE) (EEL010, Invitrogen, Carlsbad, CA, USA), and adrenocorticotrophic hormone (ACTH) (EEL017, Invitrogen, Carlsbad, CA, USA)] in the serum. The main steps are as follows: first take out the required

strip from the aluminum bag, set the standard well and sample well, add 50  $\mu\text{L}$  of gradient concentration standard and sample to be tested respectively, seal the film, and incubate. In addition to the blank wells, add 100  $\mu\text{L}$  of enzyme-labeled antibody solution to each well, seal the membrane and incubate. Discard the liquid, pat dry and wash, add substrate, and terminate the reaction. The optical density (OD) value was measured by enzyme-labeled instrument (1681130B, BioRad, Hercules, CA, USA) at 450 nm wavelength and calculate the sample concentration.

#### *Daily Life Quality Score*

After the children regained consciousness after anesthesia, the Short Form 36 Health Survey (SF-36) [12] was given to the two groups of children to measure the quality of life before and after nursing. Children were instructed to read the questions in the form patiently and fill them out truthfully. The caregiver interpreted the contents of the form to help the child come up with the most realistic answers to ensure that the answers on the form were relatively true. They also patiently guided the children to recall their quality of life from the onset of the disease to before surgery. This scale has eight dimensions, and the score is proportional to the patients' quality of life. The SF-36 scores of the two groups were compared.

#### *Postoperative Complications and Nursing Satisfaction*

The incidence of postoperative complications in the two groups were recorded. Incision infection, abdominal pain and distension, adhesive intestinal obstruction, abdominal abscess, and vomiting were recorded, and corresponding treatment measures were given. The incidence of postoperative complications was calculated and compared between the two groups. At the end of the nursing, the two groups of children were evaluated for their satisfaction with the nursing mode, including communication ability, nursing skills, and nursing attitude. Satisfaction was divided into three levels: very satisfied, basically satisfied, and dissatisfied. Satisfaction rate (%) = (very satisfied + basically satisfied) cases/total cases  $\times$  100%. The incidence of postoperative complications and satisfaction with nursing mode were calculated and compared between the two groups.

#### *Statistical Analysis*

SPSS 23.0 software (IBM, Armonk, NY, USA) was used for statistical analysis of the obtained data. Continuous data were found to be normally distributed, and are expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ). The independent sample *t*-test was used for comparison between groups, and multiple time point comparisons were analyzed using repeated-measures analysis. Count data were expressed as [n (%)], and groups were compared using the  $\chi^2$  test. *p*-values  $< 0.05$  were considered statistically significant.

**Table 1. Comparison of general characteristics between the two groups of patients [ $\bar{x} \pm s$ , n (%)].**

Items	Observation group (n = 100)	Control group (n = 100)	$\chi^2/t$ -value	p-value	
Gender	Male	54 (54%)	48 (48%)	0.720	0.396
	Female	46 (46%)	52 (52%)		
Age (years)	9.39 $\pm$ 2.54	8.92 $\pm$ 2.38	1.350	0.178	
Height (cm)	138.56 $\pm$ 10.87	140.28 $\pm$ 11.69	1.078	0.283	
Weight (kg)	29.50 $\pm$ 5.42	29.78 $\pm$ 6.13	0.342	0.733	
Course of disease (months)	16.54 $\pm$ 4.34	16.12 $\pm$ 4.65	0.660	0.510	

**Table 2. Comparison of perioperative indicators between the two groups of patients ( $\bar{x} \pm s$ ).**

Groups	Patients	Operation time (min)	First postoperative exhaust time (h)	Hospitalization time (d)
Control group	100	49.96 $\pm$ 6.82	24.29 $\pm$ 2.50	5.85 $\pm$ 1.53
Observation group	100	35.34 $\pm$ 5.93	18.43 $\pm$ 1.72	4.12 $\pm$ 0.76
t-value		16.177	19.311	10.127
p-value		<0.001	<0.001	<0.001

## Results

### *Comparison of General Characteristics between the Two Groups of Patients*

There was no statistically significant difference in the general characteristics such as gender, age, height, weight, and course of disease between the two groups of patients ( $p > 0.05$ ), and they were comparable (Table 1).

### *Comparison of Perioperative Indicators between the Two Groups of Patients*

The perioperative index results of the two groups of patients showed that the operation time, first postoperative exhaust time, and hospitalization time in the observation group were significantly shorter than those in the control group ( $p < 0.05$ ) (Table 2).

### *Comparison of VAS Scores between the Two Groups of Patients*

The VAS scores of the patients in the observation group were lower than those in the control group at each time point of 6 h, 12 h, 24 h, and 48 h after surgery ( $p < 0.05$ ) (Table 3).

### *Comparison of Stress Index Levels between the Two Groups of Patients*

The test results of the stress indices of the two groups of patients showed that there was no statistically significant difference in the serum levels of Cor, NE, or ACTH between the two groups of patients before surgery ( $p > 0.05$ ). One hour after surgery, the serum Cor, NE, and ACTH levels of the two groups of patients were significantly higher than those before surgery; and the serum Cor, NE, and ACTH levels of the observation group were significantly lower than those of the control group ( $p < 0.05$ ) (Table 4).

### *Comparison of Quality of Life Scores between the Two Groups of Patients*

The survey results of the quality of life scores of the two groups of patients showed that before treatment, there was no significant difference in the quality of life scores of the two groups of patients ( $p > 0.05$ ). After treatment, the quality of life scores of patients in both groups were significantly higher than before treatment, and the quality of life scores of patients in the observation group were significantly higher than those in the control group ( $p < 0.05$ ) (Table 5).

### *Comparison of Postoperative Complication Rates between the Two Groups*

During the treatment, patients in both groups experienced varying degrees of adverse reactions such as incision infection, abdominal pain and distension, adhesive intestinal obstruction, abdominal abscess, and vomiting, but all were effectively alleviated or disappeared after symptomatic treatment. The postoperative complication rate of the observation group was 3.00% (3/100), which was significantly lower than that of the control group (13.00% (13/100)) ( $\chi^2 = 6.793, p = 0.009$ ) (Table 6).

### *Comparison of Nursing Satisfaction between the Two Groups of Patients*

The results of the nursing satisfaction survey showed that the nursing satisfaction of the observation group was 95.00% (95/100), which was significantly higher than that of the control group (79.00% (79/100)) ( $\chi^2 = 11.317, p = 0.001$ ) (Table 7).

## Discussion

Obstruction and pathogenic infection are the main causes of acute appendicitis [13]. The appendix in children has a thin tubular structure and a small cavity, which is prone to obstruction. After obstruction occurs, a closed chamber is formed, and secretions remain in this closed chamber. The

**Table 3. Comparison of VAS scores between the two groups of patients ( $\bar{x} \pm s$ , score).**

Groups	Patients	6 h after surgery	12 h after surgery	24 h after surgery	48 h after surgery
Control group	100	4.70 ± 0.76	3.84 ± 0.71	2.77 ± 0.63	2.25 ± 0.43
Observation group	100	3.61 ± 0.68	2.73 ± 0.49	1.80 ± 0.40	1.12 ± 0.32
Comparison between groups F, <i>p</i> -value		16.487, <0.001			
Intra-group comparison F, <i>p</i> -value		23.619, <0.001			
Interaction F, <i>p</i> -value		22.924, <0.001			

Note: VAS, visual analog scale.

**Table 4. Comparison of stress index levels between the two groups of patients ( $\bar{x} \pm s$ ).**

Groups	Patients	Cor (µg/L)		NE (ng/L)		ACTH (ng/L)	
		Preoperative	1 h after surgery	Preoperative	1 h after surgery	Preoperative	1 h after surgery
Control group	100	137.35 ± 8.36	185.42 ± 17.31*	140.85 ± 10.83	176.56 ± 14.72*	47.12 ± 3.73	62.59 ± 5.33*
Observation group	100	136.43 ± 8.62	149.55 ± 13.71*	141.78 ± 11.77	157.33 ± 13.61*	46.51 ± 3.55	54.67 ± 4.42*
<i>t</i> -value		0.766	16.244	0.581	9.592	1.185	11.438
<i>p</i> -value		0.445	<0.001	0.562	<0.001	0.238	<0.001

Note: Compared with the same group of patients before operation, \**p* < 0.05. Cor, cortisol; NE, norepinephrine; ACTH, adrenocorticotrophic hormone.

**Table 5. Comparison of quality of life scores between the two groups of patients ( $\bar{x} \pm s$ , score).**

Groups	Patients	Before treatment	After treatment
Control group	100	49.14 ± 4.57	67.34 ± 7.37*
Observation group	100	48.72 ± 4.52	78.45 ± 7.64*
<i>t</i> -value		0.653	10.466
<i>p</i> -value		0.514	<0.001

Note: Compared with the same group of patients before treatment, \**p* < 0.05.

intracavitary pressure gradually increases, the blood flow in the wall of the appendix is blocked, and the local tissue ischemia-necrosis is caused. This causes bacteria to multiply in the appendix cavity, promoting the occurrence and development of infections [14]. In addition, because the omentum in children is not fully developed, inflammation is limited, and the body's immune resistance is low. After the occurrence of peritonitis, toxins are easily absorbed by the human body; this accelerates the progress of the disease, increases the risk of metabolic disorders, and can even lead to death of child [15]. As a typical minimally invasive treatment method, LA has become the preferred clinical treatment for appendicitis in children [16, 17]. Although LA has made great technical progress, and the surgical trauma is significantly reduced compared with traditional surgery, it is still a traumatic therapy, especially in special cases such as artificial pneumoperitoneum [18]. As a result, the stress response increases and there is significant persistent pain. Identifying ways to improve perioperative nursing is an urgent problem to be solved in clinical practice [19]. Research by foreign scholars has shown that the pain degree of adult patients after laparoscopic surgery is no less than that of knee replacement and thoracotomy [20, 21]. Therefore, with the increasing number of laparoscopic surgeries,

especially when the number of laparoscopic surgeries performed on children continues to rise, we must pay attention to the postoperative pain response.

With recent advances in medical treatment, the traditional nursing model has been unable to meet the current needs of patients. Recent clinical data show that during laparoscopic surgery for pediatric appendicitis, appropriate nursing interventions are needed so that the patient's condition can be stabilized, the patient's hospital stay can be short, safe, and effective [22, 23]. The combination of medical care and nursing based on rapid rehabilitation management is a new nursing model. This model makes up for the shortcomings of traditional routine nursing by providing evidence-based and effective nursing measures [24]. These measures are designed to ensure that patients receive the best nursing intervention in order to reduce the body's stress response to surgery and to promote the postoperative recovery of patients [25]. In this study, 200 children with appendicitis in our hospital were treated with LA, and different nursing modes were used during and after the operation. We compared the effects of the general nursing mode and medical care to the rapid rehabilitation nursing management mode on children with appendicitis. We measured effects on intraoperative indicators, pain level, stress responses, and quality of life. The results showed that the operation time, first postoperative exhaust time, and hospitalization time in the observation group were significantly shorter than those in the control group (*p* < 0.05). At the same time, the study found that the VAS scores of the patients in the observation group were lower than those in the control group at each time point of 6 h, 12 h, 24 h, and 48 h after surgery (*p* < 0.05). These results suggest that medical care combined with the rapid rehabilitation nursing management mode can effectively shorten the operation time of LA, help patients quickly relieve the pain brought by the operation,

**Table 6. Comparison of postoperative complication rates between the two groups [n (%)].**

Groups	Incision infection	Abdominal pain and distension	Adhesive intestinal obstruction	Abdominal abscess	Vomiting	Total
Control group	4	3	3	0	3	13 (13.00)
Observation group	1	1	0	0	1	3 (3.00)
$\chi^2$ -value						6.793
<i>p</i> -value						0.009

**Table 7. Comparison of nursing satisfaction between the two groups of patients [n (%)].**

Groups	Patients	Very satisfied	Basically satisfied	Dissatisfied	Satisfaction rate
Control group	100	33	46	21	79 (79.00)
Observation group	100	56	39	5	95 (95.00)
$\chi^2$ -value					11.317
<i>p</i> -value					0.001

and shorten the hospital stay. About 98% of patients after laparoscopic surgery need timely analgesic intervention in the recovery room, and patients still feel moderate or above pain in the first 24 h after surgery [26, 27]. Pain activates the patient’s neuroendocrine stress response to varying degrees, resulting in adverse reactions such as gastrointestinal organ dysfunction, which may lead to the patient’s continued hospitalization after surgery to eliminate adverse reactions [28]. In addition, the present study found that the quality of life score of patients in both groups was significantly higher after treatment than before treatment, and the quality of life score of patients in the observation group was significantly higher than that of the control group ( $p < 0.05$ ). The rapid rehabilitation nursing management mode combining medical and nursing care addresses more details of the life and psychology of patients, and can effectively help patients relieve anxiety and pressure brought by the disease. Preoperative and intraoperative nursing can also effectively reduce the operation time and other factors, and postoperative comprehensive nursing can also greatly reduce the occurrence of complications, so as to effectively reduce the pain of patients. The established nursing team can also design more reasonable and personalized response strategies for patient’s condition, and deal with emergencies caused by surgery in a more humane way, which is conducive to physical recovery.

LA often stimulates the body’s sympathetic nervous system, resulting in increased secretion of NE, ACTH, and epinephrine, hemodynamic changes, and elevated heart rate and blood pressure in children [29]. Some studies have pointed out that the stress response caused by surgery will greatly increase the probability of organ function damage [30, 31]. For patients undergoing surgery, the stress response can increase the risk of postoperative complications and even death [32, 33]. Therefore, we should attach great importance to the stress response of children after LA. Detecting a child’s stress level becomes even more important. Moreover, all reasonable means should be used to limit the stress level of the child to ensure that the risk has been reduced to a minimum level; this issue deserves more atten-

tion from medical workers. In this study, one hour after surgery, the serum Cor, NE, and ACTH levels of the two groups of patients were significantly higher than those before surgery, and the observation group was significantly lower than control group ( $p < 0.05$ ). The results of this study suggest that the physiological stress response of patients in the observation group were effectively alleviated when medical care was combined with the rapid rehabilitation nursing management mode. In addition, the postoperative complication rate of the observation group was 3.00% (3/100), which was significantly lower than that in the control group (13.00% (13/100)) ( $\chi^2 = 6.793, p = 0.009$ ). The nursing satisfaction of the observation group was 95.00% (95/100), which was significantly higher than that of the control group (79.00% (79/100)) ( $\chi^2 = 11.317, p = 0.001$ ). We speculate that the children in the observation group received more attention during the operation.

Before the operation begins, children should understand and adapt to the operating room environment, and be provided with comfortable temperature and humidity, as well as music, to reduce their physiological discomfort. After surgery, the children received active encouragement and communication, their attention was shifted, and they were given alternating hot and cold compresses to relieve local pain. At the same time, nutritionists provided children with a variety of high-nutrition, scientific diets to promote their recovery. Together with the joint efforts of multiple medical care departments, the children’s stress reactions were significantly alleviated. The most common complication of acute appendicitis in children is incisional infection, followed by intestinal adhesion, intestinal obstruction, abdominal abscess (empyema), and other less common complications [34]. With increasing severity of appendicitis, the incidence of complications, especially wound infection, increases significantly, affecting the physical and mental health of children after surgery [35]. Therefore, parents should be aware of the early clinical manifestations of acute appendicitis in children, pay attention to early diagnosis, and seek medical treatment as soon as possible. Delayed diagnosis and treatment of acute appendicitis in children may

not only cause simple appendicitis to develop into suppurative and gangrenous appendicitis which is not only difficult for operation and treatment, but also more likely to cause postoperative complications such as incision infection [36]. In this study, the two groups of patients had different degrees of incision infection, abdominal pain and distension, adhesive intestinal obstruction, abdominal abscess, vomiting, and other adverse reactions, but they were effectively improved or disappeared after symptomatic treatment.

The goal of the integrated medical care mode is to provide patients with holistic medical services that combine nursing, rehabilitation, and treatment provided by medical teams [37, 38]; these services can enhance the communication and cooperation between doctors and patients, shorten the postoperative hospitalization time of patients, and improve patient satisfaction [39]. In this study, rapid rehabilitation surgery with integrated medical care combining with routine nursing methods was employed in the perioperative nursing of pediatric laparoscopic surgery for appendicitis, which reduced the physical and psychological traumatic stress of patients, reduced the incidence of complications, and shortened the postoperative rehabilitation process of patients, thus achieving the goal of improving the quality of medical and nursing services and patient satisfaction. This treatment mode is worthy of clinical application.

## Conclusions

In summary, the integrated rapid rehabilitation nursing management mode is an intervention that can effectively alleviate the effects of LA on the stress response, pain degree, and quality of life of children with appendicitis. It can effectively reduce the incidence of postoperative complications, improve the nursing satisfaction of patients, promote the postoperative recovery of children with appendicitis as soon as possible, and improve the daily life ability of patients. It helps to improve the overall clinical efficacy, and the treatment process is simple, relatively safe, and reliable. The intervention has high use value and is worthy of further promotion in clinical treatment. However, the sample size of this study was limited, and the dynamic changes in serum stress indices in children with appendicitis during treatment were not detected. Additional studies should be conducted with larger sample sizes.

## Availability of Data and Materials

The data used to support the findings of this study are included within the article, and during the present study are available from the corresponding author on reasonable request.

## Author Contributions

HBH, KJQ, YY and HZX designed the research study. HBH and KJQ performed the research. YY analyzed the data. HBH wrote the original draft. All authors revised the

manuscript critically for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

## Ethics Approval and Consent to Participate

This study was approved by the Children's Hospital, Zhejiang University School of Medicine Medical Ethics Committee (KY-2024-0149), and the families provided informed consent regarding all aspects of the study. This study adhered to the principles outlined in the Helsinki Declaration.

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## Conflict of Interest

The authors declare no conflict of interest.

## References

- [1] Krzyzak M, Mulrooney SM. Acute Appendicitis Review: Background, Epidemiology, Diagnosis, and Treatment. *Cureus*. 2020; 12: e8562.
- [2] Nechay T, Sazhin A, Titkova S, Tyagunov A, Anurov M, Melnikov-Makarchuk K, *et al.* Author Correction: Evaluation of enhanced recovery after surgery program components implemented in laparoscopic appendectomy: prospective randomized clinical study. *Scientific Reports*. 2021; 11: 18646.
- [3] Gu Q, Hua Y. Perforated appendicitis treated with laparoscopic appendectomy or open appendectomy: A meta-analysis. *Journal of Minimal Access Surgery*. 2023; 19: 348–354.
- [4] Rajindrajith S, Devanarayana NM, Benninga MA. Childhood constipation: Current status, challenges, and future perspectives. *World Journal of Clinical Pediatrics*. 2022; 11: 385–404.
- [5] Tan GM, Murto K, Downey LA, Wilder MS, Goobie SM. Error traps in Pediatric Patient Blood Management in the Perioperative Period. *Paediatric Anaesthesia*. 2023; 33: 609–619.
- [6] Guitoli E, Gallo G, Cardone E, Conti L, Famularo S, Formisano G, *et al.* Consensus Statement of the Italian Polispécialistic Society of Young Surgeons (SPIGC): Diagnosis and Treatment of Acute Appendicitis. *Journal of Investigative Surgery: the Official Journal of the Academy of Surgical Research*. 2021; 34: 1089–1103.
- [7] Li R, Shen X, Zhang L, Chan Y, Yao W, Zhang G, *et al.* Effects of Child Life intervention on the symptom cluster of pain-anxiety-fatigue-sleep disturbance in children with acute leukemia undergoing chemotherapy. *Asia-Pacific*



Journal of Oncology Nursing. 2023; 10: 100243.

[8] Hu A, Chaudhury AS, Fisher T, Garcia E, Berman L, Tsao K, et al. Barriers and facilitators of CT scan reduction in the workup of pediatric appendicitis: A pediatric surgical quality collaborative qualitative study. *Journal of Pediatric Surgery*. 2022; 57: 582–588.

[9] Hall NJ, Eaton S, Sherratt FC, Reading I, Walker E, Chorozoglou M, et al. CONservative TRreatment of Appendicitis in Children: a randomised controlled feasibility Trial (CONTRACT). *Archives of Disease in Childhood*. 2021; 106: 764–773. (online ahead of print)

[10] Li S, Zhang H, Chen M, Wang Z, Lin Y. A multidisciplinary team nursing model in the treatment of patients undergoing transapical mitral valve clamping: a prospective study. *Journal of Cardiothoracic Surgery*. 2021; 16: 203.

[11] Lv C, Zou J, Shen S, Zhang F. Visual analog scale and linguistic evaluation scale for the comparison of postoperative pain assessment. *Journal of Clinical and in General Medicine Education*. 2004; 2: 214–215, 219. (In Chinese)

[12] Ware JE, Jr, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *Journal of Clinical Epidemiology*. 1998; 51: 903–912.

[13] Moris D, Paulson EK, Pappas TN. Diagnosis and Management of Acute Appendicitis in Adults: A Review. *JAMA*. 2021; 326: 2299–2311.

[14] Smith HF. A review of the function and evolution of the cecal appendix. *Anatomical Record (Hoboken, N.J.: 2007)*. 2023; 306: 972–982.

[15] Blohs M, Mahnert A, Brunnader K, Flucher C, Castellani C, Till H, et al. Acute appendicitis manifests as two microbiome state types with oral pathogens influencing severity. *Gut Microbes*. 2023; 15: 2145845.

[16] Di Saverio S, Podda M, De Simone B, Ceresoli M, Augustin G, Gori A, et al. Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. *World Journal of Emergency Surgery: WJES*. 2020; 15: 27.

[17] Poprom N, Wilasrusmee C, Attia J, McEvoy M, Thakkinstian A, Rattanasiri S. Comparison of postoperative complications between open and laparoscopic appendectomy: An umbrella review of systematic reviews and meta-analyses. *The Journal of Trauma and Acute Care Surgery*. 2020; 89: 813–820.

[18] Alkatout I, Mechler U, Mettler L, Pape J, Maass N, Biebl M, et al. The Development of Laparoscopy-A Historical Overview. *Frontiers in Surgery*. 2021; 8: 799442.

[19] Leppänen T, Kvist T, McDermott-Levy R, Kankkunen P. Nurses' and nurse managers' perceptions of sustainable development in perioperative work: A qualitative study. *Journal of Clinical Nursing*. 2022; 31: 1061–1072.

[20] van Dijk JFM, Zaslansky R, van Boekel RLM, Cheuk-Alam JM, Baart SJ, Huygen FJPM, et al. Postoperative Pain and Age: A Retrospective Cohort Association Study.

*Anesthesiology*. 2021; 135: 1104–1119.

[21] Afshan G, Khan RI, Ahmed A, Siddiqui AS, Rehman A, Raza SA, et al. Post-operative pain management modalities employed in clinical trials for adult patients in LMIC: a systematic review. *BMC Anesthesiology*. 2021; 21: 160.

[22] Zhang SM, Chen J, Li H, Guo MF, Han N, Sun JS, et al. Clinical application of enhanced recovery after surgery concept in laparoscopic treatment of pediatric acute appendicitis. *Pediatric Surgery International*. 2023; 39: 178.

[23] Zhang A, Lu H, Chen F, Wu Y, Luo L, Sun S. Systematic review and meta-analysis of the effects of the perioperative enhanced recovery after surgery concept on the surgical treatment of acute appendicitis in children. *Translational Pediatrics*. 2021; 10: 3034–3045.

[24] Dean J, Jones M, Dyer P, Moulton C, Price V, Lasser-D. Possible futures of acute medical care in the NHS: a multispecialty approach. *Future Healthcare Journal*. 2022; 9: 125–132.

[25] Eriksson J, Lindgren BM, Lindahl E. Newly trained operating room nurses' experiences of nursing care in the operating room. *Scandinavian Journal of Caring Sciences*. 2020; 34: 1074–1082.

[26] Bindra V, Nori M, Reddy R, Reddy R, Satpathy G, Reddy CA. Sciatic nerve endometriosis - The correct approach matters: A case report. *Case Reports in Women's Health*. 2023; 38: e00515.

[27] Li G, Tian DD, Wang X, Feng X, Zhang W, Bao J, et al. Muscular Tissue Oxygen Saturation and Posthysterectomy Nausea and Vomiting: The iMODIPONV Randomized Controlled Trial. *Anesthesiology*. 2020; 133: 318–331.

[28] Drewes AM, Olesen AE, Farmer AD, Szigethy E, Rebour V, Olesen SS. Gastrointestinal pain. *Nature Reviews. Disease Primers*. 2020; 6: 1.

[29] Zeraatpishe F, Valiani M, Honarmand A, Aarabi A. The effect of a flexible family visit on nausea, vomiting, pain and physiological parameters after laparoscopic cholecystectomy in post-anesthesia care unit: A randomized controlled trial. *Perioperative Care and Operating Room Management*. 2021; 25: 100222.

[30] Naito H, Nojima T, Fujisaki N, Tsukahara K, Yamamoto H, Yamada T, et al. Therapeutic strategies for ischemia reperfusion injury in emergency medicine. *Acute Medicine & Surgery*. 2020; 7: e501.

[31] Fernández AR, Sánchez-Tarjuelo R, Cravedi P, Ochando J, López-Hoyos M. Review: Ischemia Reperfusion Injury-A Translational Perspective in Organ Transplantation. *International Journal of Molecular Sciences*. 2020; 21: 8549.

[32] Dencker EE, Bonde A, Troelsen A, Varadarajan KM, Sillesen M. Postoperative complications: an observational study of trends in the United States from 2012 to 2018. *BMC Surgery*. 2021; 21: 393.

[33] Shinall MC, Jr, Arya S, Youk A, Varley P, Shah R, Massarweh NN, et al. Association of Preoperative Patient

Frailty and Operative Stress with Postoperative Mortality. *JAMA Surgery*. 2020; 155: e194620.

[34] Lv CC, Qi SQ, Huang H, Le SL, Huang BS, Xiang Y. Laparoscopic appendectomy for complicated appendicitis in children: A retrospective study. *Hong Kong Journal of Paediatrics (New Series)*. 2020; 25: 217–221.

[35] Minneci PC, Hade EM, Lawrence AE, Sebastião YV, Saito JM, Mak GZ, et al. Association of Nonoperative Management Using Antibiotic Therapy vs Laparoscopic Appendectomy with Treatment Success and Disability Days in Children with Uncomplicated Appendicitis. *JAMA*. 2020; 324: 581–593.

[36] Lounis Y, Hugo J, Demarche M, Seghaye MC. Influence of age on clinical presentation, diagnosis delay and outcome in pre-school children with acute appendicitis. *BMC Pediatrics*. 2020; 20: 151.

[37] Zhou Y, Li Y, Zhu X, Ma L. Medical and Old-age Care Integration Model and Implementation of the Inte-

grated Care of Older People (ICOPE) in China: Opportunities and Challenges. *The Journal of Nutrition, Health & Aging*. 2021; 25: 720–723.

[38] Jiang Y. Application of Medical-Nursing-Assistance Integration Model Based on Theoretical Basis of Behavioral Psychology in Management of Children's ICU. *Computational and Mathematical Methods in Medicine*. 2022; 2022: 1744357.

[39] Li Q, Wang Y, Shen X. Improvement of Negative Psychological Stress Response in Elderly Patients with Femoral Neck Fracture by Integrated High-Quality Nursing Model of Medical Care. *Frontiers in Surgery*. 2022; 9: 859269.

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