

## Original Article

# Effects of fasting and water deprivation regimen under the concept of enhanced recovery after surgery on the improvement of nursing quality during pediatric surgery

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**Abstract:** Objectives: This study aimed to analyze the effects of fasting and water deprivation regimen under the concept of enhanced recovery after surgery (ERAS) on the improvement of nursing quality during pediatric surgery. Methods: A total of 150 children underwent surgical treatment in our hospital were selected as the study subjects and divided into the observation group (n=77) and the control group (n=73) according to the preoperative diet plan. The control group received conventional fasting and water deprivation regimen, while the observation group received fasting and water deprivation regimen under the concept of ERAS. The nursing qualities were compared between the two groups. Results: The preoperative duration of fasting and water deprivation and the *postoperative initial feeding time* of infants aged 1, 2 and 3 years in the observation group were shorter than those in the control group ( $P < 0.05$ ). The thirst and hunger scores in the observation group were lower than those in the control group ( $P < 0.05$ ). The incidence of intraoperative crying, postoperative aspiration, nausea and vomiting, and abdominal distension were 9.09%, 5.19%, 16.88%, and 6.49% respectively in the observation group, while those were 32.88%, 26.03%, 46.58%, and 28.77% respectively in the control group ( $P < 0.05$ ). Conclusion: The fasting and water deprivation regimen under the concept of ERAS during pediatric surgery can markedly improve nursing quality, shorten the postoperative initial feeding time, reduce the incidence of crying, aspiration, nausea and vomiting, and abdominal distension, and alleviate the degree of thirst and hunger.

**Keywords:** Infants, surgery, enhanced recovery after surgery, fasting and water deprivation regimen, analysis of nursing quality

## Introduction

The pediatric surgery has been widely used in clinical practice. The proper preoperative fasting and water deprivation are of great significance to ensure a successful surgery and a smooth postoperative recovery. Infants have high nutritional needs and are less cooperative in surgery than adults. The long duration of preoperative fasting and water deprivation may lead to the crying and agitation of pediatric patients. This may affect the surgical compliance and hinder surgical success [1, 2].

Specifically, the concept of enhanced recovery after surgery (ERAS) is that based on evidence of evidence-based medicine (EBM), the coordination of multiple disciplines including nursing, anesthesia and surgery, and the optimization

of the contents of perioperative intervention, efforts are made to minimize perioperative stress response, alleviate the incidence of postoperative complications and shorten the postoperative recovery time of pediatric patients [3, 4]. The concept of early ERAS has been widely adopted in developed countries in Europe and America, while it was introduced into China recently. However, with the continuous deepening of the studies, the concept of ERAS has been widely applied in multiple surgical nursing fields, and the standardization of multiple intervention contents has been gradually improved [5, 6]. In view of infants' high nutritional needs and low surgical compliance, conventional fasting and water deprivation regimen is adopted in most hospitals in pediatric surgery, and the caution is 5 regarding shortening the fasting and water deprivation

time [7]. Under the concept of ERAS, the intake of solid food 6 h before surgery and the water intake 2 h before surgery can be adopted as long as there is no gastrointestinal function disorder [8].

In this study, the different implementation effects of fasting and water deprivation regimen under the concept of ERAS and conventional fasting and water deprivation regimen were compared to explore more alternative methods for preoperative diet plan for infants underwent surgery.

### Materials and methods

#### General data

A total of 150 children underwent elective surgery in our hospital from October 2018 to December 2019 were selected as the study subjects and were divided into the observation group (n=77) and the control group (n=73) according to preoperative diet plan. Inclusion criteria: patients aged 1-3 years; elective surgical treatment; preoperative fasting and water deprivation required; in line with the indications of surgery and anesthesia; parents understood the study content and voluntarily signed the consent form; this study was conducted with the approval of the ethical examination by the Ethics Committee of the First Affiliated Hospital of Hainan Medical University. Exclusion criteria: the study excluded patients with emergency surgery; those with contraindications of anesthesia; those who aged > 6 years; those with preoperative dysphagia; those with preoperative malnutrition; and those with preoperative gastrointestinal diseases.

#### Methods

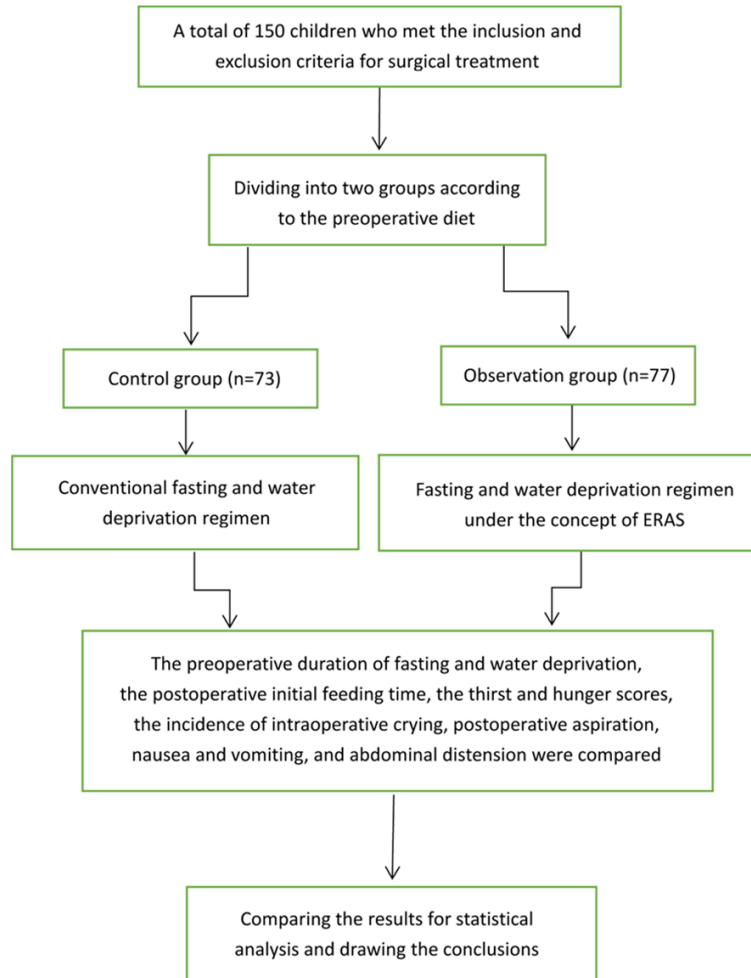
**Control group:** According to the conventional preoperative diet plan, the intervention was performed. It was expected that the infants underwent surgery in the morning would start fasting at 0:00 am on the day of surgery and water deprivation at 2:00 am. It was estimated that the infants underwent surgery in the afternoon would start fasting at 2:00 a.m. and water deprivation at 4:00 a.m. After the infants were brought to the ward after surgery, the nursing staff conducted the assessment according to the conventional nursing methods to ensure that there were no signs of

nausea and vomiting. Upon confirmation of a clear consciousness and willingness to eating, the infants were allowed to drink water 6 h after surgery, and then were allowed to eat.

**Observation group:** The ERAS group was composed of anesthesiologists, surgeons and nurses in the operating room (OA). After consulting *the Expert Consensus on Enhanced Recovery after Surgery* and relevant guidelines and conducting comprehensive assessment of infants' conditions, the individualized diet plan was formulated. The preoperative diet plan was as follows: (1) The exclusively breast-fed infants were allowed to receive breast-feeding 4 h before surgery, and 10% sugar water and pure water 2-4 h before surgery. Infants who were fed with breast milk and formula milk were fed with dairy products and formula milk 6 h before surgery, and pure water and 10% sugar water 2-4 h before surgery. Infants who were fed with pure formula milk were fed with dairy products and formula milk 6 h before surgery, and pure water 4 h before surgery and 10% sugar water 2-4 h before surgery. (2) Infants who received supplementary food were fed with semi-liquid foods, such as infant rice cereal and lotus root starch, 6 h before surgery. Meanwhile, they were fed with dairy products and formula milk, and slag-free juice, pure water or 10% sugar water 2-4 h before surgery. (3) Infants who received normal diet were allowed to receive normal diet 8 h before surgery, and had boiled milled rice and steamed bread 6 h before surgery. Meanwhile, they could have milk, and have clear tea, slag-free juice, clear water or 10% sugar water 2-4 h before surgery. The total amount of water consumed by the aforementioned infants 2-4 h before surgery was controlled below 5 ml/kg. The flow chart was as shown in **Figure 1**.

**Postoperative diet plan:** After the infants were transferred to the general ward after surgery, the nursing staff scored using the Steward Recovery scale, and assessed the degree of recovery once every 15 minutes. The scores ranged from 0 to 6 5epoints. A score of below 4 points indicated no recovery, while a score of 4 points or above meant recovered. The assessment exhibited a score of 4 points or above, and the infants revealed no signs of nausea and vomiting. Therefore, the infants were placed in a semi-recumbent position,

## Effects of fasting and water deprivation regimen



**Figure 1.** Flow chart of this study.

and fed with 15 ml of warm boiled water. After 15 min of observation, if the infants revealed no discomfort, formula milk, breast milk, and supplementary food were selected according to preoperative eating habits. The 50% of normal food intake was maintained, and then the intake was gradually increased until normal diet was restored.

### *Observation indices*

General data: basic data, including gender, age, ward, body mass index (BMI) and hospital stay, were collected.

Duration of fasting and water deprivation: The duration of preoperative fasting and water deprivation and postoperative initial feeding time were recorded in the two groups. Among them, the duration of preoperative fasting was the interval between the last feeding time

before surgery and the start time of surgery. The preoperative water deprivation time was the interval between the last water intake time before surgery and the start time of surgery. The postoperative initial feeding time was the interval between the end time of surgery and the postoperative initial feeding time.

Degree of thirst or hunger: The assessment was performed using the visual analogue scale (VAS) [9], and a scale of 0-10 marks was prepared. 0 indicates no thirst or hunger, and 10 represents unbearable thirst or hunger sensation, even a sign of dehydration or hypoglycemia. A greater mark score indicates a higher degree of thirst or hunger.

Incidence of crying: The ratio of infants who cried continuously for more than 5 minutes based on completely eliminating the influences of pain or other reasons was recorded. One infant who had cried for many times was taken as one case. The incidence of crying = the number of crying infants/150\*100%.

Incidence of aspiration: The incidence of aspiration was recorded and compared between the two groups during anesthesia. The aspiration rate = the number of infants with aspiration/150\*100%. Determination of aspiration: Nursing staff observed that the stomach contents of infants entered the throat cavity and trachea in countercurrent flow.

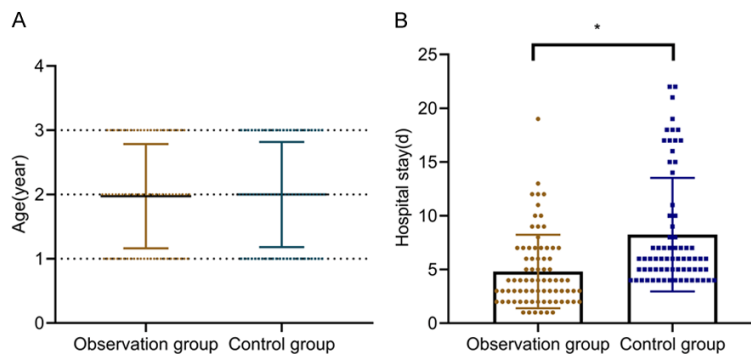
Incidence of nausea and vomiting: The incidence of postoperative nausea and vomiting was recorded and compared between the two groups. The incidence of nausea and vomiting = the number of infants with nausea and vomiting/150\*100%.

Incidence of abdominal distension: The incidence of postoperative abdominal distension

## Effects of fasting and water deprivation regimen

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

Data		Observation group (n=77)	Control group (n=73)	t/X <sup>2</sup>	P
Sex	M	41 (53.25)	38 (52.05)	0.021	0.884
	F	36 (46.75)	35 (47.95)		
Mean age (years)		2.02±0.36	2.05±0.39	0.490	0.625
Age range	1 year old	27 (35.06)	23 (31.51)	1.052	0.316
	2 years old	28 (36.36)	22 (30.14)		
	3 years old	22 (28.57)	28 (38.36)		
BMI (kg/m <sup>2</sup> )		15.89±1.38	16.24±1.42	1.531	0.128
Hospital stay (d)		5.67±3.19	7.78±3.26	4.006	0.000
Ward	Otolaryngology ward	6 (7.79)	3 (4.11)	0.846	0.117
	Ward for surgery for joint trauma	3 (3.90)	2 (2.74)		
	Ward for spinal bone surgery	4 (5.19)	3 (4.11)		
	Stomatological ward	23 (29.87)	18 (26.66)		
	Urology ward	24 (31.17)	22 (30.14)		
	General surgical ward	17 (22.08)	16 (21.92)		
	Neurosurgery ward	2 (2.60)	2 (2.74)		
	Ophthalmic ward	3 (3.90)	2 (2.74)		



**Figure 2.** Comparison of age and hospital stay between the two groups. There was no significant difference in the age between the control group (A) and the observation group ( $P > 0.05$ ). The postoperative hospital stay in the observation group was markedly lower than that in the control group (B) ( $P < 0.05$ ). \* indicates the comparison between the two groups ( $P < 0.05$ ).

was recorded and compared between the two groups. The incidence of abdominal distension = the number of infants with abdominal distension/150\*100%. Determination of abdominal distension: It felt hard when pressing on the abdomen, and there was a varying degree of banging when knocking on the abdomen.

### Statistical analysis

SPSS23.0 was adopted for statistical analysis. The measurement data were expressed as ( $\bar{x} \pm s$ ). The comparison of results was performed using the independent sample t test.

The enumeration data were expressed as [n (%)]. The comparison of results was performed using X<sup>2</sup> test. The multi-point comparison within groups was performed using ANOVA, and detected using F test. The graphs were made using Graphpad Prism 8.  $P < 0.05$  indicated a statistically significant difference.

## Results

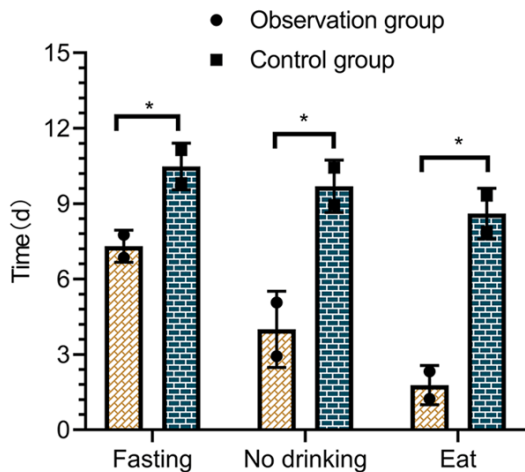
### General data

There was no statistically significant difference in the ratios of male and female infants, age of 1-3 years old, and wards between the observation group and the control group. There was no statistically significant difference in the mean age and BMI between the two groups ( $P > 0.05$ ). The mean hospital stay in the observation group was shorter than that in the control group, showing statistically significant difference ( $P < 0.05$ ) (Table 1 and Figure 2).

### Duration of fasting and feeding time

The observation group had a shorter duration of preoperative fasting and water deprivation

## Effects of fasting and water deprivation regimen



**Figure 3.** Comparison of the duration of fasting and feeding time between the two groups. Compared with those in the control group, the duration of preoperative fasting and water deprivation and the postoperative initial feeding time in the observation group were remarkably shorter ( $P < 0.05$ ). \* indicates the comparison between the two groups ( $P < 0.05$ ).

and a shorter postoperative initial feeding time than those of the control group, showing statistically significant difference ( $P < 0.05$ ) (Figure 3).

### *Duration of fasting and feeding of infants of different ages*

The duration of preoperative fasting and water deprivation of infants aged 1, 2 and 3 years in the observation group were shorter than those in the control group, and the postoperative initial feeding time in the observation group was shorter than that in the control group ( $P < 0.05$ ) (Figure 4).

### *Degree of thirst or hunger*

Compared with the control group, the observation group had markedly lower preoperative thirst and hunger scores before surgery ( $P < 0.05$ ). There was no statistically significant difference in the comparison of the thirst and hunger scores between the two groups after surgery and within groups before surgery ( $P > 0.05$ ). The thirst and hunger scores in the observation group were lower than those in the control group after surgery ( $P < 0.05$ ) (Figure 5).

### *Incidence of crying*

In the observation group, there were 7 infants with the incidence of intraoperative crying, with

the incidence of crying of 9.09% (7/77). In the control group, there were 24 infants with incidence of intraoperative crying, with the incidence of crying of 32.88% (24/73). The incidence of intraoperative crying in the observation group was significantly lower than that in the control group, indicating statistically significant difference ( $P < 0.05$ ) (Table 2).

### *Incidence of aspiration*

In the observation group, there were 4 infants with postoperative aspiration, with the incidence of aspiration of 5.19% (4/77). In the control group, there were 19 infants with postoperative aspiration, with the incidence of aspiration of 26.03% (19/73). The incidence of postoperative aspiration in the observation group was remarkably lower than that in the control group ( $P < 0.05$ ) (Table 3).

### *Incidence of nausea and vomiting*

In the observation group, there were 13 infants with postoperative nausea and vomiting, with the incidence of nausea and vomiting of 16.88% (13/77). In the control group, there were 34 infants with postoperative nausea and vomiting, with the incidence of nausea and vomiting of 46.58% (34/73). The incidence of postoperative nausea and vomiting in the observation group was markedly lower than that in the control group ( $P < 0.05$ ) (Table 4).

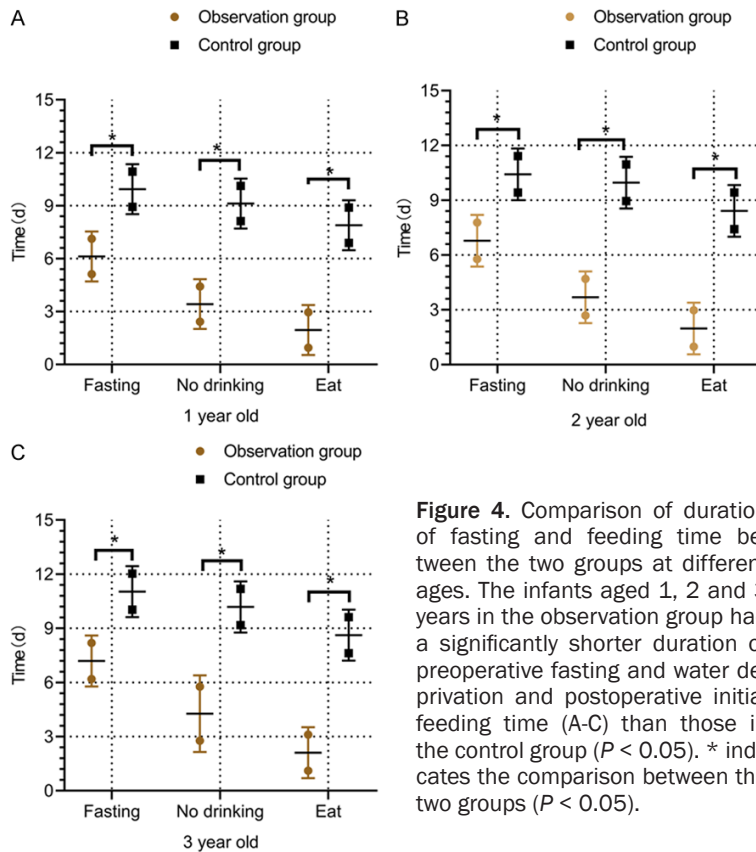
### *Incidence of abdominal distension*

In the observation group, there were 5 infants with postoperative abdominal distension, with the incidence of abdominal distension of 6.49% (5/77). In the control group, there were 21 infants with postoperative abdominal distension, with the incidence of abdominal distension of 28.77% (21/73). The incidence of abdominal distension in the observation group was significantly lower than that in the control group ( $P < 0.05$ ) (Table 5).

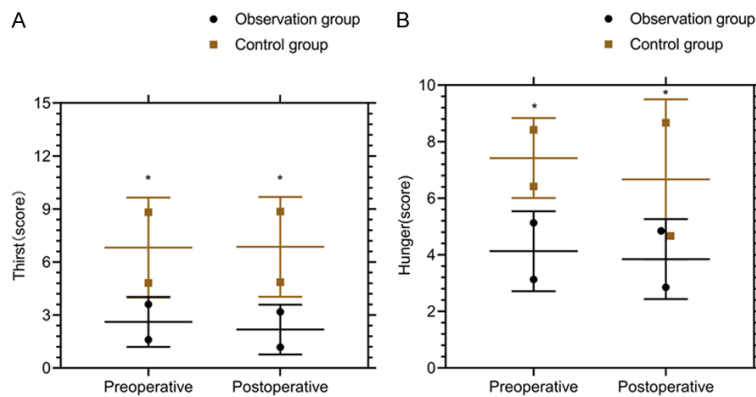
## Discussion

Preoperative fasting and water deprivation have become the conventional operations in the perioperative period of surgery. The conventional fasting for 10-12 h and water deprivation for 4-6 h before surgery are required. However, the long duration of fasting and water deprivation can make infants obviously hungry, resulting in a stronger degree of fear

## Effects of fasting and water deprivation regimen



**Figure 4.** Comparison of duration of fasting and feeding time between the two groups at different ages. The infants aged 1, 2 and 3 years in the observation group had a significantly shorter duration of preoperative fasting and water deprivation and postoperative initial feeding time (A-C) than those in the control group ( $P < 0.05$ ). \* indicates the comparison between the two groups ( $P < 0.05$ ).



**Figure 5.** Comparison of thirst and hunger scores between the two groups. There was no significant difference in the preoperative thirst score (A) and hunger score (B) between the control group and the observation group ( $P > 0.05$ ). However, the observation group had markedly lower thirst score (A) and hunger score (B) than that in the control group after surgery. \* indicates the comparison between the two groups ( $P < 0.05$ ).

for surgery. In severe cases, infants experience hypotension, dehydration and hypoglycemia [10, 11]. Due to the light body weight and fast metabolism, infants need to be fed multiple times a day and are less likely to tolerate dis-

comfort. Therefore, infants are prone to display more obvious discomfort than adults after a long duration of water deprivation and fasting [12].

Currently, with the progress of medical technologies, the changes of medical service concept and the improvement of people's standards of living, the quality and comfort of surgery have been paid more and more attention [13]. In addition, the concept of ERAS has been widely applied in clinics, resulting in a reduced implementation of conventional fasting and water deprivation regimen, and a rising demand for a new preoperative diet regimen [14]. How to minimize discomfort on the premise of ensuring a smooth and safe surgery has been widely explored in clinical practice, and reducing duration of preoperative fasting and water deprivation remains the focus of the studies of numerous scholars [15, 16]. In this study, the control group had a longer duration of preoperative fasting and water deprivation, and even underwent excessive fasting compared with that in previous related studies. The observation group received a diet plan formulated according to the characteristics of infants and relevant guidelines, and the duration of fasting and water deprivation was significantly shortened. The results exhibited that the observation group had an earlier postop-

erative initial feeding time. Studies suggested that the early postoperative eating was conducive to alleviating the impacts on the nutritional status of infants and promoting a faster postoperative recovery [17]. Studies have also

## Effects of fasting and water deprivation regimen

**Table 2.** Comparison of the incidence of intraoperative crying between the two groups [n (%)]

Group	Number of cases	Crying	Without crying
Observation group	77	7 (9.09)	70 (90.91)
Control group	73	24 (32.88)	49 (67.12)
$\chi^2$		12.931	
<i>P</i>		0.000	

**Table 3.** Comparison of incidence of postoperative aspiration between two groups [n (%)]

Group	Number of cases	Aspiration	Without aspiration
Observation group	77	4 (5.19)	73 (94.81)
Control group	73	19 (26.03)	54 (73.97)
$\chi^2$		12.527	
<i>P</i>		0.000	

**Table 4.** Comparison of incidence of postoperative nausea and vomiting between the two groups [n (%)]

Group	Number of cases	Nausea and vomiting	Without nausea and vomiting
Observation group	77	13 (16.88)	64 (83.12)
Control group	73	34 (46.58)	39 (53.42)
$\chi^2$		15.355	
<i>P</i>		< 0.000	

**Table 5.** Comparison of incidence of postoperative abdominal distension between the two groups [n (%)]

Group	Number of cases	Abdominal distension	Without abdominal distension
Observation group	77	5 (6.49)	72 (93.51)
Control group	73	21 (28.77)	52 (71.23)
$\chi^2$		12.975	
<i>P</i>		0.000	

revealed that the duration (4 h) of fasting and the duration (2 h) of water deprivation before surgery could effectively improve the perioperative comfort of infants [18]. According to the investigation, the infant proportion of thirsty, hungry, and agitation due to thirst and hunger were over 50%, 60%, and 55% respectively [19]. Compared with adults, infants are less resistant to discomfort, and often cry when they are intolerant of discomfort. The long duration of fasting and water deprivation and the high stress status of infants lead to a quicker loss in body fluids and insufficient

blood volume [20]. In this case, the implementation of surgical treatment is more likely to cause hemodynamic disorders, which poses a greater challenge to the safety of surgery.

In this study, the observation group received a new fasting and water deprivation regimen, suggesting that the postoperative thirst and hunger scores in the observation group were lower than those in the control group ( $P < 0.05$ ). This is primarily due to the reason that the new diet plan is formulated according to the infants' diet structure, age, and conditions, the liquid diets were primarily adopted. A proper amount of food was taken 2, 4 and 6 h before surgery. This effectively reduces the infants' thirst and hunger sensation, thereby relieving anxiety and stress response for surgery [21]. In this study, the residual amount of gastric contents of infants underwent preoperative fasting was detected using ultrasonography. It exhibited that the intake of clear beverage 2 h before surgery could facilitate gastric emptying and reduce the risks of intraoperative gastric juice reflux and aspiration [8]. In this study, the observation group received the new preoperative diet plan, and the incidence of intraoperative crying and postoperative nausea and vomiting, aspiration and abdominal distension in the observation group were lower than those in the control group ( $P < 0.05$ ). This exhibited that the reduced duration of preoperative fasting and water deprivation was feasible, effectively reducing the incidence of adverse conditions and ensuring the safety of surgery. Infants'

lower esophageal sphincter is short in length and needs to be developed, and they have a greater incidence of gastric juice reflux than adults. Previously, in order to alleviate the incidence of gastric juice reflux, the duration of preoperative fasting and water deprivation was prolonged to completely empty the stomach, thus reducing reflux, vomiting and aspiration induced by anesthesia [22, 23]. However, with the deepening of the studies, it is found that infants underwent surgery under general anesthesia basically do not experience pulmonary aspiration, and a long duration of

## Effects of fasting and water deprivation regimen

fasting cannot facilitate the gastric emptying and improve the pH of gastric juice. In fact, the intake of a proper amount of water before surgery can help stimulate gastric emptying [24].

In summary, the fasting and water deprivation regimen under the concept of ERAS during pediatric surgery can significantly improve the quality of nursing, shorten the postoperative initial feeding time, reduce the incidence of crying, aspiration, abdominal distension, nausea and vomiting, and alleviate the degree of thirst and hunger. However, in this study, there are insufficient subjects enrolled, and only the duration of fasting and water deprivation are compared between the two groups. As a result, there is a lack of comprehensiveness in the results. In the future, we should conduct the comparative studies with a larger sample size and a longer period, with a focus on the prospective studies.

### Disclosure of conflict of interest

None.

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## Effects of fasting and water deprivation regimen

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