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Original Article

The effect of shortening the preoperative fasting period on patient comfort and gastrointestinal function after elective laparoscopic surgery

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Abstract: Objective: To explore the influence of shortening preoperative fasting on the comfort and gastrointestinal function of patients undergoing elective laparoscopic surgery. Methods: a total of 179 patients undergoing elective laparoscopic cholecystectomies (LC) in our hospital from March, 2019 to August, 2020 were recruited as the study cohort and placed into the research group (n=97) or the control group (n=82) according to different fasting periods assigned to each patient. In the control group, the patients were subjected to 12-h fasting and 6-h water deprivation before their surgeries, and the patients in the research group were subjected to 6-h fasting and 2-h water deprivation. The preoperative hunger and thirst, comfort, anxiety, and intraoperative aspiration, as well as the postoperative hospital stay durations, the blood glucose levels, the nausea and vomiting, the pain levels, and the times to the recovery of gastrointestinal function were compared between the two groups. Results: The research group had shorter hospital stay durations and decreased blood glucose levels. No intraoperative aspiration occurred in either group, and the incidence of postoperative nausea and vomiting in the research group was lower than it was in control group. The patients in the research group were less hungry and thirsty and were more comfortable in the preoperative period, and their preoperative self-rating anxiety scale (SAS) and postoperative visual analog scale (VAS) scores were lower than the corresponding scores in the control group. The times to first oral feeding, ambulation, anal flatus, defecation, and bowel sounds in the research group were earlier than they were in the control group. Conclusion: Shortening preoperative fasting improves the comfort levels of patients undergoing elective LC, alleviates thirst and hunger, promotes the recovery of gastrointestinal function, and relieves preoperative anxiety, postoperative pain, and adverse reactions.

Keywords: Shortening preoperative fasting, elective laparoscopic surgery, comfort, gastrointestinal function

Introduction

As a result of the aging population and lifestyle changes, the incidences of cholecystolithiasis, cholecystitis, gallbladder polyps, and other benign gallbladder diseases has been increasing [1-3]. Surgical treatment is the preferred option for these diseases [4], but traditional open cholecystectomy is traumatic and induces strong stress responses and complications, resulting in hindered postsurgical recovery and unsatisfactory surgical outcomes [5]. With the advances in and the popularization of minimally invasive approaches, laparoscopic surgery has become a feasible option [6]. Laparoscopic cholecystectomy (LC) is performed under anesthesia by making incisions of approximately 10 mm in the navel, the right anterior axillary line, the midclavicular line below the right costal margin, and the upper abdomen near the xiphoid process. After the puncture needle is inserted, carbon dioxide gas is injected into the abdominal cavity, and an insufflator is used to maintain the appropriate pressure. Afterwards, the abdominal cavity and gallbladder are observed with a laparoscope and the cholecystectomy is performed using a 3D imaging screen [7-9]. Owing to its minimally invasive procedure and fast recovery, LC has been widely favored by clinicians and patients, and has become the "gold standard" of cholecystectomy [10, 11].

Nowadays, the concept of enhanced recovery after surgery (ERAS) has attracted widespread attention, and how to improve the rehabilitation quality and recovery of postoperative patients has become a hot issue in perioperative medical care [12-14]. Perioperative fasting and water deprivation is an important ERAS procedure [15]. Reflux and aspiration induce fatal inhalation pneumonia and other serious complications for patients under general anesthesia, complications that can be reduced through strict fasting and water deprivation [16, 17]. Therefore, patients are generally not allowed to eat for 8-12 hours or to drink for 4-6 hours prior to traditional surgery. Fasting and water deprivation before elective surgery aim to reduce the gastric volume and acidity and prevent nausea, vomiting and aspiration during anesthesia [18, 19]. A study has shown that excessive preoperative fasting causes malnutrition and this malnutrition is responsible for prolonged hospitalization and increased readmission and mortality rates [20]. The traditional concept of fasting and water deprivation has been questioned by surgeons and anesthesiologists after years of clinical practice. The American Society of Anesthesiologists (ASA) and the ERAS Society have put forward their guiding opinions, but no consensus has been reached [21].

In the present study, we shortened the fasting and water deprivation times for patients undergoing elective LC, in order to explore the shorter times' influence on patient comfort and postoperative gastrointestinal function.

Materials and methods

General data

A total 179 patients undergoing elective LC at the People's Hospital of Changshou District from March, 2019 to August, 2020 were recruited as the study cohort and placed into the research group (n=97, 50 males and 47 females, 34-70 years old, average age 49.90±5.01 years) or the control group (n=82, 48 males and 34 females, 32-68 years old, average age 50.25±5.12 years) according to different fasting periods each patient was assigned. In the control group, the patients were subjected to 12-h fasting and 6-h water deprivation before the surgeries, and the patients in the research group were subjected to 6-h fasting and 2-h water deprivation.

Inclusion and exclusion criteria

Inclusion criteria: (1) Patients meeting the diagnostic criteria for benign gallbladder diseases [22, 23], (2) Patients meeting the indications for laparoscopic surgery, (3) Patients classified into ASA grades I-II [24], (4) Ethical approval was granted by the Ethics Committee of People's Hospital of Changshou District, and all the participants were fully informed and signed the consent forms.

Exclusion criteria: (1) Patients with contraindications to surgical anesthesia, (2) Patients allergic to the drugs used in this study, (3) Patients comorbid with cardiovascular diseases, respiratory diseases, liver and kidney insufficiencies, or other severe primary organ diseases, (4) Patients with a history of abdominal surgery, (5) Patients with coagulation dysfunction or immune system diseases, (6) Patients with a family history of mental illness.

Intervention measures

All the patients were operated on and cared for by the same team. The participants were trained to master the process of the program. Regular training of the medical staff is conducted to assess the compliance and to standardize the criteria. In the control group, the patients were given routine education on fasting (12 hours) and water deprivation (6 hours) on preoperative day 1. In the research group, after determining the times for the surgeries the patients were subjected to 6-h fasting and 2-h water deprivation. At the same time, the primary nurse explained the significance of fasting and water deprivation for surgery and the harm of excessive fasting to the body, and through communication, provided targeted dietary guidance to increase the patients' cooperation and compliance.

Outcome measures

(1) The postoperative hospital stay durations and the blood glucose levels were recorded. (2) The intraoperative aspiration and postoperative nausea and vomiting were observed. (3) The preoperative hunger and thirst were evaluated: classification of hunger: mild, slight hunger, moderate, significant but bearable hunger, severe: strong and unbearable hunger, with dizziness, cold sweats, stomach discomfort.

Table 1. Comparison of the general data between the two groups [n (%)] (x±sd)

Classification	Research group (n=97)	Control group (n=82)	t/χ^2	P
Sex			0.876	0.349
Male	50 (51.55)	48 (58.54)		
Female	47 (48.45)	34 (41.46)		
Age (years)	49.90±5.01	50.25±5.12	0.461	0.645
BMI (kg/m^2)	22.28±2.82	22.02±2.48	0.649	0.517
Disease type			0.260	0.877
Cholelithiasis	46 (47.42)	40 (48.78)		
Cholecystitis	34 (35.05)	26 (31.71)		
Gallbladder polyps	17 (17.53)	16 (19.51)		
Marital status			0.006	0.933
Married	55 (56.70)	47 (57.32)		
Unmarried	42 (43.30)	35 (42.68)		
Residence			2.051	0.152
Urban	60 (61.86)	42 (51.22)		
Rural	37 (38.14)	40 (48.78)		
Nationality			0.564	0.452
Han nationality	71 (73.20)	64 (78.05)		
Minority minorities	26 (26.80)	18 (21.95)		
Educational background			1.397	0.237
≥ high school	63 (64.95)	60 (73.17)		
< high school	34 (35.05)	22 (26.83)		
Smoking history			0.189	0.663
Yes	21 (21.65)	20 (24.39)		
No	76 (78.35)	62 (75.61)		
History of alcohol drinking			0.176	0.674
Yes	30 (30.93)	23 (28.05)		
No	67 (69.07)	59 (71.95)		
History of hypertension			0.628	0.427
Yes	25 (25.77)	17 (20.73)		
No	72 (74.23)	65 (79.27)		

Table 2. Comparison of the hospital stay durations and the blood glucose levels (x±sd)

Group	Hospital stay (d)	Blood glucose level (mmol/L)
Research group (n=97)	4.68±1.03	6.03±2.06
Control group (n=82)	6.52±1.22	7.38±2.12
t	10.940	4.311
P	< 0.001	< 0.001

Classification of thirst: mild, slight thirst, moderate, significant but tolerable thirst, severe: strong and intolerable thirst, with dry lips. (4) The preoperative comfort levels were assessed: with a total score of 10, 1-3 indicated mild discomfort, 4-7 indicated moderate discomfort, and 8-10 indicated severe discomfort. (5) The preoperative patient anxiety levels were scored: The Self-rating Anxiety Scale (SAS, 100 points in total) was employed [25]. Patients scoring 50-70 were considered mildly anxious, 71-90 was considered moderately anxious, and > 90 was considered severely anxious. A higher score indicated a higher level of anxiety. (6) The patients' postoperative pain levels were evaluated: The Visual Analogue Scale (VAS) was used to assess the pain 24 hours after the surgery [26]. A score of 0 to 3 was defined as no pain, 4-6 as moderate pain, and 7-10 as severe pain. The higher the score, the more severe the pain. (7) The postoperative recovery of gastrointestinal function was monitored, including the times to first oral feeding, ambulation, flatus, defecation, and bowel sounds.

Statistical methods

SPSS 24.0 (IBM Corp, Armonk, NY, USA) was used for the statistical analysis, and GraphPad Prism 7 for the graphing. The categorized data were expressed by [n (%)], and the inter-group comparisons were conducted using chi-square tests. When the expected frequency was less than 5, chi-square tests were applied with continuity corrections. The continuous data were expressed as the mean ± standard deviation ($\bar{x}$±sd), and the between-group comparisons were performed using independent samples t tests. Statistical significance was set at P < 0.05.

Results

General data

There were no significant differences in the baseline data in terms of sex, age, body mass index (BMI), disease type, marital status, residence, nationality, educational background,

Table 3. Comparison of the intraoperative aspiration and the postoperative nausea and vomiting [n (%)]

Group	Aspiration	Nausea	Vomiting	Incidence rate
Research group (n=97)	0 (0.00)	4 (4.12)	1 (1.03)	5 (5.15)
Control group (n=82)	0 (0.00)	10 (12.20)	8 (9.76)	18 (21.95)
χ^2	-	-	-	11.200
P	-	-	-	0.0008

history of smoking and alcohol drinking, or the history of hypertension between the two groups (P > 0.05) (**Table 1**).

Comparison of the hospital stay durations and the blood glucose levels

The research group had shorter hospital stays and lower blood glucose levels compared to the control group after their surgeries (P < 0.001) (**Table 2**).

Comparison of intraoperative aspiration and postoperative nausea and vomiting

No intraoperative reflux or aspiration occurred in either group after the surgeries. And the postoperative incidence of nausea and vomiting in the research group was 5.15%, lower than the rate of 21.95% in the control group (P < 0.05) (**Table 3**).

Comparison of the preoperative hunger levels

After the surgeries, the patients in the research group were less hungry than the patients in control group in the preoperative period (P < 0.05) (**Table 4**).

Comparison of the preoperative thirst

The patients in the research group were less thirsty than the patients in the control group after the surgeries (P < 0.05) (**Table 5**).

Comparison of the patients' preoperative comfort levels

The patients' preoperative comfort scores in the research group were remarkably lower than the corresponding scores in the control group after the intervention (P < 0.05) (**Figure 1**).

Comparison of preoperative anxiety

There was no significant difference in preoperative SAS scores between the two groups before the surgeries. However, the scores decreased greatly in the research group after the surgeries (P < 0.05) (**Figure 2**).

Comparison of the postoperative pain levels

After the surgeries, the VAS scores in the research group were lower than they were in the control group 24 hours after the surgeries (P < 0.05) (**Figure 3**).

Comparison of the postoperative recovery of gastrointestinal function

After the surgeries, the times to first oral feeding, ambulation, flatus, defecation, and bowel sounds in the research group occurred earlier than they did in the control group (P < 0.05) (**Figure 4**).

Discussion

In recent years, with the development of medical technology, laparoscopic minimally invasive surgery is becoming more and more sophisticated, the continuous renewal of instruments and equipment, and the wide popularization of minimally invasive concept. Elective laparoscopic surgery has become the main treatment of cholecystectomy [27, 28]. Perioperative nursing care is of great significance to the rehabilitation of surgical patients. The ERAS Society holds that excessive fasting not only induces preoperative anxiety, hunger and thirst, but it also damages the metabolisms of patients undergoing elective surgery and increases their postoperative malnutrition and stress response [29, 30]. It has been confirmed that preoperative carbohydrate loading improves the prognosis of patients undergoing elective surgery by shortening the fasting [31]. However, there is no uniform standard for fasting times [32].

In the present study, we shortened the preoperative fasting and water deprivation times for patients undergoing elective LC, in order to explore the shorter times' influence on patients during the perioperative period. Savluk found that preoperative oral carbohydrates decrease insulin resistance and reduce thirst and hunger after elective heart surgery [33]. We noticed that the patients in the research group had shorter hospital stays and lower blood glucose levels, indicating a lower incidence of insulin

Table 4. Comparison of the preoperative hunger levels [n (%)]

Group	No	Mild	Moderate	Severe	χ^2	P
Research group (n=97)	75 (77.32)	18 (18.56)	4 (4.12)	0 (0.00)	102.500	< 0.001
Control group (n=82)	8 (9.76)	15 (18.29)	35 (42.68)	24 (29.27)		

Table 5. Comparison of the preoperative thirst levels [n (%)]

Group	No	Mild	Moderate	Severe	χ^2	P
Research group (n=97)	71 (73.20)	20 (20.62)	6 (6.19)	0 (0.00)	83.760	< 0.001
Control group (n=82)	12 (14.63)	14 (17.07)	36 (43.90)	20 (24.39)		

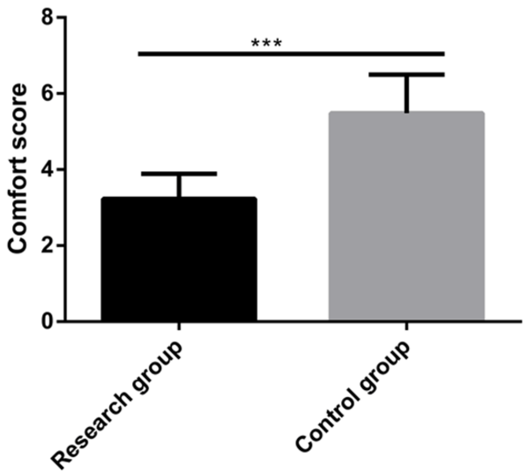

Figure 1. Comparison of the preoperative comfort levels. The patients' preoperative comfort scores in the research group were remarkably lower than the scores in the control group after the surgeries. Note: ***P < 0.001.

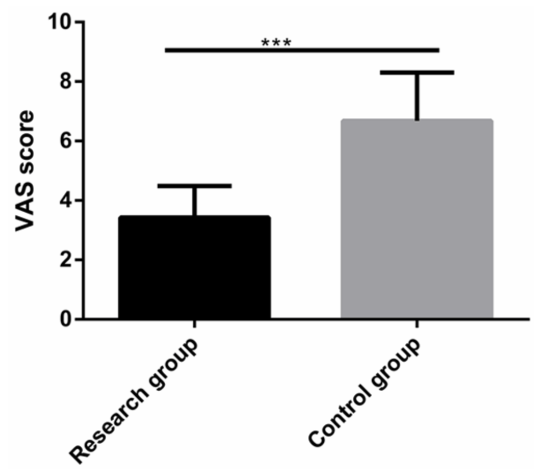

Figure 3. Comparison of the postoperative pain levels. After the surgeries, the VAS scores in the research group were lower than the VAS scores in the control group at 24 hours after the surgery. Note: ***P < 0.001.

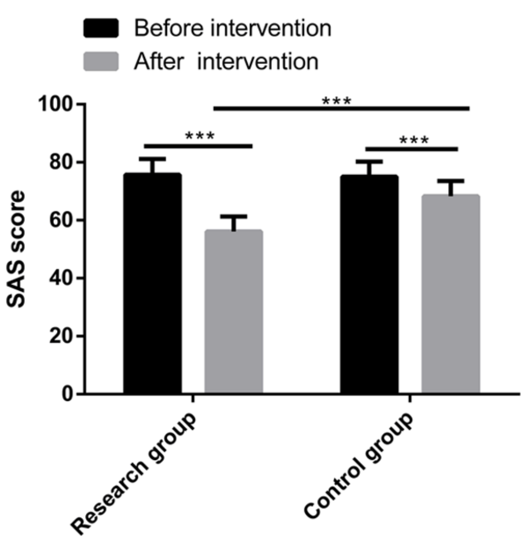

Figure 2. Comparison of the preoperative anxiety levels. There was no significant difference in the preoperative SAS scores between the two groups before the intervention. However, the scores decreased greatly in the research group after the intervention. Note: ***P < 0.001.

resistance, similar to Savluk's findings. The reason for this may lie in the fact that shortening the preoperative fasting and water deprivation is associated with a reduction of the blood glucose stimulation and stress response in patients. No intraoperative aspiration or reflux occurred in the two groups, and the incidences of postoperative nausea and vomiting in the research group was lower than it was in the control group. Therefore, shortening preoperative fasting and water deprivation is safe and feasible; moreover, it effectively reduces postoperative adverse events. Consistent with our findings, de Andrade Gagheggi Ravanini proposes that in patients undergoing LC, preoperative fasting with a carbohydrate and protein enriched solution for 2 hours is effective and safe, decreasing insulin resistance without increasing the risk of bronchial inhalation [34]. The patients in the research group showed lesser feelings of hunger and thirst, indicating that shortening the preoperative fasting re-

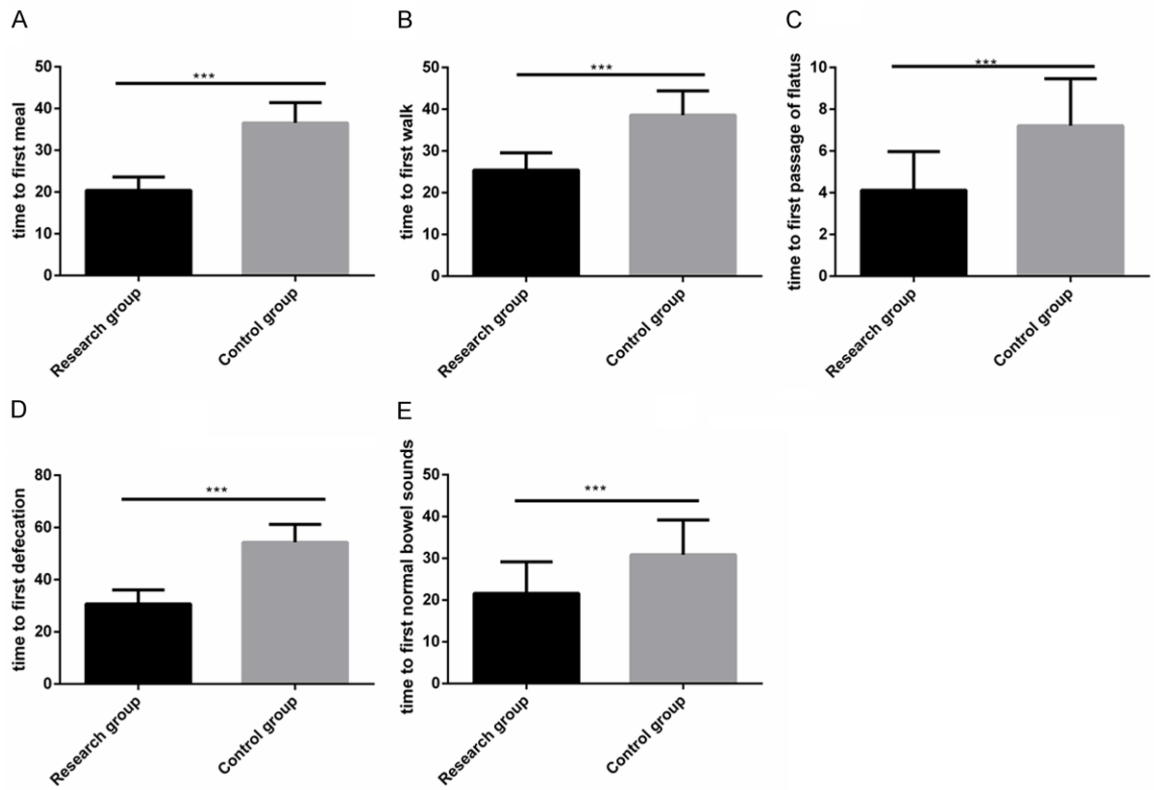

Figure 4. Comparison of the postoperative recovery of gastrointestinal function. A. After the surgeries, the times to first oral feeding in the research group were significantly earlier than they were in the control group. B. After the surgeries, the times to first ambulation in the research group were significantly earlier than they were in the control group. C. After the surgeries, the times to first flatus in the research group were significantly earlier than they were in the control group. D. After the surgeries, the times to first defecation in the research group were significantly earlier than they were in the control group. E. After the surgeries, the times to first bowel sounds in the research group were significantly earlier than they were in the control group. Note: ***P < 0.001.

lieved the patients' hunger and thirst, which is consistent with Savluk's findings. A possible mechanism behind this outcome is that shortening the preoperative fasting maintains the blood glucose concentration and the hydration of the organism, thereby reducing the hunger and thirst. According to Farias, it is safe for patients undergoing LC to take carbohydrate drinks 2 hours prior to surgery, as this can also reduce insulin resistance and relive postoperative discomforts [35]. Meanwhile, Wang reports that preoperative oral carbohydrates rather than fasting improve the thirst, hunger, and dry mouth of ESD patients without increasing the risk of reflux [36], which is similar to our research results. In addition, Xu indicated that shortened preoperative fasting is effective in improving patient comfort, increasing insulin resistance, and reducing the stress response in patients undergoing LC [37]. Also, in the present study, the lower comfort scores in the research group confirmed that the patients felt more comfortable during the perioperative period after we shortened their preoperative fasting time. We suspect that the reduction in hunger and thirst made possible by shortening the preoperative fasting enhances patient comfort. SAS and VAS are common tools for evaluating preoperative anxiety and postoperative pain. The present study demonstrated that the SAS and VAS scores were lower in the research group, suggesting that shortening the preoperative fasting time contributed to anxiety and pain relief and facilitated a smooth surgery and postoperative recovery. The reason for this may be that the reduction in hunger and thirst by shortening preoperative fasting is associated with the alleviation of the stress response and the relief of anxiety and postoperative pain. The study of Rizvanovic proposes that shortening the fasting times of colorectal surgery patients significantly reduces anxiety and pain and promotes the recovery of gastrointestinal function [38]. In the study of de Aguilar-Nascimento, it was found that reducing the preoperative fasting time reduces the postoperative gastrointestinal discomfort and insulin resistance [39]. Finally, we evaluated the postoperative recovery of gastrointestinal function. The times to first oral feeding, ambulation, flatus, defecation, and bowel sounds in the research group were earlier than the times in the control group. Thus, shortening preoperative fasting and water deprivation can significantly alleviate gastrointestinal discomfort and accelerate the recovery of gastrointestinal function, supporting the findings of Rizvanovic and de Aguilar-Nascimento. This may be due to the fact that shortening the preoperative fasting time reduces the insulin resistance, stabilizes the blood glucose levels, reduces the stress response, and protects the immune function, thus facilitating the postoperative restoration of gastrointestinal function.

Although we confirmed the benefits of shortening the preoperative fasting times for patients undergoing elective LC, there are still several limitations to this study. For example, it is possible to analyze the factors influencing the treatment effect from the perspective of patient compliance. Supplementary research will be carried out to improve our conclusions.

Overall, for patients undergoing elective LC, shortening the preoperative fasting time improves patient comfort, alleviates discomforts such as thirst and hunger, promotes the recovery of gastrointestinal function, and relieves preoperative anxiety, postoperative pain, and adverse reactions.

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Disclosure of conflict of interest

None.

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