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Original Article

The influence of enhanced recovery surgical nursing on postoperative rehabilitation, pain, and sleep in patients with primary liver cancer undergoing hepatectomy

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Abstract: Objective: This article aims to analyze the efficacy of enhanced recovery after surgery in the nursing of primary hepatic carcinoma patients treated with liver resection. Methods: 75 patients who were diagnosed with primary hepatic carcinoma and confirmed to receive liver resection in our hospital were selected as objects of study for a retrospective analysis and divided into a control group (n=35) and an observation group (n=40) using the random number table method. The control group received routine perioperative nursing intervention on the basis of the operation, and the observation group received perioperative nursing of enhanced recovery after the surgery on the basis of the operation so as to compare the postoperative rehabilitation, pain degree, and sleep quality in the two groups. Results: (1) The functional recovery time, activities under the bed time, intestinal ventilation time and duration of hospitalization in the observation group were shorter than those in the control group after the operations (P<0.05). The incidences of moderate and severe pain within 2 days after the operations in the observation group were lower than those in the control group (P<0.05). There was no statistical difference in the readmission rate in the two groups within 1 month after the operation (P>0.05). (2) The VAS pain scores at 3 days, 5 days, and 7 days after the operation in the observation group were lower than those in the control group (P<0.05). (3) The complication incidence was 17.50% in the observation group and 42.86% in the control group (P<0.05). (4) The sleep quality scores in the observation group were lower than those in the control group at 1 week and 1 month after the operation (P<0.05). Conclusion: Enhanced recovery surgical nursing for patients with primary liver cancer who have received hepatectomy is helpful to postoperative recovery, which can reduce postoperative pain and improve the sleep quality of the patients, showing an obvious application value.

Keywords: Primary hepatic carcinoma, liver resection, nursing of enhanced recovery after surgery, rehabilitation, pain, sleep

Introduction

Liver resection is the main treatment method for primary hepatic carcinoma (PHC) patients in the early and intermediate stages. The pathological tissues are resected in the operation to prolong the cancer-free survival time and the overall survival time of the patients [1, 2]. With the continuous improvement of medical technology, the therapeutic effect of liver resection can be further guaranteed gradually, and the death rate reduced continuously in the perioperative period [3]. However, due to obvious trauma caused by liver resection, the patients still face a higher risk of complications after the operation, which prolongs the duration of hospitalization and affects the patients' rehabilitation [4].

In order to accelerate the postoperative rehabilitation of primary hepatic carcinoma patients, the nursing intervention should be conducted on the basis of operative treatment in clinical practice. The concept of enhanced recovery after surgery (ERAS) is a new nursing concept proposed by foreign scholars, which works actually to optimize the perioperative intervention contents on the basis of evidence-based

medicine [5]. The implementation of this concept primarily aims to relieve the stress reaction caused by the operation, reduce the incidence of postoperative complications, and minimize the postoperative rehabilitation time [6]. Enhanced recovery after surgery nursing should be implemented both with the participation of surgeons and with the support and cooperation of the nursing staff, anesthetists, rehabilitation physicians, patients, and the patients' family members [7]. Initially, this concept was applied in the nursing of patients treated with cardiac surgery, which clearly verified that the duration of hospitalization and the medical expenses were reduced. Later, with the development of research, this concept was applied in all the hospital departments, which clinically verified that it had good value in the nursing of patients in the department of breast surgery, the department of cardiac surgery, the general surgery department, the obstetrics and gynecology department, the orthopedics department, and the department of urinary surgery, etc. [8].

The experience in nursing implementation is not abundant under the guidance of ERAS in the department of hepatic surgery, and the published studies are also insufficient in this aspect. In this study, 75 primary hepatic carcinoma patients who were admitted to our hospital were selected as objects of study and the grouping analysis method was used to discuss the value of enhanced recovery after surgery nursing in the nursing of liver resection so as to provide more useful methods for the clinical treatment and nursing of primary hepatic carcinoma.

Materials and methods

Materials

75 patients who were diagnosed with primary hepatic carcinoma in our hospital from January 2017 to February 2019 were selected for a retrospective analysis and divided into two groups using the random number table method. There were 35 patients in the control group, ranging in age from 37-72 and with a tumor diameter of 3-12 cm, and 40 patients in the observation group, ranging in age from 39-75 and with a tumor diameter of 2-13 cm. (1) Inclusion criteria: This study included patients in found to be in conformity with the diagnostic criteria for primary hepatic carcinoma [9]; those in the early and intermediate stages [10]; those in Grades I II according to the ASA (American Society of Anesthesiologists) grading [11]; those not treated with interventional therapy in the past; and those with their underlying diseases effectively controlled. Also, the patients themselves or their guardians signed the informed consent forms. This study was approved by the Nanfang Hospital, Southern Medical University Ethics Committee. (2) Exclusion criteria: This study excluded patients suffering from secondary hepatic carcinoma or metastatic hepatic carcinoma; those in the later stages; those in Grade II according to the ASA grading; those complicated with severe organ dysfunction; those needing an emergency operation; those treated with intestinal surgery in the past; and those with extensive intra-abdominal metastasis.

Methods

All the patients were treated with liver resection by the same team of medical workers, and the procedures included a partial hepatectomy, left lateral lobectomy, hemihepatectomy, extensive hemihepatectomy, middle lobectomy, right posterior lobectomy or a caudate lobectomy according to the specific situations of patients. The control group received routine perioperative nursing intervention, and the observation group received perioperative nursing of enhanced recovery after the surgery on the basis of the operation, with the details shown below:Preoperative nursing: (1) Preoperative evaluation: All the patients received routine imagological and serological examinations, and the patients in the observation group received an evaluation of their hepatic functional reserves additionally. (2) Operative planning: No operative planning was made for the control group before the operation. The 3D virtual operative planning system was used for the operative planning of the observation group. (3) Preoperative education: The pre-bed visit was conducted in the control group 1 day before the operation and the measures of oral interpretation, texts, pictures and videos, etc. were taken in the observation group 1 day before the operation to inform the patients and their family members of the operation related contents, lis-

ten to the questions posed by patients patiently, and answer questions in detail. (4) Carbohydrates: Carbohydrates were forbidden before the operation in the control group. Oral glucose of 500 ml 10% was given to the observation group on the night before the operation. (5) No drinking and eating: Drinking was forbidden 8 hours before the operation and eating was forbidden 12 hours before the operation in the control group. Eating was permitted 6 hours before anesthesia and drinking was permitted 2 hours before anesthesia in the observation group. (6) Intestinal preparation: Polyethylene glycol electrolyte was given to the control group routinely. Intestinal preparation was not routinely performed, nor was a mechanical enema conducted in the observation group. (7) Indwelling of urinary catheter: In the control group, the urinary catheter was indwelt before the operation and after anesthesia and removed after the operation. In the observation group, the urinary catheter was indwelt before the operation and after anesthesia and removed rapidly after the operation. (8) Indwelling of stomach tube: The stomach tube was indwelt before the operation and after anesthesia and removed after the operation in the control group. The stomach tube was not indwelt routinely in the observation group. But it was removed rapidly after the operation if the stomach tube was indwelt.

(1) Intraoperative operation: The liver resection was performed using routine methods in the control group. The anatomy of the porta hepatis and the separation of liver parenchyma were conducted accurately in the observation group to minimize the degree of injury to the residual liver tissues. (2) Blocking of porta hepatis: The hepatic blood inflow occlusion was performed using the Pringle method in the control group, during which the occlusion belt was released for 5 minutes every 15 minutes and then tightened again. The occlusion of the first porta hepatis was not performed routinely in the observation group. But the anatomical regional vascular occlusion was performed if necessary. (3) Intraoperative temperature control: The intraoperative temperature was not specially controlled in the control group. But in the observation group, the intraoperative temperature was adjusted properly, and the patients were kept warm in the operating room. All the fluids and medical devices were used after warming and the peritoneal irrigation was performed using warm saline. (4) Intraoperative infusion: The infusion volume was not limited during the operation in the control group. The restrictive infusion was applied in the observation group, with the central venous pressure (CVP) <5 mmHg. It was forbidden to increase the blood pressure by infusing a large volume of fluids. (5) Antibiotic use: The preventive use of antibiotics was applied in the control group, but it was applied in the observation group only half an hour before the operation. (6) Indwelling of drainage tube: The drainage tube was indwelt routinely after the operation in the control group, but not indwelt in the observation group.

Postoperative nursing: (1) Nutritional support: In addition to partial parenteral nutrition, the patients in the control group tried to drink water on the first day after the operation and ate liquid food on the second day, semi-liquid food on the third day, and normal food on the fourth day after the operation. The patients in the observation group tried to drink water after the anesthetic effect wore off and ate liquid food on the first day after the operation and normal food on the second day after the operation. In addition to partial parenteral nutrition, the amount of food intake was controlled according to the patients' tolerance levels in the observation group. (2) Fluid infusion: The intravenous infusion volume was not limited after the operation in the control group, with a daily infusion volume of 2,500-3,000 ml before their hospital discharge. In the observation group, the intravenous infusion volume did not exceed 2,000 ml every day, and the fluid infusion volume was further controlled after the patients drank water per os. 4 days after the operation, and no other intravenous fluids were given except for hepatoprotectives. (3) Control of hydrothorax and ascites: The patients in the control group were not treated with diuretics and human serum albumins within 3 days of the operation and the observation group patients were treated with albumins every day within 3 days of the operation to increase their colloid osmotic pressure. Also, a small dose of diuretics was used in the observation group. (4) Analgesia: A patient-controlled intravenous analgesia pump was used for analgesia in the control group. The multi-mode, individualized and advanced analgesic scheme was formulated for the pa-

tients in the observation group according to their own situations. Additionally, the non-steroidal anti-inflammatory drugs were used for analgesia on the basis of patient-controlled intravenous analgesia. (5) Treatment of urinary catheter and intraperitoneal drainage tube: In the control group, the urinary catheter was removed 12 hours after the analgesia pump was removed. The volume of drainage through the intraperitoneal drainage tube did not exceed 30 ml at the time of ultrasonic examination and the drainage tube was removed from the normal patients. In the observation group, the urinary catheter was removed 12 hours after the analgesia pump was removed. In order to avoid the drainage of ascites, the drainage tube was removed 2-3 days after the operation if it had to be be indwelt. (6) Postoperative rehabilitation activities: The rehabilitation guidance was provided verbally for the patients in the control group, without specific requirements on the rehabilitation processes. In the observation group, the patients received specific rehabilitation guidance, including sitting up for over 1 hour continuously on the first day after the operation; doing off-bed activities twice a day, and walking for over half an hour on the second day after the operation; doing off-bed activities four times a day and walking for over 40 minutes on the third day after the operation; doing off-bed activities four times a day and walking for over 1 hour on the fourth day after the operation; and doing activities casually for over 1 hour on the fifth day after the operation.

Observation targets

(1) Postoperative rehabilitation: The two groups were compared in terms of their functional recovery times, activities under the bed times, intestinal ventilation times, duration of hospitalization, incidence of moderate and severe pain within 2 days after the operation (VAS scores >4 scores) and readmission rate within 1 month after hospital discharge. Functional recovery criteria: The patients did not need intravenous infusion anymore; returned to a normal diet; moved independently; achieved a better analgesic effect through oral analgesics; and returned to a normal serum bilirubin level.

(2) Pain degree: The Visual Analogue Scale (VAS) [12] was used to evaluate the patients' pain levels on the day of the operation and at 3 days, 5 days and 7 days after the operation respectively. The pain grade was represented by the numbers 0-11, with 0 representing no pain and 10 representing intense and intolerable pain. The higher the figure selected by the patients, the higher the pain degree.

(3) Complication incidence: The two groups were compared in terms of their incidences of bile leakage, a large amount of ascites, abscess formation in the abdominal cavity, liver failure, hemorrhea, intestinal obstruction, infection of incision, urinary tract infection, delayed gastric emptying, deep venous thrombosis and pulmonary embolisms during and after the operation.

(4) Sleep quality: The Pittsburgh Sleep Quality Index (PSQI) Table [13] was used to evaluate the sleep quality of the patients at 1 day, 1 week, and 1 month after the operation respectively, including sleep quality, sleep latency, sleep time, sleep efficiency, sleep disorders, hypnotics, and daytime dysfunction. The severity of each item was represented by 0, 1, 2, or 3, values which corresponded to no effect, slight effect, moderate effect, and severe effect respectively, for a total of 0-21 possible scores. The higher the score is, the poorer the sleep quality is.

Statistical methods

SPSS 22.0 was used for the statistical analysis; the measurement data were represented as ($\overline{x}$ ±s); independent-samples t tests were used for the comparison of results between groups and within a group; the enumeration data were represented as [n (%)]; and X^2 tests were used for the comparison of results between groups and within a group. A multi-point comparison was performed by repeated measures ANVOA. $P<0.05$ indicated that the difference had statistical significance.

Results

Comparison of general data in the two groups

There was no obvious difference in terms of gender ratio ($P>0.05$), average age ($P>0.05$), average height ($P>0.05$), average weight ($P>0.05$), average tumor diameter ($P>0.05$), ratios of Grade I and Grade II in ASA grading

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

Data		Observation group (n=40)	Control group (n=35)	t/X^2	P
Gender	Male	24 (60.00)	20 (57.14)	0.063	0.802
	Female	16 (40.00)	15 (42.86)		
Age (years old)		52.31±10.19	51.86±10.45	0.608	0.545
Height (cm)		165.38±5.49	167.43±6.43	1.489	0.141
Weight (kg)		65.89±10.47	66.78±11.23	0.3550	0.724
ASA grading	Grade	18	17	0.956	0.757
	Grade	22	18		
Tumor diameter (cm)		6.35±2.49	6.78±2.61		
Operative methods	Partial hepatectomy	6 (15.00)	4 (11.43)	0.653	0.217
	Left lateral lobectomy	7 (17.50)	5 (14.29)		
	Hemihepatectomy	5 (12.50)	6 (17.14)		
	Extensive hemihepatectomy	7 (17.50)	5 (14.29)		
	Middle lobectomy	6 (15.00)	6 (17.14)		
	Right posterior lobectomy	5 (12.50)	5 (14.29)		
	Caudate lobectomy	4 (10.00)	4 (11.43)		

Table 2. Comparison of the relevant indicators of postoperative rehabilitation between the observation and control groups ($\bar{x} \pm s$)/[n (%)]

Group	Functional recovery (d)	Activities under the bed (d)	Intestinal ventilation (h)	Duration of hospitalization (d)	Moderate and severe pain [n(%)]	Readmission rate [n(%)]
Observation group (n=40)	6.38±2.11	2.16±1.37	35.46±12.35	6.89±3.56	8 (20.00)	1 (2.50)
Control group (n=35)	8.82±2.94	3.51±2.09	43.79±15.24	9.25±4.18	15 (42.86)	2 (5.71)
t/X^2	4.166	3.347	2.613	2.641	4.587	0.502
P	0.000	0.001	0.011	0.010	0.032	0.479

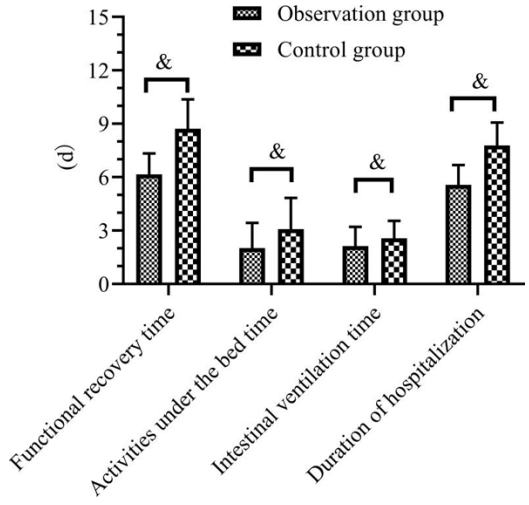

Figure 1. Comparison of the postoperative rehabilitation between the observation and control groups. The functional recovery time ($P<0.05$), the activities under the bed time ($P<0.05$), the intestinal ventilation time ($P<0.05$), and the duration of hospitalization ($P<0.05$) in the observation group were much shorter than they were in the control group. &indicates P<0.05 when the same indicators are compared in the two groups.

($P>0.05$) and operative methods ($P>0.05$) in the two groups (**Table 1**).

Comparison of postoperative rehabilitation in the two groups

The functional recovery time, activities under the bed time, intestinal ventilation time and duration of hospitalization in the observation group were shorter than those in the control group after the operation ($P<0.05$). The incidences of moderate and severe pain in the observation group were lower than those in the control group within 2 days after the operation ($P<0.05$). The readmission rate of the observation group was lower than that of the control group within 1 month after the operation, but the difference had no statistical significance ($P>0.05$) (**Table 2** and **Figure 1**).

Table 3. Comparison of the degree of pain on the day of the operation and at 3 days, 5 days, and 7 days after the operation between the observation and control groups ($\bar{x} \pm s$, scores)

Group	On the day of operation	3 days after the operation	5 days after the operation	7 days after the operation
Observation group (n=40)	5.78±1.63	3.25±1.04	2.67±0.82	2.13±0.43
Control group (n=35)	5.96±1.78	4.87±1.22	4.31±0.96	2.89±0.67
X^2	0.457	6.208	7.980	5.918
P	0.649	0.000	0.000	0.000

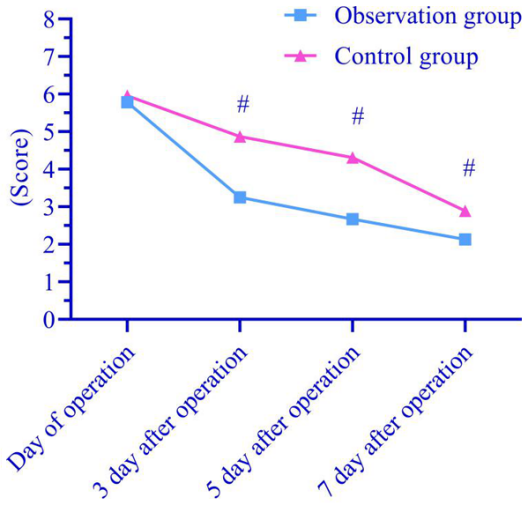

Figure 2. Comparison of the degree of pain at different times after the operation between the observation and control groups. There was little difference in the pain scores on the day of operation in the two groups (*P*>0.05). The pain scores of the observation group were much lower than those of control group at 3 days (*P*<0.05), 5 days (*P*<0.05), and 7 days (*P*<0.05) after the operation. The pain scores on the day of the operation were much higher than those at 1 day, 3 days, 5 days, and 7 days after the operation respectively in the observation group (*P*<0.05) and the control group (*P*<0.05). #indicates *P*<0.05 for the comparison of two groups at the same time.

Comparison of pain degrees at different times after the operation in the two groups

There was little difference in the VAS pain scores on the day of the operation in the two groups (*P*>0.05). The VAS pain scores on the day of the operation were much higher than those at 3 days, 5 days, and 7 days after the operation respectively in the observation and control groups (*P*<0.05). The VAS pain scores at 5 days and 7 days after the operation were much lower than those on the day of operation and at 3 days after the operation respectively in the observation and control groups (*P*<0.05). The VAS pain scores 7 days after the operation were much lower than those on the day of operation and at 3 days and 5 days after the operation respectively in the observation and control groups (*P*<0.05). The VAS pain scores of the observation group were much lower than those of the control group at 3 days, 5 days, and 7 days after the operation (*P*<0.05) (**Table 3** and **Figure 2**).

Comparison of the incidences of intraoperative and postoperative complications in the two groups

7 patients suffered from complications in the observation group, including 2 cases of bile leakage, 1 case of infection of incision, 3 cases of a large amount of ascites, and 1 case of abscess formation in the abdominal cavity, for a complication incidence rate of 17.50%. 15 patients suffered from complications in the control group, including 1 case of bile leakage, 1 case of pulmonary embolism, 1 case of deep venous thrombosis, 1 case of delayed gastric emptying, 1 case of urinary tract infection, 3 cases of infection of incision, 1 case of intestinal obstruction, 4 cases of a large amount of ascites, 1 case of abscess formation in the abdominal cavity, and 1 case of liver failure, for a complication incidence rate of 42.86% (*P*<0.05) (**Table 4** and **Figure 3**).

Comparison of sleep qualities at different times after the operation in the two groups

There were no statistical differences in the sleep quality scores 1 day after the operation in the two groups (*P*>0.05). The sleep quality scores 1 week after the operation were much lower than those at 1 day after the operation respectively in the observation and control groups (*P*<0.05), and the sleep quality scores 1 month after the operation were much lower than those at 1 day and 1 week after the operation respectively in the observation and control

Table 4. Comparison of the incidences of intraoperative and postoperative complications between the observation and control groups [n (%)]

Complications	Observation group (n=40)	Control group (n=35)	X^2	*P*
Bile leakage	2 (5.00)	1 (2.86)	0.223	0.637
Pulmonary embolism	0 (0.00)	1 (2.86)	1.158	0.282
Deep venous thrombosis	0 (0.00)	1 (2.86)	1.158	0.282
Delayed gastric emptying	0 (0.00)	1 (2.86)	1.158	0.282
Urinary tract infection	0 (0.00)	1 (2.86)	1.158	0.282
Infection of incision	1 (2.50)	3 (8.57)	1.363	0.243
Intestinal obstruction	0 (0.00)	1 (2.86)	1.158	0.282
Hemorrhea	0 (0.00)	0 (0.00)	/	/
A large amount of ascites	3 (7.50)	4 (11.43)	0.340	0.560
Abscess formation in the abdominal cavity	1 (2.50)	1 (2.86)	0.009	0.924
Liver failure	0 (0.00)	1 (2.86)	1.158	0.282
Total incidence	7 (17.50)	15 (42.86)	5.790	0.016

The incidence of complications in the observation group was significantly lower than it was in the control group ($P<0.05$).

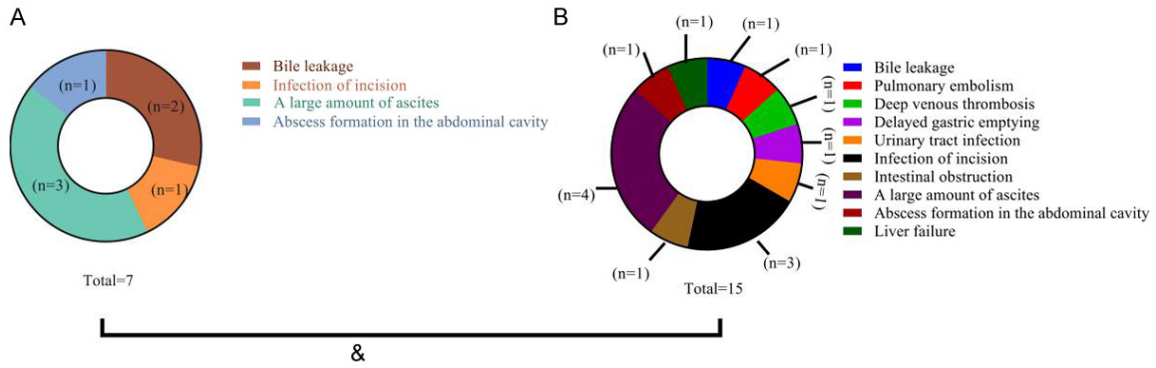

Figure 3. Comparison of the incidences of complications between the observation and control groups. There was little difference in the incidences of bile leakage ($P>0.05$), infection of the incision ($P>0.05$), the number of ascites ($P>0.05$), and abscess formation in the abdominal cavity ($P>0.05$) in the two groups. There was 1 case of pulmonary embolism, 1 case of deep venous thrombosis, 1 case of delayed gastric emptying, 1 case of urinary tract infection, 1 case of intestinal obstruction, and 1 case of liver failure in the control group, which were all prevented in the observation group. So, the complication incidence of the observation group was much lower than it was in the control group ($P<0.05$). &indicates $P<0.05$ when the total incidence was compared in the two groups.

groups ($P<0.05$). The sleep quality scores of the observation group were much lower than those of the control group at 1 week after the operation ($P<0.05$) and those of the observation group were much lower than those of the control group 1 month after the operation ($P<0.05$) (**Table 5** and **Figure 4**).

Discussion

According to statistical data, about 800,000 patients are diagnosed with PHC every year in the world, and the PHC incidence in China is proportionally higher than it is in the rest of the world [14]. From the perspective of China's national condition, the hepatitis B virus is the main cause of PHC. It was found in clinical practice that most hepatic carcinoma patients have a clinical manifestation of hepatic cirrhosis [15, 16]. Surgery is the chief treatment method for PHC patients in the early or intermediate stages, and liver resection is the preferred operation. But in order to guarantee the safety and efficacy of treatment, the corresponding nursing intervention must be implemented on the basis of each operation.

With the change of medical philosophy and the deepening of humane ideas, the therapeutic goal of clinical surgery has gradually trans-

Table 5. Comparison of the sleep qualities at different times after the operation between the observation and control groups ($\overline{X}$ ± s, scores)

Group	Number of cases	1 day after the operation	1 week after the operation	1 month after the operation
Observation group	40	13.63±2.28	10.81±1.69	7.64±1.21
Control group	35	14.25±2.51	12.78±1.75	9.67±1.57
X^2		1.121	4.954	6.313
P		0.266	0.000	0.000

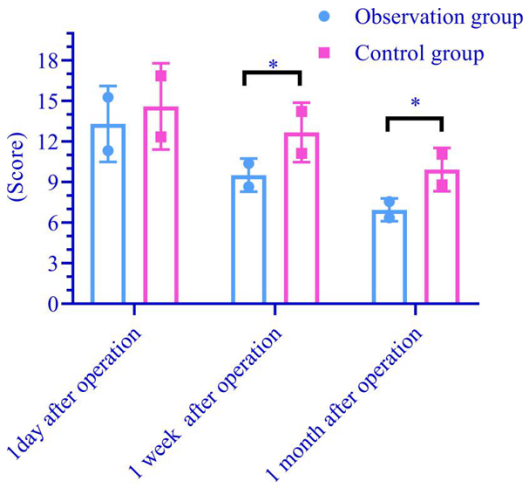

Figure 4. Comparison of sleep quality at different time points after the operation between the observation and control groups. There was little difference in sleep quality scores 1 day after the operation in the two groups (*P*>0.05). The sleep quality scores of the observation group were much lower than those of the control group at 1 week (*P*<0.05) and 1 month (*P*<0.05) after the operation. The sleep quality scores 1 day after the operation were much higher than those at 1 week and 1 month after the operation respectively in the observation (*P*<0.05) and control groups (*P*<0.05). *indicates *P*<0.05 for the comparison between the two groups at the same time.

formed from the removal of lesions and the treatment of diseases to the fastest and safest rehabilitation with minimum injury [17]. The ERAS nursing applied in this study is a new nursing model obtained by further integrating and optimizing the traditional routine nursing intervention modes in the perioperative period [18]. The application of ERAS nursing in the department of hepatic surgery has made a certain difference with the specific conditions of China. In other countries, the patients who are treated with liver resection are mostly diagnosed with hepatic metastasis of colonic carcinoma, but in China, they are mostly primary hepatic carcinoma patients. Meanwhile, most patients are complicated with hepatic cirrhosis or other multiple underlying diseases simultaneously and their livers have poor compensation and reserve functions [19, 20]. Hence, the promptness of rehabilitation cannot be ensured by directly introducing overseas experiences in the ERAS nursing of liver resection to clinical applications in China [21]. In order to guarantee the best nursing efficacy, it is necessary to combine the implementation experience from abroad with the specific situations of Chinese patients, fully considering the basic conditions of the patient's liver, referring to the excellent nursing experience of liver resection in China, and, finally, implementing ERAS nursing.

In this study, the observation group received ERAS nursing in the perioperative period, and the control group only received routine perioperative nursing intervention. The results show that the functional recovery time, activities under the bed time, intestinal ventilation time, and duration of hospitalization in the observation group were much shorter than they were in the control group (*P*<0.05). Moreover, the incidence of moderate and severe pain was 20.00% in the observation group within 2 days after the operation, which was much lower than the 42.86% rate in the control group (*P*<0.05). This indicated that the PHC patients receiving ERAS nursing in the perioperative period resumed their diets and did off-bed activities more rapidly. Besides, the functional recovery time and duration of hospitalization were more clearly reduced, so they could achieve a better overall rehabilitation effect. Chong et al. [22] indicated that ERAS nursing could clearly reduce the intestinal ventilation time, duration of hospitalization, and medical expenses for patients treated with liver resection. In this study, the VAS pain scores in the observation group were much lower than those in the control group at 3 days, 5 days, and 7 days after

the operation, and the sleep quality scores of the observation group were lower than those of the control group at 1 week and 1 month after the operation ($P<0.05$). Furthermore, the complication incidence in the observation group was 17.50%, which was much lower than the 42.86% in the control group ($P<0.05$). This implied that the application of ERAS nursing in the perioperative period could clearly reduce the postoperative pain degree and the incidence of postoperative complications. And the patients had better sleep quality because the sleep quality was affected by fewer and milder factors after the operation. Zhuang et al. [23] found that the application of ERAS nursing could clearly reduce the incidence of complications in the perioperative period. Dai et al. [24] showed that the application of the ERAS concept in the perioperative period could effectively control the degree of pain at different times after the operation. As for the ERAS nursing used in perioperative period in this study, the tubes were not routinely indwelt in the observation group, which reduced the infections caused by indwelling tubes, alleviated the patients' discomfort, and thus relieved the pain. Balak et al. [25] found that early postoperative activities played an important role in controlling pulmonary embolisms and pulmonary infections. In this study, the first time for the off-bed activities in the observation group was much earlier than it was in the control group, and the incidence of pulmonary embolisms in the observation group was also lower than it was in the control group, which is consistent with the above conclusion. Cho et al. [26] showed that the early postoperative activities were primarily affected by low subjective initiatives, indwelling tubes, continuous intravenous infusion, and the poor effect of pain control, etc. In this study, all these influencing factors were controlled and intervened in a targeted manner in the observation group, so the patients in the observation group could do activities and exercises earlier after the operation, which was conducive to postoperative rehabilitation.

In conclusion, enhanced recovery after surgery nursing, with an obvious application value, can promote postoperative rehabilitation, reduce the postoperative degree of pain, and improve sleep quality in primary hepatic carcinoma patients treated with liver resection. But the results were not representative enough due to the small cohort, the short follow-up time, and the low number of research and analysis indicators. Therefore, much more attention shall be paid to broader studies with longer times and larger sample sizes in the future so as to further clarify the application value of the nursing of enhanced recovery after surgery in the nursing of primary liver resection to provide more useful guidance for the nursing of primary hepatic carcinoma.

Disclosure of conflict of interest

None.

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