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Fast-Track Surgery Could Improve Postoperative Recovery in Patients with Laparoscopy D2 Gastrectomy

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The objective of this study is to evaluate the safety and efficacy of fast track surgery (FTS) management in gastric cancer (GC) with laparoscopy D2 gastrectomy. FTS is the integration of different medical intervention activities during the perioperative period to accelerate the recovery of patients undergoing surgery. It has been used for colorectal cancer. The present study focuses on evaluating FTS in GC with laparoscopy D2 gastrectomy. Seventy-five patients diagnosed with GC between June 2014 and December 2016 were enrolled in this study and were divided into FTS and conventional care groups. All patients received elective standard D2 gastrectomy. The clinical parameters and serum indicators were compared. FTS was associated with shorter postoperative hospital stay (17.17 ± 9.27 versus 14.06 ± 5.05 days; $P = 0.046$), shorter time to bowel function return (4.56 ± 1.16 versus 3.12 ± 0.88 days; $P < 0.01$), less stress response on postoperative day 1 (108.13 ± 40.55 versus 79.01 ± 37.10; $P < 0.01$), and accelerated decrease in serum albumin (30.76 ± 4.10 versus 32.56 ± 3.20 g/L; $P = 0.04$) and lymphocyte count (0.78 ± 0.34 versus 0.78 ± 0.34 g/L; $P = 0.016$). The postoperative complications, including ileus, anastomotic leakage, and infection, were similar (all $P > 0.05$). FTS combined with laparoscopy D2 gastrectomy can promote faster postoperative recovery, improve early postoperative nutritional status, and more effectively reduce postoperative stress reaction and is safe and effective for GC patients.

Key words: Fast-track surgery – Gastric cancer – Laparoscopy D2 gastrectomy – Postoperative recovery

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Fast-track surgery (FTS), which was proposed by Wilmore and Kehlet in 2002,[1,2] can facilitate postoperative recovery by reducing postoperative physical and psychological stresses.[1] FTS was first involved in colorectal cancer and effectively reduced postoperative complications and shortened hospital stay. In recent years, FTS has been applied to a variety of surgeries such as bladder cancer,[3] esophageal cancer,[4,5] and autologous breast reconstruction.[6]

Gastric cancer (GC) is one of the most common malignancies and the third cause of death from cancer worldwide; it caused 720,000 deaths in 2012. At this time, surgery is the most efficient treatment of GC, and D2 gastrectomy has been the standard surgical approach for advanced GC.[7–9] Traditional open gastrectomy uses a long incision, has a longer postoperative recovery, and is contraindicated for minimally invasive surgery. Laparoscopic surgery can alleviate immune inhibition[10] and inflammation[11] and accelerate postoperative recovery.

However, it is controversial whether laparoscopic surgery combined with FTS has more benefits for GC. Some scholars believe that the Enhanced Recovery After Surgery (ERAS) program combined with laparoscopy is associated with a shorter hospital stay in GC patients undergoing radical gastrectomy. However, some do not believe this. Therefore, the aim of the present study was to evaluate the safety and efficacy of FTS management in GC with laparoscopy D2 gastrectomy.

Methods

Patients

Patients with GC were admitted to the hospital between June 2014 and December 2016. The study was approved by the hospital ethics committee, and signed informed consent was obtained from the patients and their family. The inclusion criteria were as follows: (1) diagnosis of GC by preoperative pathologic biopsy with gastroscope; (2) age between 18 and 75 years; (3) no distant metastasis; and (4) no history of autoimmune disease. The exclusion criteria were as follows: (1) received radiotherapy and chemotherapy before surgery; (2) had acute infection; (3) merged with obstruction or perforation that needed emergency surgery; (4) history of abdominal surgery or other malignant tumor; and (5) contraindication to anesthetization and pneumoperitoneum.

Operation and treatment

Patients in the conventional care (CC) group received conventional perioperative care. Patients in the FTS group received fast recovery perioperative care. Details of the interventions are listed in Table 1. Both groups were protocol driven, with appropriate protocol details for patients, surgeons, and nurses to ensure compliance.

Statistical analysis

Date were processed using SPSS 18.0 (IBM, New York). Measurement data were expressed as means ± SDs and were analysis by a 2-tailed Student's *t*-test. Enumeration data were analyzed using the χ^2 test or rank sum test. $P < 0.05$ was considered statistically significant.

Results

Comparison of general preoperative information and indicators

During this study, all patients completed the treatment. The preoperative baseline characteristics are summarized in Table 2. There were no significant differences between the FTS and CC groups for age, sex, BMI, complications, TNM staging, or American Society of Anesthesiologists grade. Intraoperative characteristics were also matched, including time of operation (minutes, mean ± SD), type of operation (n), type of reconstruction (n), intraoperative blood loss (mL, mean ± SD), type of tumor, and pathologic type.

Comparison of postoperative observation index

Postoperative recovery indicators are list in Table 3. The postoperative hospital stay was significantly shorter in the FTS group than the CC group (17.17 ± 9.27 versus 14.06 ± 5.05; $P = 0.046$). Time of first flatus and postoperative eating time were also significantly shorter in the FTS group than the CC group [4.56 ± 1.16 versus 3.12 ± 0.88; $P < 0.01$ and 17.17 ± 9.27 versus 14.06 ± 5.05; $P < 0.01$). There were no significant differences between the 2 groups regarding postoperative complications, which included pulmonary infection, urinary tract infection, incision infection, gastric retention, intestinal obstruction, anastomotic leakage, and hospital readmission ($P > 0.05$).

Comparison of nutritional status indicators and systemic stress response indicators

Nutritional status indicators and systemic stress response indicators are list in Table 4. On the first

Table 1 Details of FTS and conventional perioperative intervention protocols

Time	Items	CC	FTS
Preoperative	Education	Tell patients the possible risk of surgery	Inform patients the preoperative and preoperative management and the possible risk
	Diet	Semi-fluid diet from 3 days before surgery; fasting 12 hours for diet and 4 hours for liquid	Take 1000 mL 10% glucose solution 12 hours prior to surgery and 500 mL 2 hours prior to surgery; fasting 6 hours for diet and 2 hours for liquid
	Bowel preparation	Routine mechanical bowel preparation	No mechanical bowel preparation
	Nasogastric tubes	Use nasogastric tubes routinely for preoperative and postoperative removal after anal exhaust	No routine nasogastric tubes
Intraoperative	Anesthesia	Epidural analgesia pump 24–48 hours; no use of opioid drugs	Intravenous analgesia pump for 48 hours, use of opioid drugs
	Restricted fluid replacement	Sufficient fluid administered. Hypervolemic treatment first when artery pressure or urine volume decreased	fluid administered is less than 1500 mL; use vasoactive drug first when artery pressure or urine volume decreased
	Thermal insulation	NO thermal insulation	Body temperature was maintained at 36°C
	Abdominal drainage tube and catheter	Use abdominal drainage tube and catheter routinely	No use of an abdominal drainage tube; if necessary, remove as early as possible; use catheter routinely and remove on the first day after surgery
Postoperative	Pain management	Opioid analgesic by intramuscular injection or PCA	Stop PCA and use nonsteroid anti-inflammatory drug if necessary
	Oral diet	Initiate oral diet after flatus	Initiate oral diet 1 day after operation
	Mobilization	Mobilization out of bed depend on patient	Encourage patient mobilization on bed after anesthesia recovery and out of bed 8–12 hours after surgery

PCA, patient-controlled analgesia.

day before the operation and the fourth and seventh days after the operation, serum albumin, lymphocyte count, CRP levels, and pain intensity were evaluated using a visual analog scale and were not significantly different between the 2 groups. On the first day after surgery, serum albumin and lymphocyte count were significantly higher in the FTS group than the CC group (30.76 ± 4.10 versus 32.56

Table 2 Comparison of general preoperative information and intraoperative indicators between treatment groups

Characteristics	CC	FTS	*P* value
Age (years, mean ± SD)	62.93 ± 9.44	63.74 ± 9.65	0.716
Sex (n, male/female)	31/10	25/9	0.837
BMI (kg/m^2, mean ± SD)	20.88 ± 2.7	21.92 ± 1.95	0.146
TNM staging (I/II/III)	6/20/15	7/17/10	0.714
ASA grade I/II/III	7/24/3	10/27/4	0.906
Time of operation (minutes, mean ± SD)	191.71 ± 39.10	194.94 ± 29.63	0.693
Type of operation (n) (proximal gastrectomy/distal gastrectomy/total gastrectomy)	1/22/18	0/21/13	0.552
Type of reconstruction (n) (Billroth-I/Billroth-II/Roux-en-Y)	5/9/27	1/13/20	0.148
Intraoperative blood loss (mL, mean ± SD)	170.00 ± 47.96	166.18 ± 63.63	0.768
Pathologic type			0.955
Mucinous adenocarcinoma, signet ring cell carcinoma, and undifferentiated adenocarcinoma	36	30	
Highly/moderately differentiated adenocarcinoma	5	4	
Type of tumor (protruded type/ulcerative type/flat type)	5/34/2	2/29/3	0.529

There are no significant differences between the FTS and CC groups in age, sex, BMI, complications, TNM staging, ASA grade, intraoperative characteristics, intraoperative blood loss (mL, mean ± SD), type of tumor, or pathologic type.

Table 3 Comparison of postoperative observation index between treatment groups

Characteristics	CC	FTS	*P* value
Total hospital stay (days)	26.73 ± 11.20	21.94 ± 7.31	0.66
Postoperative hospital stay (days)	17.17 ± 9.27	14.06 ± 5.05	0.046
Postoperative eating time (days)	5.88 ± 1.94	3.24 ± 2.20	<0.01
Time of first flatus (days)	4.56 ± 1.16	3.12 ± 0.88	<0.01
Postoperative complications			
Total	10	6	0.577
Pulmonary infection	5	3	0.722
Urinary tract infection	0	0	
Incision infection	0	0	
Gastric retention	2	1	1.0
Intestinal obstruction	3	1	0.622
Anastomotic leakage	0	1	0.453
Hospital readmission	3	2	1.0
Mortality	0	0	

Postoperative hospital stay, time of first flatus, and postoperative eating time were significantly shorter in the FTS group than in the CC group. There were no significant differences between the 2 groups in postoperative complications.

Table 4 Comparison of nutritional status indicators and systemic stress response indicators between treatment groups

Characteristics	CC	FTS	*P* value
Serum albumin (g/L)			
Before operation	38.51 ± 5.00	39.01 ± 4.19	0.645
POD 1	30.76 ± 4.10	32.56 ± 3.20	0.04
POD 4	31.86 ± 4.20	31.82 ± 3.95	0.967
POD 7	32.87 ± 3.30	32.70 ± 3.52	0.827
Lymphocyte count			
Before operation	1.54 ± 0.53	1.64 ± 0.54	0.408
POD 1	0.78 ± 0.34	0.98 ± 0.36	0.016
POD 4	0.93 ± 0.45	1.02 ± 0.35	0.337
POD 7	1.12 ± 0.43	1.17 ± 0.40	0.588
CRP			
Before operation	4.23 ± 6.44	5.44 ± 11.33	0.957
POD 1	108.13 ± 40.55	79.01 ± 37.10	<0.01
POD 4	110.80 ± 60.30	90.23 ± 53.77	0.127
POD 7	57.63 ± 54.78	46.00 ± 40.08	0.293
Pain intensity			
POD 1	4.85 ± 0.96	4.35 ± 0.95	0.027
POD 4	2.88 ± 0.78	2.79 ± 0.81	0.65
POD 7	1.07 ± 0.79	1.03 ± 0.72	0.804

On the first day after surgery, serum albumin and lymphocyte count were significantly higher in the FTS group than the CC group; CRP and pain intensity were significantly lower in the FTS group than in the CC group. On POD 4 and 7, serum albumin, lymphocyte count, CRP levels, and pain intensity were not significantly different between the 2 groups. POD, postoperative day.

± 3.20: $P = 0.04$ and 0.78 ± 0.34 versus 0.78 ± 0.34; $P = 0.016$), whereas CRP and pain intensity were significantly lower in the FTS group than the CC group (108.13 ± 40.55 versus 79.01 ± 37.10; $P < 0.01$ and 4.85 ± 0.96 versus 4.35 ± 0.95; $P = 0.027$). The variation of serum albumin, lymphocyte count, CRP levels, and pain intensity was smaller in the FTS group than the CC group. The difference may be caused by a more stable homeostasis, which is the product of shorter fasting time, thermal insulation, and appropriate anesthesia.

Discussion

The FTS aims to reduce the perioperative stress reactions of patients and accelerate recovery. FTS was first used in colorectal cancer (CRC), and it has been shown that FTS is safe in advance of the CRC surgery.[12,13] The standard surgery method for GC is D2 gastrectomy, and FTS can lessen postoperative stress, accelerate rehabilitation, and shorten the postoperative hospital stay.[14,15] Studies has verified that the short-term clinical effect and long-term clinical effect of laparoscopic techniques in GC are similar or even better than open grastectomy.[16,17] In this application, FTS was used with laparoscopic surgery and had a better outcome compared with conventional care. The FTS group had a shorter postoperative (3 days) hospitalization time and a faster postoperative bowel evacuation time (1.44 days). Also, the FTS group did not have an increased incidence of complications.

Most of the GC patients had malnutrition, which will decelerate rehabilitation and affect immune function. It has been shown that whole-body protein balance and the suppressive effect of insulin on endogenous glucose release are better maintained when patients receive oral carbohydrates before operation.[18] The peristalsis of the small intestine recovered 6 hours after surgery, and the liquid in the small intestine can be reabsorbed at an early stage.[19–21] Therefore, it was feasible to eat early after the surgery. An early postoperative oral diet can promote the return of gut function, protect gut-mucosal barrier function, enhance portal circulation, and hasten nutritional intake.[22] It has been shown in CRC surgery that an early oral diet can reduce catabolism, promote the recovery of gut function, and lower the risks of complication,[12,13] but there is little research in GC. In the present study, the majority of patients in the FTS group had a shorter fasting time and tolerated an early oral diet. As a result, the function of the intestines recovered faster in the FTS group. The postoperative serum albumin

and lymphocyte count remained higher and steadier, which means patients in the FTS group had a better nutritional status.

Hypothermia will affect coagulation function and increase the risk of cardiovascular system complications and incision infection.[23] In the present study, the room temperature was set at 26°C, and an insulation blanket was used to maintain the temperature of patient at 36°C. The traditional idea is that sufficient transfusion capacity could increase cardiopulminary functional reserve. A previous study has shown that reducing the transfusion capacity during surgery can promote the recovery of gut function, lower the risks of complication, and shorten the postoperative hospital stay.[24] In the present study, the transfusion capacity was less than 1500 mL during surgery.

Nasogastric tubes have been routinely used for decompression after gastric surgery, and it was moved until the first flatus after gastric resection. This was to prevent aspiration and reduce the risk of intestinal obstruction and anastomotic leak. However, the occurrence of an anastomotic leak is based on preoperative nutritional status and how well the anastomosis is working.[25] Recent studies comparing in-dwelling nasogastric tubes with no use of nasogastric tubes confirmed that a gastric tube may induce pulmonary complications and prolong the time to first flatus with no difference in anastomotic leak rate.[26–28] In this study, nasogastric tubes were not used routinely in the FTS group, and the anastomotic leak rate was not different from the CC group, which is consistent with previous studies.

The placement of abdominal drainage in FTS is controversial. It has been reported that patients without abdominal drainage have less operative complications and shorter hospital stays.[29] That is consistent with our study. The placement of the abdominal drainage will increase the feeling of pain and delay mobilization. The main emphasis of FTS is early mobilization, which can decrease risk of pulmonary complications, promote blood circulation, and accelerate incision healing. In the present study, patients in the FTS group without abdominal drainage had mobilization out of bed earlier and had no significant differences with the CC group.

The limitation of our present study was the number of patients was too small, which will amplify selection bias and confounding bias. We tried to ensure that the experiment was randomized and blinded. Also, surgery and perioperative management for all patients was done by the same group of doctors.

Conclusion

In conclusion, FTS is a safe and efficient perioperative management in patients undergoing radical gastrectomy. Our study verified that FTS could shorten the duration of hospital stay and promote postoperative recovery. However, it will still take time to create a uniform FTS strategy and make it applicable to exceptional patients.

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