

Original Article

ERAS protocol implementation in surgery is favorable for the recovery of patients

Xia Liu¹, Shouhua Yang², Chen Wang³, Zhonghua Jin⁴

Departments of ¹Dermatology, ²Stomatology, ³Neurosurgery, ⁴Thoracic Surgery, The Second Affiliated Hospital of Dalian Medical University, Dalian, Liaoning Province, China

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Abstract: To determine the effect of implementing the Enhanced recovery after surgery (ERAS) concept on the rehabilitation of patients undergoing radical gastrectomy for gastric cancer. Medical records of 213 patients who underwent D2 radical gastrectomy were analyzed retrospectively. Of these, 151 patients were managed as per the ERAS concept (recovery group) and 62 patients received conventional care (conventional group). The postoperative recovery, anxiety and depression score, quality of life score and satisfaction with nursing care as well as the incidence of complications, follow up results and the survival rates were also recorded. The time to anal exhaust, oral feeding, and activity out-of-bed in the recovery group were shorter than those in the conventional group (all $P < 0.05$). There were significant differences between the two groups in the self-rating anxiety score ($P < 0.05$). The difference in the rate of complications between the two groups was statistically significant ($\chi^2 = 5.085$, $P = 0.024$). After nursing care, the emotional function, cognitive function, physical function, and social function in the two groups of patients improved and the difference between the two groups was statistically significant ($P < 0.05$). The nursing satisfaction in the recovery group was significantly superior to that in the conventional group ($P < 0.05$). Implementing the concept of ERAS in the perioperative period of gastric cancer surgery effectively improves the psychological state of the patients, reduces the incidence of complications, enhances the rehabilitation of patients after surgery, and improves the quality of life and the nursing care satisfaction among patients.

Keywords: ERAS, radical gastrectomy of gastric cancer, gastrointestinal function recovery, perioperative period

Introduction

Gastric cancer, the most common malignant tumor of the digestive tract, occurs usually in people above 40 years of age with a male-female ratio of approximately 2-3:1 and is one of the major causes of death, accounting for about 24% of the total number of deaths [1, 2]. With the improvement in the standard of living and diet levels, the incidence of gastric cancer has been increasing year after year [3]. Radical surgery is the only cure for gastric cancer, but the high medical expenses result in a great psychological and economic burden on the patients [4]. Therefore, rapid recovery after surgery is important to reduce the economic and psychological stress on the patients.

Enhanced recovery after surgery (ERAS) is a new MDT (Multidisciplinary teamwork) concept that has emerged in recent years. The key ele-

ments of ERAS include patient/family education, patient optimization prior to admission, minimal fasting that includes a carbohydrate beverage two hours before anesthesia, multimodal analgesia with appropriate use of opioids when indicated, return to normal diet and activities the day of surgery, and return home. Compared to the conventional surgical perioperative care, nursing as per the ERAS guidelines requires a complete understanding of the pathophysiological changes in patients with various diseases before and after surgery. It aims at reducing the stress related to surgery, shortening the period of hospitalization, reducing complications, increasing patient satisfaction, and reducing medical expenses by adopting a series of intervention measures in the perioperative period including the optimization of the surgical procedure and anesthesia methods and adequate relief in pain [5, 6]. Recently,

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the concept of ERAS has been consistently and highly recognized in colorectal surgery, obstetrics and gynecology, as well as hepato-biliary surgery. It has been especially very successful in colorectal surgery [7, 8]. Although there have been many reports of gastric cancer and the implementation of ERAS concept in recent years [9, 10], it is still in its initial stages. Moreover, there are few reports about the implementation of ERAS concept in D2 radical gastrectomy.

In this study, we retrospectively analyzed the clinical data of 151 patients undergoing D2 radical gastrectomy for gastric cancer, to understand the outcomes following implementation of the ERAS concept of nursing.

Methods and materials

The medical records of 213 patients who underwent D2 radical gastrectomy at The Second Affiliated Hospital of Dalian Medical University were analyzed retrospectively. In total, there were 151 patients who received perioperative care based on the enhanced recovery after surgery (ERAS) protocol (recovery group), and 62 patients who received conventional (conventional group) care in the perioperative period. The inclusion criteria were all patients diagnosed with gastric adenocarcinoma in our hospital based on histopathology. The patients were in the age group of 36-58 years and met the surgical indications for D2 radical gastrectomy, with ASA grade III and no abnormality in the leukocyte and lymphocyte counts. According to the imaging diagnosis, no distant metastasis was observed, a radical surgical resection was possible, and the survival time was expected to be more than 3 months. The patients did not receive any antitumor treatment before surgery and had no history of other tumors; dysfunctions of the heart, liver, and kidney; undiagnosed bleeding; or abnormal coagulation function. None of the patients were allergic to propofol or sevoflurane and had no history of excessive drinking or glycerin trinitrate intake. Patients with incomplete medical records, history of gastritis, mental disorders or learning dysfunction and excessive tumor diameter were excluded. This study was approved by the ethics committee of The Second Affiliated Hospital of Dalian Medical University, and the patients or their family members signed the informed consent.

Perioperative care

Conventional surgical nursing: The patients in the conventional group received conventional surgical care, including preoperative routine (complete medical record, cross-matching of blood, drug skin test, etc.), dietary recommendations and symptomatic treatment etc., and postoperative care comprising postoperative nursing routines, psychological counseling, dietary recommendations, symptomatic treatment as well as health education.

ERAS nursing: Patients in the recovery group received ERAS recommended perioperative care. This comprised preoperative psychological counseling, wherein the diagnosis, treatment process, and prognosis were discussed with the patients and their families, establishing a good nurse-patient relationship and alleviating the patient's fear of the disease and surgery. Intraoperative care included temperature management to maintain normothermia during surgery, fast track anesthesia to achieve rapid postoperative consciousness and early activity, and to limit the intraoperative fluid transfusion. The postoperative care comprised early activity, early fluid intake, and alleviating pain and anxiety through communication, music, and medicine.

Observation index

The postoperative recovery (time to anal exhaust, time to oral feeding, time to out-of-bed activity), the anxiety score (Self-rating Anxiety Scale-higher score indicating more anxiety), and the depression score (Self-rating Depression Scale-higher score more indicating more depression) 2 days before discharge, and 1, 2, and 3 days after surgery were analyzed. The quality of life score (QOL of cancer patients, higher score indicating a better quality of life), nursing satisfaction score (Newcastle Satisfaction with Nursing Scale, higher score indicating greater patient satisfaction) 2 days before discharge were recorded and analyzed as well. The incidence of complications, the 3-year follow up results and the survival rates of the patients were also analyzed.

Statistical analysis

SPSS 19.0 (Asia Analytics Formerly SPSS China) was used for statistical analysis. The

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Table 1. General information

	General (n=62)	Recovery (n=151)	Statistic	P-Value
Sex [n (%)]			0.040	0.841
Male	41 (66.1)	102 (67.5)		
Female	21 (33.9)	49 (32.5)		
Age (year)	62 (47.5±11.2)	151 (46.9±10.7)		
ASA scale			0.154	0.926
I	16 (25.8)	41 (27.2)		
II	25 (40.3)	63 (41.7)		
III	21 (33.9)	47 (31.1)		
Differentiation [n (%)]			0.008	0.996
Poorly	8 (12.9)	20 (13.2)		
Intermediate	29 (46.8)	71 (47.0)		
Well	25 (40.3)	60 (39.7)		
Clinical stages [n (%)]			0.107	0.948
I	6 (9.7)	15 (1.0)		
II	25 (40.3)	63 (41.7)		
III	31 (51.6)	73 (48.3)		
Lymphatic metastasis [n (%)]			0.035	0.851
Yes	25 (40.3)	63 (41.7)		
No	37 (59.7)	88 (58.3)		

Table 2. Postoperative recovery in the two groups

	General (n=62)	Recovery (n=151)	Statistic	P-Value
Micturition time (d)	3.34±1.39	2.02±1.06	7.511	<0.001
Eat time via mouth (d)	3.85±3.22	1.61±1.02	7.682	<0.001
Time of off-bed (d)	2.54±1.44	1.39±1.25	5.830	<0.001

Table 3. Self-rating anxiety in the two groups

	General (n=62)	Recovery (n=151)	Statistic	P-Value
Pre-operation	54.7±7.2	52.6±7.8	3.455	>0.05
Postoperation 1 d	51.5±7.1*	42.2±6.1*	9.626	<0.001
Postoperation 2 d	36.4±6.4**	33.5±5.3**	3.409	<0.001
Postoperation 3 d	32.6±7.1***	28.1±5.7***	4.861	<0.001

Note: *represents the value of one day after surgery compared with the value before the surgery within the same group (P<0.05); **represents the value of two day after surgery compared with the value of one day after surgery within the same group (P<0.05); ***represents the value of three day after surgery compared with the value of two day after surgery within the same group.

numerical data were expressed as [n (%)], and the chi-square test (χ^2) was used to compare the outcomes. The measurement data were expressed as $\bar{x} \pm sd$, the t-test was used for comparison between the two groups, and the repeated variance test was used for comparison at different time points within the group. P<0.05 implied the statistical significance.

Result

General information

The study included 213 patients with gastric cancer. The average age of patients was 36-58 years; 62 patients were in the routine care group comprising 41 males and 21 females at an average age of (47.5±11.2) years; 151 cases were in the recovery group comprising 102 males and 49 females at an average age of (46.9±10.7) years. There were no significant differences in the sex ratio and age between both groups (P>0.05). The other baseline parameters such as ASA classification, differentiation degree, clinical stages and lymph node metastasis were not statistically different between the two groups (both P>0.05) (**Table 1**).

Postoperative recovery of the two groups of patients

The time to anal exhaust of the conventional and recovery group was (3.34±1.39) days and (2.02±1.06) days, respectively, the time to oral feed was (3.85±3.22) and (1.6±1.02) days, respectively, and the time to out-of-bed activity

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Table 4. Self-rating depression in the two groups

	General (n=62)	Recovery (n=151)	Statistic	P-Value
Pre-operation	66.3±8.9	61.2±7.8	4.157	>0.05
Postoperation 1 d	61.7±8.2*	57.6±6.9*	3.727	<0.001
Postoperation 2 d	54.4±7.3**	49.2±6.4**	5.167	<0.001
Postoperation 3 d	50.2±7.1***	44.5±5.8***	6.091	<0.001

Note: *represents the value of one day after surgery compared with the value before the surgery within the same group (P<0.05); **represents the value of two day after surgery compared with the value of one day after surgery within the same group (P<0.05); ***represents the value of three day after surgery compared with the value of two day after surgery within the same group.

Table 5. Statistical result of complications in the two groups

	General (n=62)	Recovery (n=151)	Statistic	P-Value
Total rate	9 (14.5)	8 (5.3)	5.085	0.024
Anastomotic bleeding	0 (0.0)	1 (0.7)		
Gastroparesis	1 (1.6)	0 (0.0)		
Pulmonary infection	1 (1.6)	0 (0.0)		
UTI	1 (1.6)	0 (0.0)		
Seroperitoneum	1 (1.6)	1 (0.7)		
Incision infection	1 (1.6)	0 (0.0)		
Incisional fat liquefaction occurred	1 (1.6)	1 (0.7)		
Nausea and vomiting	3 (4.8)	4 (2.6)		
Lymphatic leakage	0 (0.0)	1 (0.7)		

was (2.54±1.44) and (1.39±1.25) days, respectively. All 3 postoperative recovery parameters were shorter in the recovery group than in the conventional group (P<0.05) (Table 2).

The self-rating anxiety score of the two groups of patients

There were significant differences between the two groups of patients in the self-rating anxiety scores 1, 2, and 3 days after surgery. The anxiety scores of the patients in the recovery group were lower than those in the conventional group (P<0.05). The scores of the self-rating anxiety in both groups reduced after surgery and continued reducing with time (all P<0.05) (Table 3).

The self-rating depression score of the two groups of patients

There were significant differences between the two groups in the self-rating depression scores 1, 2, and 3 days after surgery. The depression scores of the patients in the recovery group

were lower than those in the conventional group (all P<0.05). The scores of the self-rating depression in both groups reduced after surgery and continued to reduce with time (all P<0.05) (Table 4).

The statistical analysis of complications in the two groups

Complications occurred in 9 cases (14.5%) in the conventional group including gastroparesis, pulmonary infection, urinary tract infection, peritoneal effusion, surgical site infection, surgical site fat liquefaction in one case each, and nausea and vomiting in 3 cases. In the recovery group, 8 cases (5.3%) developed complications, including anastomotic bleeding, peritoneal effusion, surgical site fat liquefaction and lymphatic leakage one case each, and nausea and vomiting in 4 cases. All the complications in both groups of patients were treated successfully.

The difference in the complication rate between the two groups was statistically significant ($\chi^2=5.085$, P=0.024) (Table 5).

Quality of life scores in the two groups

The emotional function, cognitive function, physical function and social function between the two groups of patients were not different at baseline (P>0.05) After perioperative care, the emotional function, role function, cognitive function, physical function and social function between the two groups of patients improved and were statistically different from baseline (P<0.05). On comparing each index, it was found that the improvement of these functions in the recovery group was greater than that in the conventional group (P<0.05) (Table 6).

Analysis of nursing satisfaction in the two groups

The nursing satisfaction score of the conventional group was (71.14±9.17), while that of the recovery group was (86.12±9.88). The nursing

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Table 6. Quality of life score in the two groups

		General (n=62)	Recovery (n=151)	Statistic	P-Value
Physical function	Prior treatment	48.73±11.15	49.25±11.36	0.305	0.761
	Posttreatment	63.72±10.01*	78.49±10.55*	9.418	<0.001
Role function	Prior treatment	47.32±12.39	46.58±11.67	0.413	0.680
	Posttreatment	69.36±10.47*	78.59±11.42*	5.486	<0.001
Emotional functioning	Prior treatment	51.27±11.46	52.26±11.58	0.569	0.570
	Posttreatment	64.11±11.99*	79.44±12.31*	8.318	<0.001
Cognitive function	Prior treatment	48.55±11.69	49.17±12.34	0.338	0.736
	Posttreatment	62.88±8.46*	78.47±8.59*	12.083	<0.001
Social function	Prior treatment	46.34±10.57	47.12±11.01	0.475	0.635
	Posttreatment	66.33±13.14*	80.25±15.20*	6.306	<0.001

Note: *represents P<0.05 before surgery.

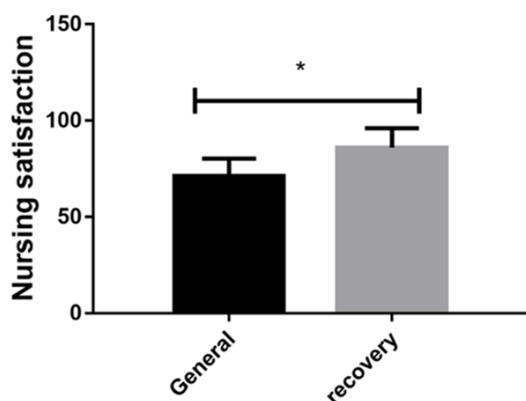


Figure 1. Satisfaction analysis of two groups of patients. *represents P<0.05.

satisfaction in the recovery group was significantly superior to that in the conventional group, and the difference between the two groups was statistically significant (P<0.05) (Figure 1).

Survival analysis of the two groups of patients

The survival analysis of the two groups showed that the 1-year and 3-year survival rate of the patients in the conventional group was 82.3% (51 cases) and 51.6% (32 cases), respectively, and the 1-year and 3-year survival rate was 84.8% (128 cases) and 53.6% (81 cases), respectively in the recovery group. There was no statistical difference in the 1-year and 3-year survival rate of the patients in the two groups (P>0.05) (Figure 2).

Discussion

Gastric cancer can be classified into early and progressive gastric cancer. Depending on the extent of metastasis and the size of lymph

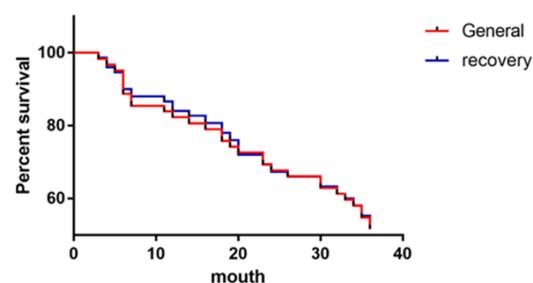


Figure 2. Survival analysis of two groups of patients.

nodes, the surgery for gastric cancer could be radical therapy 1, 2, or 3 to excise the lymph nodes at the first, second, and third stations, respectively [11, 12]. Although with the development of medical technology, the radical gastrectomy technique has also advanced, the mortality rate in gastric cancer patients remains high and the complete cure rate is still unsatisfactory. In recent years, with the development and modernization of nursing concepts, nursing has become a major point of focus in clinical treatment. Since the concept of ERAS was proposed by Danish professor Kehlet in 2001, it has achieved remarkable outcomes in many surgical treatments [13-15]. However, in radical gastrectomy for gastric cancer, the concept of ERAS has not been fully implemented, and more exploration and research are necessary to determine its value in such patients [10]. This study retrospectively analyzed the implementation of the concept of ERAS in the perioperative period of D2 radical gastrectomy for gastric cancer and analyzed its impact on clinical treatment.

The results of our study showed that the patients receiving conventional nursing care

and patients receiving ERAS protocol-based care were not statistically different in terms of baseline parameters, which indicates that the data of this study was comparable, and the results are reliable. We first analyzed the postoperative recovery of patients, including the three indices of time to anal exhaust, oral feeding, and out of bed activity. Early feeding and early activity are indicators of excellent postoperative recovery [16, 17]. Our results showed that the postoperative time to anal exhaust, oral feeding time, and out-of-bed activity of the recovery group were shorter than those in the conventional group, indicating that the postoperative recovery of patients in the recovery group was superior to that in the conventional group. Usually, the intestinal peristalsis is irregular in the first 2 days after radical gastrectomy after which it stabilizes [18], which was consistent with the results of our study. Anxiety and depression are also important factors affecting the recovery of intestinal functions. It has been reported in previous studies that anxiety and depression are closely associated with the gastrointestinal dysfunction and impact the normal distribution of intestinal microflora [19, 20]. Therefore, we also analyzed the results of self-rated anxiety and depression in the two groups of patients before and after surgery. The results showed that although the scores in both groups continued to reduce after surgery, the scores in the recovery group were significantly lower than those in the conventional group before and after the surgery, which indicated that the ERAS protocol was more effective. This would enhance not only postoperative recovery, but also make the surgical process more successful. Post-operative complications are an important factor affecting the recovery of patients [21]. The analysis of postoperative complications in the two groups demonstrated that the incidence of postoperative complications in the recovery group was significantly lower than that in the conventional group. Previous studies have indicated that higher the incidence of postoperative complications, the longer it takes for the patient to recover to the preoperative physiological state [22, 23]. This was also one of the reasons for the recovery time in the recovery group being shorter than that of the conventional group. Early postoperative recovery can also improve the quality of life of the patients and from the results of our study, the quality of life of patients in the recov-

ery group, including the physical function, cognitive function, social function, emotional function and role function, was higher than that of the conventional group. It has been reported in the studies in other surgical fields that the concept of ERAS is favorable for improving the quality of life of patients, which is similar to our results. Shorter recovery time, better mental state, fewer complications, and higher quality of life together resulted in the significantly higher satisfaction scores in the recovery group than in the conventional group. However, the study did not find a significant difference in 3-year survival rate between the two groups. Gustafsson, et al. [24] reported that the enhanced recovery concept could effectively improve the 5-year survival rate of colorectal cancer surgery patients, which was significantly different from our results. We speculate that apart from the differences in the follow-up duration, subjects, and population, the inadequate implementation of the ERAS protocol could have affected our results [25]. This limitation of the study is a small sample size and further clinical data is necessary to verify the results.

In conclusion, the ERAS protocol implementation in the perioperative period of gastric cancer surgery effectively improves the psychological state of the patients, reduces the incidence of complications, promotes postoperative rehabilitation of patients, improves the quality of life, and enhances the satisfaction with nursing care.

Disclosure of conflict of interest

None.

Address correspondence to: Zhonghua Jin, Department of Thoracic Surgery, The Second Affiliated Hospital of Dalian Medical University, No.467, Zhongshan Road, Shahekou District, Dalian 116027, Liaoning Province, China. Tel: +86 13664268959; E-mail: zhonghuajinyx@163.com

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