

Compliance with Guidelines of Enhanced Recovery After Surgery in Elderly Patients Undergoing Gastrectomy

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Abstract

Background Enhanced recovery after surgery (ERAS) aims at expediting postoperative recovery by implementing specific strategies in perioperative management. However, the tolerance to such fast-tracking protocols is under debate, especially in elderly patients. We aimed to investigate rate of compliance with the main ERAS guidelines in elderly gastrectomy patients.

Methods Using data for 168 gastric cancer patients who underwent ERAS after gastrectomy as part of Clinical Trial NCT01653496, we calculated the rates of compliance with nine main ERAS guidelines and compared the compliance rates of elderly (≥ 70 years) and non-elderly (< 70 years) patients. Surgical outcomes and fulfillment of criteria for postoperative discharge were also compared.

Results The study included 55 elderly and 113 non-elderly patients. There were no significant differences between these groups of patients with respect to operative techniques and tumor stage. Except for restricted intravenous fluid administration, the patients in both groups showed very high compliance rates ($> 90\%$) for every ERAS guideline. Notably, the overall compliance rates did not differ significantly between the groups. Postoperatively, the mean time to fulfillment of discharge criteria was slightly longer for elderly patients (4.7 vs. 4.2 days, $p = 0.005$), but there were no significant differences between the groups with respect to the incidence of postoperative complications, length of hospitalization, and readmission rate.

Conclusion Compliance of the medically and physically fit elderly patients with the main ERAS guidelines is comparable to that of non-elderly patients, and such protocols can be safely applied to elderly patients without significant modification.

Introduction

The incidence of gastric cancer is known to increase with age. In Korea, the mean age of the patients who undergo surgery for gastric cancer is approximately 60 years, and

20% of such patients are older than 70 years [1]. Because of frequent underlying comorbidities and low physiological reserve, elderly surgical patients tend to exhibit greater risk of complications and longer postoperative convalescence [2]; therefore, tailored perioperative management should be administered in such patients.

Protocols of enhanced recovery after surgery (ERAS) are becoming increasingly common in the management of abdominal surgery patients. ERAS involves a combination of evidence-based perioperative strategies that aims at reducing surgical stress and expediting postoperative recovery [3]. A number of studies have shown that ERAS

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Table 1 Enhanced recovery after surgery (ERAS) guidelines

Guideline	Practice
Preoperative	
Patient education	Preoperative education about ERAS including health information, guidelines details, hospital care plans, and discharge plan
No mechanical bowel preparation	Do not perform routine preoperative mechanical bowel preparation using laxative
Curtailed preoperative fasting	Avoid preoperative fasting and allow the patients to have regular meals up to 6 h before surgery
Preoperative carbohydrate-rich drink	Administer 200–400 mL of carbohydrate-rich drink 2 h before surgery
Intraoperative	
Avoiding the use of nasogastric tube/abdominal drainage	Do not use perioperative nasogastric tube or abdominal drainage during surgery
Maintaining intraoperative normothermia	Monitor body temperature during surgery and maintain normal range using a circulating warm-air blanket or warm intravenous fluid
Single dose prophylactic antibiotics	Use single dose of a first-generation cephalosporin before skin incision and do not make extended postoperative use
Postoperative	
Thoracic epidural anesthesia	Use patient-controlled thoracic epidural analgesia for postoperative pain control
Thromboprophylaxis	Apply an intermittent pneumatic compression device until hospital discharge for thromboprophylaxis
Early oral nutrition	Start oral meal at the postoperative day 1
Restricted intravenous fluid administration	Administer intravenous fluid with restricted amount (20 mL/kg/day) up to three postoperative days
Early active ambulation	Encourage early active ambulation, beginning at the postoperative day 1 (more than 2 h/day)
Early removal of urinary catheter removal	Remove urinary catheter as early as postoperative day 1
Planned hospital discharge	Evaluate patient recovery using standard discharge criteria to determine discharge plan

can reduce the incidence of postoperative complications and the length of hospitalization in patients undergoing abdominal surgery [4, 5]. ERAS implements the following strategies established on the basis of a scientific reappraisal of traditional surgical care: curtailed preoperative fasting, preoperative carbohydrate loading, avoiding the use of an abdominal drain or nasogastric tube, restricted administration of intravenous fluid, early active ambulation, and early oral nutrition [3]. Despite the proven efficacy of ERAS, many surgeons are concerned about the ability of elderly patients to tolerate such fast-tracking protocols [6]. In the present study regarding the feasibility of ERAS in elderly surgical patients, we investigated the rate of compliance with the main ERAS guidelines and the short-term surgical outcomes of gastrectomy in elderly and non-elderly patients.

Methods

Patients and data

Between 2012 and 2013, 168 gastric cancer patients were enrolled in a phase 2 clinical trial that investigates the compliance with ERAS after gastrectomy (ClinicalTrials.gov,

NCT01653496). Inclusion criteria were patients undergoing gastrectomy for gastric carcinoma, Eastern Cooperative Oncology Group (ECOG) performance status of 0–2, and normal hepatic, renal, and hematologic function. Patients undergoing neoadjuvant chemotherapy, emergency surgery (bleeding or perforation), or who exhibited other concomitant malignancies were excluded. All operations were performed by three experienced gastric surgeons at a tertiary referral hospital. Gastrectomy and lymph node dissection (LND) were carried out according to the Japanese treatment guideline (2010, ver. 3) [7]. Laparoscopic surgery was indicated for cT1N0 gastric cancer; otherwise, open surgery was performed. All patients were perioperatively managed according to the standardized ERAS guidelines (Table 1).

This study was performed as the secondary analysis of the registered trial. Using the prospectively collected data, we compared elderly (≥ 70 years) and non-elderly (< 70 years) patients with respect to rates of compliance with the main ERAS guidelines, postoperative recovery, and short-term surgical outcomes. This study was approved by the institutional review board of the Chonnam National University Hospital, South Korea; informed consent was obtained from all patients participating in the study.

ERAS guidelines

To compare the feasibility of ERAS between the elderly and non-elderly group, we investigated nine main ERAS guidelines in which patient compliance may be of concern: no mechanical bowel preparation, no preoperative fasting, preoperative carbohydrate-rich drink, no abdominal drainage, no perioperative nasogastric tube, early oral nutrition, restricted intravenous fluid administration, early active ambulation, and early removal of urinary catheter.

Non-compliance was defined as when the guideline could not be applied or was withdrawn due to patient's intolerance or other reasons. In addition, any adverse events related to the application of the guidelines were also recorded as non-compliance. For instance, if a patient could not continue early oral nutrition due to gastrointestinal discomfort, that patient was recorded as non-compliant. Regarding early active ambulation, patients who did not meet the required ambulation time were recorded as non-compliant.

Postoperative recovery and surgical outcomes

As a parameter of postoperative recovery, the time until fulfillment of the discharge criteria was compared between the elderly and non-elderly groups. The discharge criteria consisted of four major functional goals to be met before hospital discharge: adequate pain control; ambulation and self-care ability; tolerance to oral intake; no abnormal physical signs; or laboratory results [8].

Other postoperative outcomes including gas passage time, postoperative fever, postoperative blood transfusion, length of stay, and postoperative complications were also compared between the two groups. Postoperative complications were defined as any complications within 30 days of operation or during the hospitalization. The complications arising at the operating field or abdominal cavity were defined as a local complication, and otherwise, they were defined as a systemic complication. The type and severity of complications were based on the institutional guidelines of definition and classification of complications after gastrectomy [9].

Statistical analysis

Data are expressed as mean \pm standard deviation or *n* (%). Student's *t* test was used to compare continuous data, and the Chi-square or Fisher's exact test was used to compare categorical data, as appropriate. The statistical analyses were performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA), and two-sided *p* values of <0.05 were considered statistically significant.

Results

Of the 168 patients, 55 were elderly and 113 were non-elderly. The baseline characteristics for the patients in the two groups are summarized in Table 2. There were no statistically significant differences between the two groups regarding gender, body mass index, operation method, or tumor stage. However, compared to non-elderly patients, elderly patients exhibited comorbidities more frequently, which was statistically significant ($p < 0.001$), and higher American Society of Anesthesiologists (ASA) score ($p = 0.001$). Histological examination revealed that differentiated-type tumors were more common in elderly patients ($p = 0.002$).

The rates of compliance with the nine main ERAS guidelines are shown in Table 3. Of the nine guidelines, those referring to mechanical bowel preparation, preoperative fasting, and consumption of preoperative carbohydrate drinks were successfully applied for all patients. Other guidelines, except for that referring to restricted administration of intravenous fluid, had rates of compliance higher than 90% for both groups. Of note, the rates of compliance were not significantly different between the two groups for any of the main ERAS guidelines under study.

Table 4 shows the postoperative outcomes for the patients in the two groups. The mean time to complete fulfillment of the discharge criteria was slightly longer for the elderly (4.7 days) than for the non-elderly (4.2 days), which was statistically significant ($p = 0.005$). However, there were no statistically significant differences between the two groups regarding postoperative complications, hospital stay, or readmission rate.

Discussion

The fundamental concept of ERAS is to enable expedite postoperative recovery [3]; nevertheless, concerns about the patients' tolerance to such fast-tracking protocols have been one of the main obstacles undermining the widespread acceptance of ERAS strategies. In the present study, we investigated the compliance with nine main ERAS guidelines in elderly gastrectomy patients. We found that elderly patients showed very high ($>90\%$) rates of compliance with most ERAS guidelines, and the compliance rates were similar to those noted in non-elderly patients. The strength of our study is that we analyzed prospective data that were collected during a clinical trial. Ours is the first study that demonstrated the feasibility of implementing ERAS guidelines in elderly patients. We suggest that the fast-tracking ERAS protocols can be safely and

Table 2 Baseline characteristics

	Non-elderly (<70 years)	Elderly (\geq 70 years)	<i>p</i> value
No. of patients	113	55	
Age (years)	55.7 \pm 9.1	75.7 \pm 4.0	<0.001
Gender			0.380
Male	66 (58.4)	36 (65.5)	
Female	47 (41.6)	19 (34.5)	
BMI (kg/m ²)	24.1 \pm 3.1	24.8 \pm 3.6	0.190
Comorbidity	33 (29.2)	32 (58.2)	<0.001
ASA score			0.001
1	89 (78.8)	30 (54.5)	
\geq 2	24 (21.2)	25 (45.5)	
Operative approach			0.824
Open surgery	17 (15.0)	9 (16.4)	
Laparoscopic surgery	96 (85.0)	46 (83.6)	
Gastric resection			0.813
Distal gastrectomy	102 (90.3)	49 (89.1)	
Total gastrectomy	11 (9.7)	6 (10.9)	
Lymph node dissection ^a			0.128
D1+	90 (79.6)	49 (89.1)	
D2	23 (20.4)	6 (10.9)	
Combined organ resection	3 (2.7)	2 (3.6)	0.663
Histological type			0.002
Differentiated	38 (33.6)	32 (58.2)	
Undifferentiated	75 (66.4)	23 (41.8)	
Tumor size (mm)	15 \pm 18	23 \pm 35	0.061
Tumor stage			0.949
I	92 (81.4)	45 (81.8)	
II–IV	21 (13.3)	10 (10.9)	

Data are expressed as mean \pm standard deviation or total number (percentage)

BMI body mass index, ASA American Society of Anesthesiology

^a Japanese gastric cancer treatment guidelines 2010 (ver. 3)

efficiently applied in such patients, without significant modification.

Improving rates of compliance with ERAS guidelines is very important for achieving better outcomes in surgical patients. Gustafsson et al. [10] showed that, as the adherence to ERAS guidelines increased over time, the incidence of postoperative complications and readmissions decreased significantly in patients undergoing ERAS. However, compliance with ERAS guidelines may somewhat vary in each institution, according to the available resources and experience with ERAS protocols. While relatively low compliance is found in institutions with less ERAS experience, compliance can reach up to nearly 90% when a well-organized expert group is involved in an ERAS program [11, 12]. Experts suggest a few strategies to improve compliance with ERAS guidelines. First, a

specialized unit and expert working group should be involved in the implementation of ERAS protocols. Second, continuous education for the members of the working group is required to ensure that all staff involved apply a professional approach. Finally, auditing and dissemination of the results should be performed regularly, with establishment of an active ERAS-related research program on where possible [13].

The impact of age on compliance with ERAS guidelines has been controversial. Feroci et al. [6] showed that old age (>75 years) and higher ASA score were associated with lower compliance with the ERAS guidelines referring to early removal of the urinary catheter, early transition to regular diet, and early mobilization in patients undergoing ERAS after colorectal surgery. Interestingly, our previous study regarding early adoption of oral nutrition after

Table 3 Compliance with enhanced recovery after surgery (ERAS) guidelines in elderly and non-elderly patients

ERAS guidelines	Compliance (%)		<i>p</i> value*
	Non-elderly (<i>n</i> = 113)	Elderly (<i>n</i> = 55)	
1. Avoiding preoperative bowel preparation	113 (100)	55 (100)	–
2. Avoiding preoperative fasting	113 (100)	55 (100)	–
3. Preoperative carbohydrate drink	113 (100)	55 (100)	–
4. No use of abdominal drainage	107 (94.7)	52 (94.5)	0.744
5. Avoiding use of nasogastric tube	109 (96.5)	53 (96.4)	0.681
6. Early oral nutrition	108 (95.6)	52 (94.5)	0.928
7. Restricted intravenous fluid administration	101 (89.4)	47 (85.5)	0.461
8. Early active ambulation	111 (98.2)	54 (98.2)	0.549
9. Early removal of urinary catheter	107 (94.7)	51 (92.7)	0.874

* Chi-square with Yates' correction

Table 4 Postoperative outcomes in elderly and non-elderly patients

	Non-elderly (<i>n</i> = 113)	Elderly (<i>n</i> = 55)	<i>p</i> value
Fulfillment of discharge criteria (days)	4.2 ± 0.9	4.7 ± 0.9	0.005
Start regular diet (days)	1.4 ± 1.3	1.3 ± 1.1	0.668
Gas passage (days)	2.2 ± 0.8	2.1 ± 0.8	0.656
Postoperative fever	43 (38.1)	16 (29.1)	0.253
Blood transfusion	2 (1.8)	1 (1.8)	0.549
Complications	10 (8.8)	6 (10.9)	0.670
Local	7 (6.2)	5 (9.1)	0.531
Luminal bleeding	2	1	
Ileus	2	2	
Gastric stasis	1	1	
Pancreatitis	1	0	
Abdominal infection	1	0	
Wound	0	1	
Systemic	3 (2.7)	4 (7.3)	0.218
Enteritis	1	0	
Arrhythmia	1	0	
Urinary tract infection	1	2	
Drug fever	0	1	
Pneumonia	0	1	
Hospital stay (days)	7.3 ± 3.7	6.9 ± 1.9	0.517
Readmission	4 (3.5)	1 (1.8)	0.893

Data are expressed as mean ± standard deviation or total number (percentage)

gastrectomy indicated that old age was one of the main factors that undermined the patient's tolerance for oral intake [14]. However, our present study shows significantly improved compliance with the guideline for early oral intake in both elderly and non-elderly gastrectomy patients (>90% in both groups). Because of the limited results, the influence of age on the feasibility of specific ERAS

protocols may require further investigation. Nevertheless, our study suggests that compliance with ERAS guidelines in elderly patients may be improved via organizational efforts including continuous auditing, patient education, and protocol amendment.

The hallmark of ERAS is shorter postoperative convalescence and early hospital discharge. Contrary to wide

differences in the duration of hospitalization noted for patients managed by traditional perioperative care, the target length of hospitalization in gastrectomy patients managed by ERAS is 6–7 days [15]. There is a concern that early hospital discharge may increase the risk of readmission. However, several studies have demonstrated no significant increase in readmission rates in patients undergoing ERAS compared to the readmission rates in patients undergoing conventional care [16, 17]. Our study also indicated that readmission rates were similar for elderly and non-elderly patients undergoing ERAS, suggesting no age-related influence on this aspect. However, it should be noted that appropriate decision of hospital discharge based on standard discharge criteria is essential to ensure the safe early discharge in patients undergoing ERAS.

As we mentioned in the ERAS protocol, the concept of restricted intravenous fluid administration was to avoid fluid overload and give a minimum requirement of IV fluid during the postoperative period. However, when a surgeon decided oral intake of fluid was not sufficient during the early postoperative period, additional fluid was given to the patients at the discretion of surgeons. Because of this, the compliance was relatively lower than other protocols, but this also successfully reached a target compliance of more than 80% in our study.

A high incidence of underlying comorbidities and low physiological reserve often result in longer convalescence after surgery in elderly patients [2]. In the present study, we assessed postoperative recovery in elderly and non-elderly patients. The assessment was based on the standard discharge criteria [8] and found that elderly patients required slightly longer time (4.7 vs. 4.2 days, $p = 0.005$) to fulfill the discharge criteria; however, this difference was not clinically significant, as the final duration of hospitalization did not differ between elderly and non-elderly patients (6.9 vs. 7.3 days, $p = 0.517$). Other short-term surgical outcomes including morbidity and mortality were also comparable between the two groups, suggesting that the efficacy of ERAS may be more relevant for elderly patients. Future studies of the efficacy of ERAS protocols should focus on determining the specific patient population most likely to benefit from ERAS.

There are some limitations to our present study. First, because this study selectively included elderly patients who are regarded as being medically and physically fit, outcomes of ERAS in elderly patients with severe underlying medical conditions could not be analyzed in our study. Appropriate ERAS program for high-risk elderly patients is an important topic. Considering the low incidence of these patients, a larger, multicenter study will be required to investigate the efficacy of ERAS in such high-risk group. Second, our study was performed in an experienced center

serviced by a well-organized team of ERAS and gastric cancer specialists. This may limit the interpretation of our results in a more general context, but at the same time emphasizes the key importance of the organized team approach for successful implementation of ERAS guidelines.

In summary, this report specifically addresses the compliance with ERAS guidelines in elderly gastrectomy patients. We found that elderly patients showed high rates of compliance with most ERAS guidelines that were comparable to those observed in non-elderly patients. Therefore, our study suggests that fast-tracking ERAS protocols can be safely and efficiently applied in elderly patients.

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Compliance with ethical standards

Conflict of interest The authors have no conflict of interest to disclose.

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