Original Article

Outcome of Enhanced Recovery After Surgery (ERAS) for Colorectal Surgery in Early Elderly and Late Elderly Patients

Varut Lohsiriwat, [1]MD, PhD

Abstract

Introduction: This study aimed to determine the outcome of enhanced recovery after surgery (ERAS) programme in elderly colorectal surgery patients. Materials and Methods: Details and surgical outcomes of elderly patients undergoing elective colectomy and/or proctectomy according to ERAS protocol from 2011 to 2017 were retrospectively reviewed. Patients were divided into 2 groups: early elderly (EE, n = 107) aged 65–74 years old and late elderly (LE, n = 74) aged ≥75 years old. Results: This study included 181 patients. The LE group had poorer baseline characteristics, but the operative details in both groups were comparable. Overall complication and severe complication rates were 28% and 3.3%, respectively. The LE group had a higher overall complication rate (38% vs 22%; P = 0.016) but comparable rate of severe complications (2.7% vs 3.7%; P = 1.00). Median postoperative stay was 4 days (interquartile range [IQR], 4–6 days) and it was not significantly different between both groups (5 days for LE vs 4 days for EE; P = 0.176). No difference was seen in time to gastrointestinal recovery and 30-day mortality or readmission between both groups. Overall compliance with ERAS protocol was 76% (IQR, 65–82%) and it did not vary significantly between the LE (71%) and EE (76%) groups (P = 0.301). However, the LE group had lower compliance with fluid management, nutrition therapy and use of multimodal analgesia. Conclusion: ERAS is a safe and effective protocol that can be used in EE and LE colorectal surgery patients.

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Introduction

Individuals ≥65 years old are termed elderly. In the literature, a distinction is made between those aged 65–74 years, described as "early elderly" (EE), and those aged ≥75 years, known as "late elderly" (LE).[1] In surgical practice, there is evidence that advanced age is an important risk factor for postoperative morbidity and mortality.[2] To minimise postoperative complications and reduce hospital stay, a multidisciplinary approach to the care of surgical patients known as enhanced recovery after surgery (ERAS) is widely practised including colorectal surgery.[3] Recent results from several ERAS registries have shown that higher compliance with—or better adherence to—an ERAS programme is associated with better outcomes following elective and emergency colorectal surgeries.[4,5]

A systematic review of ERAS in elderly patients who underwent colorectal surgery has concluded that it is a safe care pathway and confers clinical benefits such as shorter hospital stays and fewer complications.[6] A recent multicentre observational study in Spain[7] and a comparative study (pre- and post-ERAS) in Italy[8] have also supported the feasibility and beneficial effects of ERAS in elderly colorectal surgery patients. A study from Thailand has shown that ERAS helped patients to maintain their activities

of daily living (ADL) and improve their quality of life following colorectal surgery.[9]

However, most studies in the literature have mainly compared elderly patients on ERAS against those on traditional care pathways.[8,10,11] They also focused on ERAS outcomes in elderly and young patients[9,12–14] or reported on such outcomes in elderly patients as a case series.[7] Little is known about detailed compliance with ERAS protocol in the elderly and the differences in clinical outcomes and use of ERAS protocol, if any, in different age groups of the elderly.[15] This study aimed to determine the outcome of ERAS in the elderly after colorectal surgery and to compare the results between EE and LE patients.

Materials and Methods

This is a retrospective study of 181 patients ≥65 years old who underwent elective open colectomy and/or proctectomy in an ERAS programme from January 2011 to September 2017 at a university hospital in Thailand. Patients with acute colonic obstruction or perforation and those who underwent a non-resection procedure (such as proximal colostomy and bypass operation) were excluded. Since the focus of our study is on ERAS outcome, patients who underwent laparoscopic surgery were excluded as laparoscopy has been shown to confer advantages that are independent of ERAS.[16] This study was approved by the institutional ethics committee and written informed consent was provided by patients.

All patients were operated on and treated by a board-certified colorectal surgeon and his team according to an established ERAS protocol based on the recommendations for perioperative care in elective colorectal surgery published by ERAS Society.[17,18] The ERAS protocol comprised 17 interventions that were implemented in 3 phases: preoperative, intraoperative and postoperative (Table 1). The details and application of the protocol were not distinguished by the age of the patients. At discharge, patients were afebrile and ambulated independently, and pain was adequately managed with oral analgesics and recovery of gastrointestinal function was satisfactory. Postoperatively, they were followed up at 7–10 days and 1 month. At 1 month follow-up, they underwent a physical examination and reported on their functional status, including any unplanned visits or admissions to a medical facility such as hospital.

Data collection included patients' baseline characteristics, operative details, postoperative outcomes and compliance with ERAS protocol. The baseline characteristics included

Table 1. ERAS Protocol for Elective Colorectal Surgery

Phase		Intervention
Preoperative	1.	Structured and detailed preoperative counselling to patients and their relatives
	2.	Cessation of smoking and intake of alcohol
	3.	Preoperative optimisation of nutrition status
	4.	Optimisation of other general conditions including anaemia
	5.	No mechanical bowel preparation
	6.	Administration of appropriate prophylactic antibiotics
Intraoperative	7.	Prophylaxis of postoperative nausea and vomiting
	8.	Use of mid-thoracic epidural anaesthesia
	9.	Use of atraumatic O-ring wound retractor/protector
	10.	Active warming to avoid hypothermia
	11.	Near-zero fluid balance to avoid overload of salt and water
	12.	No intra-abdominal or pelvic drain
Postoperative	13.	Early intake of oral fluids and semi-solid foods (from postoperative day 0)
	14.	Early ambulation (from postoperative day 1)
	15.	Multimodal analgesia with opioid-sparing strategies
	16.	Removal of urinary catheter by postoperative day 3
	17.	Discontinuation of intravenous fluid infusion by postoperative day 3

ERAS: Enhanced recovery after surgery

age, body mass index, gender, indication for surgery, preoperative haematocrit and serum albumin, the American Society of Anesthesiologists (ASA) classification results and ColoRectal Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity.[19] The operative details included operative time and type, estimated blood loss and use of epidural analgesia. Postoperative outcomes included complications graded according to the Clavien-Dindo classification of surgical complications,[20] severe complications (defined as Clavien-Dindo grade ≥III), time to first defecation and resumption of solid diet, duration of postoperative stay, death and readmission within 30 days after surgery. Compliance rate with ERAS protocol was derived by the division of the number of ERAS interventions in each patient against the aggregate of 17 interventions in our ERAS programme. All data were prospectively collected by the author and his ERAS coordinators through paper-based data collection before they were transferred to an electronic record for analysis.

Statistical analyses were performed using PASW Statistics for Windows version 18.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation or median and interquartile range (IQR), and were compared using Student's t-test or Mann-Whitney U test. Categorical data were expressed in aggregate values

(percentage) and compared using Pearson's chi-square or Fisher's Exact test. A value of P <0.05 was considered statistically significant.

Results

Mean age of the patients was 73 years (range, 65–90 years) and was 68.6 years and 79.6 years in the EE (n = 107) and LE (n = 74) groups, respectively. Seventy (39%) patients underwent proctectomy and 38 (21%) patients had stoma formation. Although the LE group had significantly poorer baseline characteristics, the operative details of both groups were comparable (Table 2).

Overall complication and severe complication rates were 28% and 3.3%, respectively. The most common postoperative complication was ileus (n = 14; 7.7%) followed by wound infection (n = 10; 5.5%) and pneumonia (n = 7; 3.9%). The most common severe complication was anastomotic leakage that required reoperation (n = 4; 2.2%). The LE group had a significantly higher overall complication rate (38% vs 22%; P = 0.016) but comparable rate of severe complications (2.7% vs 3.7%; P = 1.00).

Median postoperative stay was 4 days (IQR, 4–6 days) and it was not significantly different between both groups (5 days for LE vs 4 days for EE; P = 0.176). In both groups,

Table 2. Baseline Characteristics of Patients and Operative Details

Variable	Aggregate (n = 181)	Early Elderly (n = 107)	Late Elderly (n = 74)	P Value
Age (years, mean ± SD)	73.1 ± 6.4	68.6 ± 2.9	79.6 ± 4.0	<0.001*
Male (%)	112 (62)	67 (63)	45 (61)	0.806
BMI (kg/m², mean ± SD)	22.9 ± 3.8	23.3 ± 3.7	22.2 ± 3.8	0.037*
ASA classification ≥3 (%)	53 (29)	21 (20)	32 (43)	<0.001*
Diabetes mellitus (%)	60 (33)	28 (26)	32 (43)	0.016*
CR-POSSUM (median, IQR)	2.5 (1.8 – 3.5)	1.9 (1.4 – 2.5)	3.5 (2.6 – 9.0)	<0.001*
Preoperative haematocrit (%, mean ± SD)	36.2 ± 5.1	37.0 ± 5.0	35.1 ± 5.0	0.013*
Preoperative serum albumin (g/dL, mean ± SD)	3.8 ± 0.5	3.9 ± 0.4	3.7 ± 0.6	0.007*
Cancer surgery (%)	170 (94)	101 (94)	69 (93)	0.750
Rectal surgery (%)	70 (39)	44 (41)	26 (35)	0.416
Resection with stoma formation (%)	38 (21)	19 (18)	19 (26)	0.198
Multivisceral organ resection (%)	17 (9)	11 (10)	6 (7)	0.412
Operative time (minutes, mean ± SD)	183 ± 71	189 ± 75	175 ± 65	0.197
Estimated blood loss, mL (median, IQR)	150 (55 – 300)	150 (50 – 300)	150 (78 – 213)	0.879
Use of epidural analgesia (%)	62 (34)	36 (34)	26 (35)	0.835

ASA: American Society of Anesthesiologists; BMI: Body mass index; CR-POSSUM: ColoRectal Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity; IQR: Interquartile range; SD: Standard deviation
*P <0.05.

median time to first defecation was 3 days ($P = 0.915$). There were no significant differences in admission rate to the high dependency unit or intensive care unit, 30-day mortality and 30-day readmission rate between both groups. The outcome measures in both groups are shown in Table 3 and Figure 1.

Overall compliance with ERAS protocol was 76% (IQR, 65–82%) and it did not vary significantly between the LE (71%) and EE (76%) groups ($P = 0.301$). However, the LE group had significantly lower compliance with preoperative optimisation of nutrition status (55% vs 72%; $P = 0.026$), intraoperative fluid management (45% vs 60%; $P = 0.049$) and postoperative use of opioid-sparing multimodal analgesia (36% vs 60%; $P = 0.003$) (Fig. 2). In both groups, the lowest adherence to ERAS interventions included avoidance of mechanical bowel preparation (overall compliance of 23%) and use of mid-thoracic epidural analgesia (overall compliance of 34%). There was no significant difference in the percentage of patients who had epidural analgesia and who did not undergo bowel preparation in both groups (12% in LE vs 7% in EE; $P = 0.190$).

Discussion

This study has demonstrated the usefulness of ERAS protocol in open colorectal surgery in different age groups of the elderly. Although LE patients had significantly poorer baseline characteristics than EE patients, the clinical outcomes of ERAS following major colorectal surgery (such as time to gastrointestinal recovery, hospital stay and severe complication rate) were not significantly different between both groups. This finding suggests that ERAS protocol is safe and effective in elderly patients, and that more vulnerable patients such as LE may benefit most from an ERAS programme.

Although overall compliance with ERAS protocol was comparable between EE and LE patients, the latter had significantly lower compliance with some ERAS manoeuvres, namely, optimisation of nutrition status, intraoperative fluid management and postoperative use of opioid-sparing multimodal analgesia. The lowest adherence to ERAS protocol in our patients was seen in their avoidance of mechanical bowel preparation and use of mid-thoracic epidural analgesia. This finding highlighted the challenges that can be encountered in the implementation of certain ERAS interventions in an aged population.

Although an ERAS programme will benefit most surgical patients through a reduction of their stress response to surgery and facilitation of functional recovery, it may compromise the well-being of certain groups of patients that include the elderly who typically have multiple comorbidities, higher risk of postoperative complications and require an extended period of convalescence.[21–23] Nevertheless, our study has highlighted some clinical benefits of ERAS in the elderly. For example, the median postoperative stay of 4 days in our patients was remarkably low compared to that reported in the literature.[6,10,11] The median postoperative stay in the LE group was also insignificant compared to the EE group, being 1 day more than the latter. Our finding that LE patients had more overall complications—but not more

Table 3. Outcome Measures

Variable	Aggregate (n = 181)	Early Elderly (n = 107)	Late Elderly (n = 74)	*P* Value
Time to resume normal diet in days (median, IQR)	2 (0 – 3)	1 (0 – 3)	2 (1 – 3)	0.436
Time to first defecation in days (median, IQR)	3 (2 – 4)	3 (2 – 4)	3 (2 – 4)	0.915
Overall complications (%)	51 (28)	23 (22)	28 (38)	0.016*
Severe complications (%)†	6 (3.3)	4 (3.7)	2 (2.7)	1.000
Patients who required HDU or ICU stay (%)	14 (7.7)	7 (6.5)	7 (9.5)	0.470
HDU/ICU stay in days (median, IQR)‡	3 (2 – 4)	3 (2 – 4)	2 (1 – 4)	0.116
Postoperative stay in days (median, IQR)	4 (4 – 6)	4 (3 – 5)	5 (4 – 6)	0.176
30-day mortality (%)	1 (0.6)	0	1 (1.4)	0.409
Unplanned 30-day readmission (%)	2 (1.1)	2 (1.9)	0	0.514
Compliance with ERAS, % (median, IQR)	76 (65 – 82)	76 (65 – 82)	71 (65 – 82)	0.301

ERAS: Enhanced recovery after surgery; HDU: High dependency unit; ICU: Intensive care unit
*$P <0.05$.
†Clavien-Dindo grade ≥III. The most severe complication was observed in patients with >1 complication.
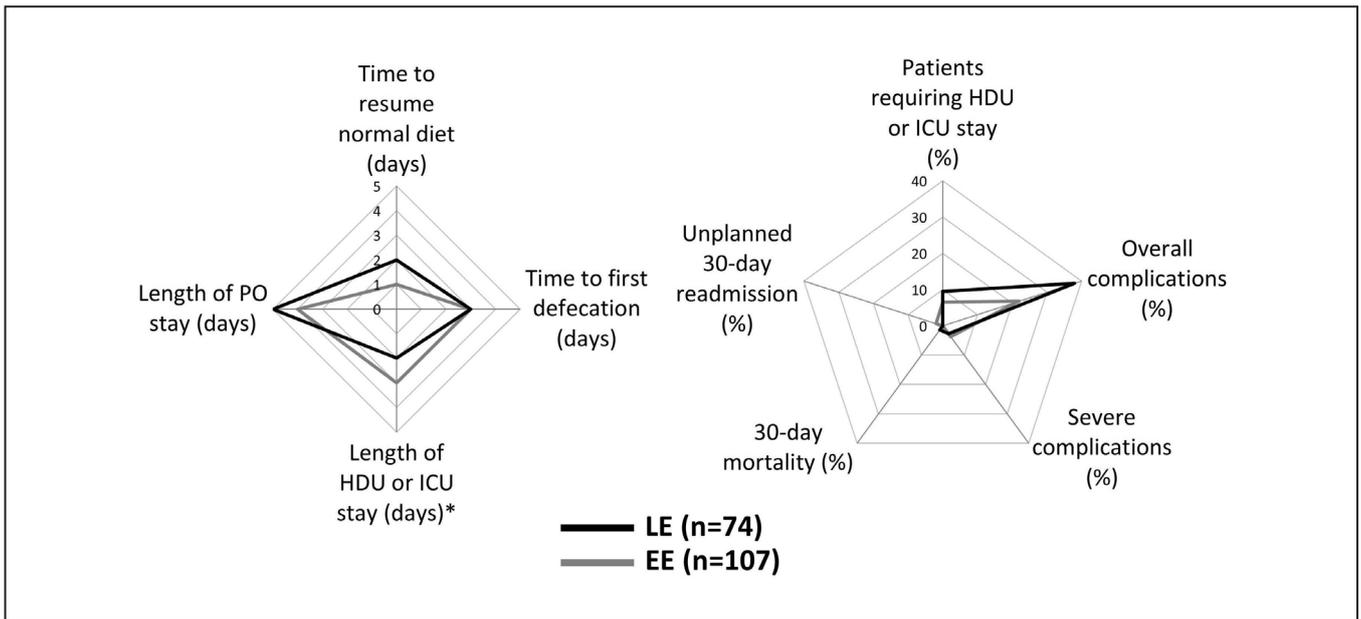‡Fourteen patients required admission to HDU or ICU.

Fig. 1. Radar chart showing surgical outcomes of ERAS in EE and LE colorectal surgery patients. EE: Early elderly; ERAS: Enhanced recovery after surgery; HDU: High dependency unit; ICU: Intensive care unit; LE: Late elderly; PO: Postoperative
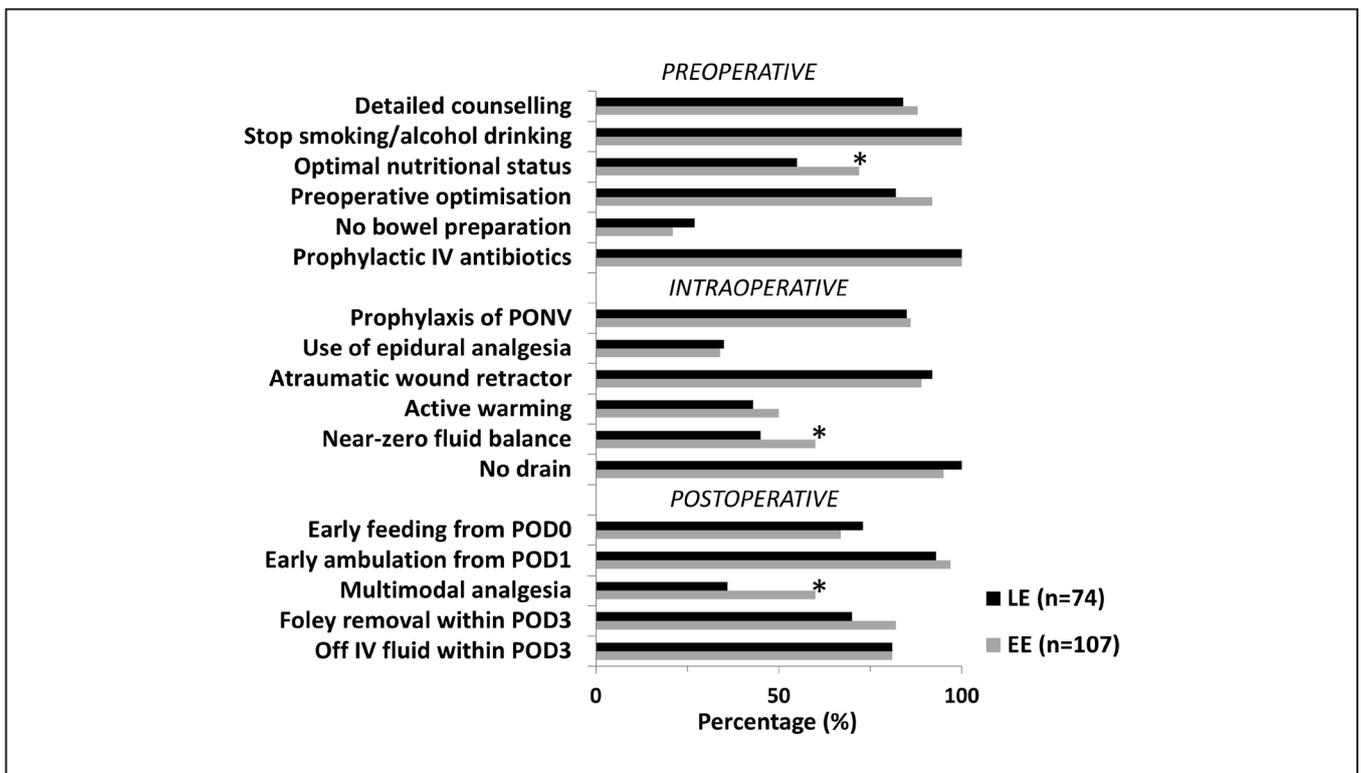*A total of 14 (7 EE and 7 LE) patients required admission to HDU or ICU.

Fig. 2. Percentage of EE and LE patients who adhered to the 17 interventions in ERAS protocol. EE: Early elderly; ERAS: Enhanced recovery after surgery; IV: Intravenous; LE: Late elderly; POD: Postoperative day; PONV: Postoperative nausea and vomiting
*$P < 0.05$.

severe complications—also corroborated a similar finding from an ERAS registry for colorectal surgery in Italy.[14]

Due to differences in physical fitness and comorbidities in the aged population, one could argue the need for specific ERAS guidelines and recommendations or different perioperative care protocols in elderly and frail patients.[13,24] It is, however, well documented that increased ERAS compliance correlates with fewer complications, shorter hospital stay and lower hospital expenses.[4,25] Some studies have reported that colon surgery, laparoscopy and lack of stoma formation were linked to higher compliance with ERAS[7] while a high ASA grade and older age were significantly associated with lower adherence.[14]

In our study, high overall compliance with ERAS—76% in EE and 71% in LE—was comparable to that reported by ERAS centres in Europe.[8,12,13] Several studies indicated that when compliance with ERAS protocol reached 70%, there was a significant improvement in short- and long-term outcomes following colorectal surgery.[26,27] In our study, high adherence to ERAS could be attributed to the implementation of a multidisciplinary team approach after ERAS was implemented for colorectal surgery in 2011.

Low compliance with preoperative optimisation of nutrition status in our LE patients could be partly caused by a higher incidence of malnourishment. They could also experience more difficulty imbibing solid food and nutritional supplements. Compliance with intraoperative fluid therapy was also lower in older patients who underwent major abdominal surgery for endothelial injury and interstitial oedema,[28] likely due to existing comorbidities—such as cerebrovascular disease, coronary artery disease and renal insufficiency—that made fluid management a challenge. The comorbidities also provide absolute or relative contraindications for the administration of non-steroidal anti-inflammatory drugs or selective cyclo-oxygenase-2 inhibitors as part of opioid-sparing multimodal analgesia.[29]

In our patients, low compliance with mechanical bowel preparation could be attributed to the routine use of preoperative bowel preparation in our institute for any surgical procedure related to left-sided colon and rectum. However, recent evidence suggests that it is not a prerequisite for elective colorectal surgery.[30] The limited use of thoracic epidural analgesia in our patients could be due to the reluctance of some anaesthesiologists to offer it to patients since it could heighten the risk of hypotension.[31] Some clinicians may also prefer other analgesic approaches such as transverse abdominis plane block and surgical site infiltration.

Our study has a few limitations. First, certain ERAS interventions—such as absence of preoperative bowel preparation and use of mid-thoracic epidural anaesthesia—were not widely used in our study. This could be addressed by closer cooperation within the multidisciplinary ERAS team to improve the implementation of all ERAS interventions. Second, some interventions recommended by ERAS Society were not introduced in our protocol. These included preoperative carbohydrate loading and pharmacological prophylaxis against venous thromboembolism,[17,18] and their absence was attributed to the lack of commercially available carbohydrate drinks in Thailand and low incidence of venous thromboembolism in Thais undergoing major abdominal surgery for gastrointestinal malignancy,[32] respectively. Third, this was a single-centre study of a limited cohort of elderly patients. Multicentre and large-scale studies are needed to validate the findings of this study.

There is also a need to investigate long-term outcomes in elderly patients who have undergone major colorectal surgery according to ERAS protocol. Future studies should include measures of clinical outcomes and patient-reported outcomes such as functional recovery and quality of life. A small case series has shown that ERAS helped surgical patients ≥75 years old to maintain their ADL after colorectal surgery. Although the modified Barthel index of their ADL dropped by 3%, it returned to preoperative baseline level 1 month after surgery.[9]

A strength of this study was that data were extracted from the prospective database of a colorectal surgery unit in the largest university hospital in Thailand, and all patients were managed by the ERAS team according to a well established ERAS protocol. Second, there was no selection or performance bias since all elderly patients who underwent elective colorectal resection during the study period were included. Third, overall compliance with ERAS and its interventions were compared. Finally, this study included only "open" surgeries that are known to result in bigger physiological changes and it is also more difficult to implement an ERAS programme compared to laparoscopic surgery,[16] thus highlighting the novel findings of this study.

Conclusion

Although LE patients presented with more comorbidities and poorer baseline characteristics, they had—with the exception of a higher overall complication rate—good gastrointestinal recovery and other clinical outcomes that were comparable to EE patients in an ERAS programme for colorectal surgery. ERAS compliance was also relatively high in both groups of patients. The findings of this study suggest that an ERAS protocol for colorectal surgery is safe and effective in different age groups of elderly patients.

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