Original paper

Videosurgery

Enhanced recovery after colorectal surgery in elderly patients

Mikhail Kisialeuski[1], Michał Pędziwiatr[1], Maciej Matłok[1], Piotr Major[1], Marcin Migaczewski[1], Damian Kołodziej[1], Anna Zub-Pokrowiecka[1], Magdalena Pisarska[2], Piotr Budzyński[1], Andrzej Budzyński[1]

[1]Second Department of General Surgery, Jagiellonian University Medical College, Krakow, Poland
[2]Medical College Jagiellonian University, Krakow, Poland

Videosurgery Miniinv 2015; 10 (1): 30–36
DOI: 10.5114/wiitm.2015.48697

Abstract

Introduction: *The elderly will soon constitute 20% of the population. Their number is constantly rising, particularly in developed countries. It was found that they particularly benefit from the use of minimally invasive surgery. The Enhanced Recovery After Surgery (ERAS) protocol may further improve clinical outcomes in this group of patients.*
Aim: *To assess the implementation of the ERAS protocol in elderly patients submitted to laparoscopic colorectal surgery.*
Material and methods: *Ninety-two patients who underwent elective laparoscopic colorectal surgery were included in the study. Patients were divided into group 1 (≤ 65 years) and group 2 (> 65 years). Perioperative care was based on ERAS Society guidelines. Length of hospital stay, time of first stool passage, perioperative complications and readmissions were analyzed.*
Results: *Group 2 patients had higher ASA grades in comparison to group 1. In all cases, oral fluid intake started on the day of surgery. The groups did not differ according to oral fluid tolerance, first stool passage time or length of hospital stay. Number and character of perioperative complications were comparable between the two groups. Four patients were readmitted within 30 days after discharge. One patient required reoperation.*
Conclusions: *Implementation of the ERAS protocol is possible regardless of the age of surgical patients. Its use in the elderly allows the length of hospitalization to be shortened and is not associated with higher risk of postoperative complications or readmissions.*

Key words: *postoperative care, fast-track, enhanced recovery, evidence-based medicine.*

Introduction

The strategy of perioperative care in colorectal surgery known as Enhanced Recovery After Surgery (ERAS) was proposed by Kehlet almost two decades ago and spread all over the world [1]. Among the main principles, restrictive intravenous fluid therapy, use of laparoscopy in combination with appropriate anesthesia, analgesia with early enteral feeding and early postoperative mobilization seem to be most important. More detailed recommendations can be found in the guidelines of the ERAS Society [2, 3].

Several randomized clinical trials have shown that in patients after colorectal surgery perioperative care according to the ERAS protocol was associated with a shorter hospital stay, lower risk of perioperative complications, and earlier discharge without an increased readmission rate [4, 5].

The number of elderly patients is increasing due to the changing structure of the population. Commonly they are at an increased perioperative risk, undernourished, with limited physical capacity. It was clearly shown that this group of patients particularly benefits from the use of minimally invasive techniques

Address for correspondence
Mikhail Kisialeuski MD, Second Department of General Surgery, Jagiellonian University Medical College, 21 Kopernika St, 31-501 Krakow, Poland, phone: +48 889 767 589, e-mail: kisialeuskim@gmail.com

Table I. Characteristics of patients

Parameter	Group 1	Group 2	Overall	Value of *p*
Number of patients	43	49	92	
Females	15	28	43	
Males	28	21	49	
Mean age [years]	55.8	76.3	66.9	< 0.05
BMI [kg/m^2]	26.41	25.47	25.91	
ASA grade 1	3	0	3	
ASA grade 2	32	25	57	
ASA grade 3	8	20	28	
ASA grade 4	0	4	4	
Mean ASA grade	2.11	2.57	2.34	< 0.05

BMI – body mass index, ASA – The American Society of Anesthesiologists (ASA) Physical Status classification system.

since shortening of the hospital stay significantly reduces the risk of systemic complications, mainly due to the decreased trauma related to surgery [6].

It seems that implementation of the ERAS protocol in elderly patients with colorectal cancer can lead to further improvement of the treatment outcomes. Even though there are data supporting the use of enhanced rehabilitation based on the ERAS protocol, strong evidence according to evidence-based medicine is missing [7, 8].

Aim

The aim of the study is to assess the implementation of the ERAS protocol in elderly patients submitted to laparoscopic colorectal surgery.

Material and methods

Ninety-two patients operated electively for colorectal cancer from November 2012 to April 2014 were included into the study after approval by the Jagiellonian University Bioethical Committee. All patients gave their informed consent. Emergency cases and cases where colonic resection was a part of multiorgan resection were excluded. All operations were performed by the same team of experienced laparoscopic colorectal surgeons.

Patients were divided into two groups according to age. Group 1 consisted of patients 65 years old or younger, and patients older than 65 years were included in group 2. Group 1 comprised 43 patients, and group 2 comprised 49 patients. The mean age in group 1 was 55.74 years (range: 27–65 years) and in group 2 was 76.18 years (range: 66–94 years). The mean age of the whole studied group was 66.63 years. Group 1 included 15 females and 28 males, and group 2 had 28 females and 21 males. The mean ASA grade in group 2 was significantly higher than in group 1 ($p < 0.05$) (Table I).

In total, 29 right hemicolectomies, 8 left hemicolectomies, 24 sigmoid resections, 26 anterior resections of rectum with total mesorectal excision, 4 low intersphincteric rectal resections and 1 abdominoperineal rectum resection were performed (Table II).

Perioperative care was based on the ERAS protocol (Table III). Patients were admitted to the hospital on the day preceding surgery. Every patient received detailed information regarding the surgical procedure and principles of perioperative care based on

Table II. Types of performed operations

Parameter	Group 1	Group 2	Overall
Right hemicolectomy	12	17	29
Left hemicolectomy	5	3	8
Sigmoid resection	11	13	24
Anterior resection with TME	15	11	26
Intersphincteric low anterior rectal resection	2	2	4
Abdominoperineal resection	0	1	1
Total	43	49	92

TME – total mesorectal excision.

Table III. Enhanced Recovery After Surgery Protocol used in hospital

At admission	• Detailed discussion with patient and patient's family • Anesthesiological consultation • No bowel preparation (exception in case of low rectum resection) • Prophylactic shot of low-molecular-weight heparin (LMWH)
Preoperatively	• 400 ml of carbohydrate-rich drink 2–3 h prior to surgery • Single shot of antibiotic • Catheterization of urinary bladder • Operation from laparoscopic approach • Antiemetic prophylaxis • Infiltration of trocar placement sites with bupivacaine and/or transversus abdominis plane (TAP) block
Day of surgery	• Oral fluid intake (up to 800 ml) • Intravenous analgesia: paracetamol 4 × 1 g, metamizole 2 × 2.5 g, ketoprofen 3 × 100 mg, proton pump inhibitor • Prophylactic shot of LMWH in the evening • Protein-rich drink in the evening • Removal of urinary catheter and diuresis monitoring • Mobilization of patient in the evening (2 h sitting up or standing up from bed)
1st postoperative day	• Administration of drugs orally, diet extension • Analgesia and pain control, oral fluid intake control (around 1500 ml) • Oral lactulose/liquid paraffin administration • Prophylactic shot of LMWH in the evening • Mobilization of patient in the evening (4–6 h spent outside the bed)
2nd postoperative day	• Analgesia and pain control, normal diet • Oral lactulose/liquid paraffin administration • Removal of intravenous accesses • Full mobilization of patient (most of daytime outside the bed)
3rd postoperative day	• Planning discharge, giving instructions about the following outpatient control
7th postoperative day	• Wound control, removal of stitches from the skin • Providing histological result and planning adjuvant therapy if needed

the ERAS protocol. Active participation in the recovery protocol of patients and their families was anticipated. Expectations from the patient and potential difficulties were discussed.

With the exception of low anterior rectal resection, no routine bowel preparation was used. Two hours prior to the surgery every patient received 400 ml of carbohydrate-rich drink. A prophylactic intravenous antibiotic shot was given to every patient 30 min before the operation. All operations were performed laparoscopically.

Transverse minilaparotomies in the epigastrium (right hemicolectomy, transverse colon resection) or hypogastrium (left hemicolectomy, sigmoid resection, rectal resection) were used to remove the specimen. A wound-protecting device was used in all cases. In patients after low anterior rectal resection or intersphincteric rectal resection with total mesorectum excision, a defunctioning loop ileostomy was made.

No drains were routinely left in the peritoneal cavity. At the end of the operation some form of locoregional anaesthesia was used. In some patients it was a local infusion of abdominal wounds with bupivacaine, in others Transversus Abdominis Plane (TAP) block. No nasogastric tubes were left postoperatively. In all patients perioperative antiemetic prophylaxis was used via intravenous administration of ondansetron and/or dexamethasone prior to the end of the surgery. The urinary catheter was removed and oral fluid intake was initiated upon patients' return to the ward from the recovery room.

In the evening, patients received a protein-rich drink. Postoperative mobilization was also started on the day of surgery. The following day, solid food was introduced. If the patient was drinking satisfactory amounts, no intravenous fluids were given. Analgesia was based on paracetamol, nonsteroidal anti-inflammatory drugs, and in the case of very strong pain tramadol was given. Stronger opioids were ad-

ministered exclusively on the demand of the patient when regular analgesia was insufficient.

Discharge was possible when the patient was mobilized, taking fluids and food orally, and pain complaints were well controlled by oral non-opioid analgesics. Patients who did not pass a stool and had no symptoms of postoperative ileus could be discharged, provided that they stayed in touch daily via telephone with an ERAS nurse until a stool was passed.

The end points of the study were: complication rate, toleration of oral fluids and food intake, length of hospital stay, time to first stool passage and readmission rate.

Statistical analysis

Prospectively collected data were processed with Statistica StatSoft v10.0 software. Statistical tests used were χ^2, Kolmogorov-Smirnov and Mann-Whitney test.

Results

There were 2 conversions in the entire group (2.17%). One was due to small intestine adhesions in the pelvis in a patient after abdominoperineal resection in the past. Another conversion was due to infiltration of cancer of the urinary bladder. In 4 patients grade IIIa complications (in Clavien-Dindo classification), in 3 patients grade IIIb, in 7 patients grade II and in 19 patients grade I complications occurred.

Postoperative general complications such as fever or diarrhea occurred in 15 (16.3%) patients, whereas 18 (19.5%) patients had a surgical complication, giving an overall complication rate of 35.8%.

There were no significant differences between group 1 and group 2 ($p > 0.05$). None of the complications were higher than grade III in the Clavien-Dindo classification. A detailed analysis of perioperative complications is presented in Table IV.

In total, 4 (4.34%) patients (1 from group 1 and 3 from group 2) required rehospitalization within 30 days after the day of surgery. The reasons were: presence of paralytic ileus signs in 1 patient and signs of bleeding from the anastomosis staple line in 2 patients. In those patients conservative treatment was effective. Another patient readmitted on the 6th day after laparoscopic right hemicolectomy with cholecystectomy required reoperation due to biliary peritonitis caused by leakage from the cystic duct.

Table IV. Detailed analysis of perioperative complications

Complication	Group 1	Group 2	Overall *n* (%)	Clavien-Dindo classification
Anastomosis leakage	2	2	4 (4.3)	IIIA
Iatrogenic perforation of small intestine	0	1	1 (1)	IIIB
Iatrogenic perforation of transverse colon	0	1	1 (1)	IIIB
Peristomal fistula	1	0	1 (1)	IIIB
Bleeding from anastomosis suture line	2	2	4 (4.3)	2 – I grade 2 – II grade
Intraperitoneal hematoma	0	1	1 (1)	II
Pelvic hematoma	0	2	2 (2.1)	II
Surgical site infection	2	2	4 (4.3)	3 – I grade 1 – II grade
Postoperative nausea and vomiting	4	5	9 (9.7)	I
Diarrhea	2	1	3 (3.2)	I
Postpuncture syndrome	1	0	1 (1)	I
Fever requiring antibiotics	1	0	1 (1)	II
Urinary retention	0	1	1 (1)	I
Overall	15 (34.5%)	18 (36.7%)	33 (35.8)	

In all cases oral fluid intake was started on the day of surgery. In 38 (88%) patients from group 1 and 43 (87%) patients from group 2 it was tolerated well and allowed postoperative intravenous fluid administration to be significantly reduced or avoided. In 29 (67%) patients from group 1 and 24 (49%) patients from group 2 intravenous fluid administration was ceased within 24 h after the surgery. The total mean intravenous fluid amount in group 1 was 2547 ml (range: 1000–4500 ml) and in group 2 was 2573 ml (range: 2500–4500 ml). No statistically significant differences were noted between the two groups.

In 4 (9%) patients from the younger group and in 5 (10.2%) patients from group 2 postoperative nausea and vomiting (PONV) was observed. The first stool was passed at a mean of 2.27 days (range: 0–6 days) in group 1 and in group 2 after 2.59 days (range: 0–7 days). The mean length of hospital stay was 4.52 (range: 2–13 days) in group 1 and 5.48 (range: 2–18 days) in group 2 (Table V).

Discussion

The number of elderly patients, especially in developed countries, is constantly rising. It is estimated that in these populations the elderly will constitute 20% of the population [9].

Importantly, people older than 65 years prevail among patients submitted to abdominal surgery [10]. These patients are frequently characterized by increased perioperative risk due to many comorbidities and reduced circulatory and pulmonary capacity [11].

Advanced age is a proven risk factor of postoperative complications. Turrentine's study of almost 8 000 surgical patients showed an overall postoperative morbidity rate as high as 28% and mortality rate 2.3%, whereas in elderly patients those parameters were significantly higher – 51% and 7%, respectively [12].

Surprisingly, it was also found that shorter hospital stay is associated with a lower risk of postoperative complications [13]. According to the traditional perioperative care, the length of hospitalization in patients after elective colorectal surgery was in general around 10 to 15 days and was associated with delayed return of bowel motility [14–16]. The use of laparoscopic techniques reduces surgery-induced trauma and allows for quicker recovery [17, 18]. There is increasing evidence that the implementation of programs based on ERAS Society guidelines enables the length of hospital stay to be significantly shortened and the number of postoperative complications to be reduced [3, 13].

Postoperative complication rate, length of hospital stay and number of hospital readmissions are the indicators of a successfully implied ERAS protocol. Even though the overall complication rate was 35.8%, the surgical complication rate of 19.5% corresponds to the reports of other authors. Anastomosis dehiscence in 4 (4%) patients and 4 surgical site infections (4%) is an acceptable result that can be compared with other studies [8, 19].

Table V. Parameters of perioperative care

Parameter	Group 1	Group 2	Overall	Value of *p*
Number of patients	43	49	92	
Need for opioid administration (PCA), *n* (%)	24 (55)	14 (28)	38 (41)	0.08
Oral fluid tolerance on 1st postoperative day, *n* (%)	38 (88)	43 (87)	50 (88)	0.92
Discontinuing intravenous fluids on 1st postoperative day, *n* (%)	29 (67)	24 (49)	53 (57)	0.07
Intravenous fluid administration, mean (range) [ml]	2547 (1000–4500)	2573 (2500–4500)	2560 (1000–4500)	0.83
Postoperative nausea and vomiting, *n* (%)	4 (9)	5 (10)	9 (9)	0.88
Mobilization on 1st postoperative day	35 (81)	27 (55)	62 (67)	0.06
Urinary retention after removal of urinary catheter	0 (0)	1 (2)	1 (1)	0.87
First stool passage, mean (range) [days]	2.27 (0–6)	2.59 (0–7)	2.43 (0–7)	0.37
Length of hospital stay, mean (range) [days]	4.52 (2–13)	5.48 (2–18)	5 (2–18)	0.10

PCA – patient-controlled analgesia.

None of the patients of higher than grade III in the Clavien-Dindo classification had complications, and only 3 patients with complications required reoperation. Our study supports previous observations that age does not increase the complication rate in patients whose perioperative care was based on the ERAS protocol [7–9].

The length of hospitalization after colorectal surgery does not significantly differ between younger and older age groups of patients, averaging in both groups about 5 days. It is a longer period than reported by some studies [19, 20], but similar to others, like those presented by Scharfenberg and Bardram [8, 13]. In contrast, Verheijen presented in his study 10 days as the mean length of hospital stay in the elderly group of patients [7]. The length of hospital stay is very difficult to comment on, as it usually represents local surgical tradition and varies greatly between various reports. Despite this fact, we believe that shortening of the hospital stay can be accomplished by implementation of all ERAS protocol elements. The postoperative nausea and vomiting rate of 9.7% is also comparable to other authors' reports [2, 21]. It was found that early postoperative oral fluid and food intake was well tolerated in the early postoperative hours in both the younger and older groups of patients. Smart's study demonstrated that compliance with the ERAS protocol on the first postoperative day is a good predictive factor for the further course of recovery [22].

In our opinion, early mobilization is one of the most important factors in the ERAS protocol. It requires full cooperation from patients and their families. The use of appropriate analgesia (drugs administered at constant time intervals, infiltration of trocar sites with bupivacaine, TAP blocks), and early removal of the urinary catheter (immediately after the surgical procedure) are also helpful. Restricted intravenous fluid administration aided early postoperative mobilization of most patients on the first postoperative day regardless of their age. Good compliance with the ERAS protocol also resulted in faster peristalsis return and earlier stool passage, namely at 2.5 days postoperatively on average, regardless of the age of patients. Similar results were reported by other authors, who underlined that this kind of perioperative care shortens postoperative ileus time [23, 24].

Readmission was required in 4 (4.34%) cases – including 1 patient from the younger and 3 patients from the elderly group. The difference was not significant ($p > 0.05$). This also supports previous observations that age is not a risk factor for hospital readmission [8, 9].

Very short hospital stay (around 2–3 days) can be associated with a higher readmission rate (even up to 20%) [19, 20]. Bearing in mind that the most important goal of the ERAS protocol is to improve the quality of perioperative care, the reduction of length of hospital stay (although possible) should not be forced, particularly in elderly patients, who frequently are left without appropriate care at home.

Conclusions

The conclusion of our study is that implementation of the ERAS protocol is possible irrespective of the age of surgical patients. Its use in elderly patients allows the length of hospitalization to be shortened and is not associated with a higher risk of postoperative complications or readmissions. Its introduction in the elderly requires good quality of care at home, especially after quicker discharge from the surgical ward.

Acknowledgments

The publication of this article was supported by Faculty of Medicine, Jagiellonian University Medical College, Leading National Research Centre (KNOW) 2012–2017.

Conflict of interest

The authors declare no conflict of interest.

References

1. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. Br J Anaesth 1997; 78: 606-17.
2. Nygren J, Thacker J, Carli F, et al. Guidelines for perioperative care in elective rectal/pelvic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. World J Surg 2013; 37: 285-305.
3. Gustafsson UO, Scott MJ, Schwenk W, et al. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. World J Surg 2013; 37: 259-84.
4. Wind J, Hofland J, Preckel B, et al. Perioperative strategy in colonic surgery. LAparoscopy and/or FAst track multimodal management versus standard care (LAFA trial). BMC Surg 2006; 6: 16.
5. Sosada K, Wiewiora M, Piecuch J, Zurawiński W. Fast track in large intestine surgery – review of randomized clinical trials. Videosurgery Miniinv 2013; 8: 1-7.

6. Delgado S, Lacy AM, Garcia Valdecasas JC, et al. Could age be an indication for laparoscopic colectomy in colorectal cancer? Surg Endosc 2000; 14: 22-6.
7. Verheijen PM, Vd Ven AW, Davids PH, et al. Feasibility of enhanced recovery programme in various patient groups. Int J Colorectal Dis 2012; 27: 507-11.
8. Scharfenberg M, Raue W, Junghans T, Schwenk W. "Fast-track" rehabilitation after colonic surgery in elderly patients: is it feasible? Int J Colorectal Dis 2007; 22: 1469-74.
9. Keller DS, Lawrence JK, Nobel T, Delaney CP. Optimizing cost and short-term outcomes for elderly patients in laparoscopic colonic surgery. Surg Endosc 2013; 27: 4463-8.
10. Stewart BT, Stitz RW, Lumley JW. Laparoscopically assisted colorectal surgery in the elderly. Br J Surg 1999; 86: 938-41.
11. Ballesta Lopez C, Cid JA, Poves I, et al. Laparoscopic surgery in the elderly patient. Surg Endosc 2003; 17: 333-7.
12. Turrentine FE, Wang H, Simpson VB, Jones RS. Surgical risk factors, morbidity, and mortality in elderly patients. J Am Coll Surg 2006; 203: 865-77.
13. Bardram L, Funch-Jensen P, Kehlet H. Rapid rehabilitation in elderly patients after laparoscopic colonic resection. Br J Surg 2000; 87: 1540-5.
14. Marusch F, Koch A, Schmidt U, et al. Colon-/rectal carcinoma prospective studies as comprehensive surgical quality assurance. Chirurg 2002; 73: 138-46.
15. Kehlet H, Buchler MW, Beart RW, et al. Care after colonic operation: is it evidence-based? Results from a multinational survey in Europe and the United States. J Am Coll Surg 2006; 202: 45-54.
16. Staib L, Link KH, Blatz A, Beger HG. Surgery of colorectal cancer: surgical morbidity and five- and ten-year results in 2400 patients: monoinstitutional experience. World J Surg 2002; 26: 59-66.
17. Stocchi L, Nelson H, Young-Fadok TM, et al. Safety and advantages of laparoscopic vs. open colectomy in the elderly: matched-control study. Dis Colon Rectum 2000; 43: 326-32.
18. Piątkowski J, Jackowski M. Laparoscopic colon resections – own experience report. Videosurgery Miniinv 2009; 4: 135-7.
19. Basse L, Raskov HH, Hjort Jakobsen D, et al. Accelerated postoperative recovery programme after colonic resection improves physical performance, pulmonary function and body composition. Br J Surg 2002; 89: 446-53.
20. Delaney CP, Zutshi M, Senagore AJ, et al. Prospective, randomized, controlled trial between a pathway of controlled rehabilitation with early ambulation and diet and traditional postoperative care after laparotomy and intestinal resection. Dis Colon Rectum 2003; 46: 851-9.
21. Skrovina M, Czudek S, Bartos J, et al. Colorectal cancer complications of laparoscopic resection. Videosurgery Miniinv 2006; 1: 142-9.
22. Smart NJ, White P, Allison AS, et al. Deviation and failure of enhanced recovery after surgery following laparoscopic colorectal surgery: early prediction model. Colorectal Dis 2012; 14: e727-34.
23. Lobo SM, Ronchi LS, Oliveira NE, et al. Restrictive strategy of intraoperative fluid maintenance during optimization of oxygen delivery decreases major complications after high-risk surgery. Crit Care 2011; 15: R226.
24. Nygren J, Soop M, Thorell A, et al. An enhanced-recovery protocol improves outcome after colorectal resection already during the first year: a single-center experience in 168 consecutive patients. Dis Colon Rectum 2009; 52: 978-85.

Received: 10.10.2014, **accepted:** 2.11.2014.