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REVIEW

Are enhanced recovery programs in colorectal surgery feasible and useful in the elderly? A systematic review of the literature

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KEYWORDS

Enhanced recovery
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Colorectal surgery;
Elderly patient;
Morbidity

Summary

Introduction: Enhanced recovery programs (ERP) are no longer questionable in the management of patients undergoing surgery. However, there is some doubt as to their feasibility and efficacy in the elderly. Our goal was to systematically review the evidence-based literature concerning the feasibility of ERP in elderly patients undergoing colorectal surgery.

Material and methods: The PubMed and Cochrane Database for systematic reviews as well as the "grey" literature between 2000 and 2015 were sought. Articles were selected if they compared ERP in elderly patients to ERP in young patients (feasibility) or compared ERP to traditional post-operative management in the elderly (efficacy).

Results: Sixteen articles were identified according to the inclusion criteria. All showed that an ERP was feasible in the elderly although post-operative morbidity was higher compared to younger patients. Compared to traditional management, ERP was effective since it decreased (as in the young) the overall rate of complications and thus the duration of hospital stay. There were not enough data on the degree of implementation of ERP and the medico-economic aspects to come to any formal conclusions.

Conclusion: This comprehensive systematic review of the literature showed that ERP was feasible and effective in the elderly undergoing colorectal surgery. Protocols should be adapted to the particular aspects of this population. Future research should target pre-operative evaluation and the place of pre-habilitation in geriatric ERP.

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Introduction

The French National Institute of Statistics and Economic studies (INSEE or Institut National de la Statistique et des Études Économiques) forecasts that the portion of the French population over 65 years of age will rise from 18% in 2015 to 25% in 2035 [1]. In the United States, the “Baby-Boom” generation has a substantial part in the health-care burden [2]. The elderly present specific physical, metabolic and socio-environmental characteristics that should be considered in their management. Age is an independent prognostic factor for post-operative morbidity in colorectal surgery [3]. Geriatric specificities corresponding to the progressive development of frailty appear around age 70. A specific facet of aging – defined by nutritional, functional, cognitive and social attributes – increases the risk of loss of autonomy, the propensity for falls, institutionalization, and death [4,5]. This so-called “geriatric age” corresponds to a relatively recent evolution in the care of the elderly.

Enhanced recovery programs (ERP) in surgery have proven to be a major improvement in peri-operative management of younger patients [6] in several surgical specialties. ERP should theoretically be effective in the elderly as well, but it has to be tailored to their specific characteristics. However, in daily practice, many practitioners have doubts about whether geriatric surgery can be performed within the framework of ERP. The goal of this review of the literature is to appraise the evidence in 2016 on colorectal surgery in the elderly, emphasizing what has been shown and to highlight the data that are not or are poorly evaluated in this particular population.

Method

We conducted a comprehensive search of the literature using the Medline and Cochrane Database for systematic reviews combined with a manual search between 2000 and 2015. The grey literature (Congress abstracts) was also sought.

The key words and Boolean operators used were “elderly” AND “enhanced recovery” OR “fast track” AND “colorectal surgery OR rectal surgery OR colonic surgery” AND “elderly”.

Articles on elective surgery, whether retrospective or prospective, randomized or not, meta-analyses and reviews of the literature published in English or French were included. Not-included were articles concerning emergency surgery, articles in which “elderly patients” were only a subgroup and whose characteristics and outcomes did not allow any detailed analysis of the main endpoint, editorials, expert opinions and narrative reviews.

The main endpoints were: (1) feasibility of ERP in the elderly patient: does ERP increase the morbidity or mortality in the elderly compared to a younger population? (2) Efficacy of ERP: does ERP have a beneficial effect on duration of hospital stay, morbidity and quality of life compared to traditional care? (3) Compliance with ERP and the correlation between the number of items implemented and clinical outcome in terms of morbidity and duration of hospital stay. We also sought any medico-economic analyses concerning ERP in the elderly. Non-randomized studies were evaluated with the MINORS index [7].

Results

Retained articles

The literature search found 289 articles. After removal of all studies that did not specifically examine the elderly patient and colorectal surgery, 21 articles remained for analysis. The items of ERP according to the recommendations of the French Society of Gastro-intestinal surgery (Société Française de Chirurgie Digestive (SFCD)) and the French Society of Anesthesia and Intensive care (Société Française d’Anesthésie et Réanimation (SFAR)) [8] as well as those of the GRACE group were the same as those published by the ERAS Society in 2015 [9,10].

In order to homogenize the analysis with respect to these recommendations, we excluded four studies that did not follow any ERP and one study in which the protocol called for routinely maintaining a post-operative nasogastric tube during two to three days [11]. The study by Bagnall et al. [12] is a review of the literature without any analysis or specific protocol, which explains why it is not represented in Tables 1 and 2. Of the 16 studies, seven evaluated the feasibility of ERP in the elderly compared to ERP in younger patients (Table 1) [13–20]; four were not comparative [12,21–23] and four, randomized or not, evaluated the efficacy of ERP (Table 2) compared to traditional management in the elderly [24–27].

Feasibility of ERP in the elderly

Eleven studies and one review of the literature evaluated the feasibility of ERP in the elderly (Table 1). The comparative studies evaluated the differences in mortality, complications, and the rate of re-admission between the elderly and younger patients: the results, however, were biased by specific differences in patient characteristics. For Pawa et al. [13], mortality and the overall rate of complications were statistically significantly higher in patients over 80, but more patients in this group had cancer and their ASA score was statistically significantly higher. For Baek et al. [16] the rate of re-admission was statistically significantly higher for patients 70 years old or more, but again, the ASA was statistically significantly higher in this group of patients. Rumstadt et al. [18] described a higher complication and re-admission rate for patients over 80, but there were more patients with cancer and who did not undergo laparoscopy in this group. In the review of the literature by Bagnall et al. [12], age was found to be an independent factor of mortality, even though it was not associated with increased infectious, urinary tract, neurological or overall complications. Feroci et al. [20] also found limited compliance to ERP in patients over 75: nearly half of patients were unable to tolerate refeeding on day 1, even of liquids; less than half tolerated solid feeding on day 2 and only 60% could be mobilized more than 8 h on day 2.

The feasibility of ERP in the elderly undergoing colorectal surgery was also analyzed in other observational studies. Bardram et al. [21] reported a series of 50 patients whose mean age was 81 (range 70–83) who underwent elective colonic resection in conjunction with an ERP: the overall complication rate was 16% including a 4% anastomotic leakage rate. Their conclusion was that ERP had certain advantages in terms of post-operative morbidity well beyond just the type of surgical approach. DiFronzo et al. [22] reported a series of 87 patients, mean age 77 (range 70–90), who had undergone colectomy *via* laparotomy with

Table 1 Studies evaluating the feasibility of enhanced recovery in colorectal surgery in the elderly.

Studies	Age (years)	ASA	Cancer	Laparoscopy	Post-operative morbidity (%)	Fistula (%)	Re-operation	Mortality	Readmissions within 30 days	Mean hospital stay (days)	MINORS score
<i>Comparative studies</i>											
Verheijen et al. [14]	<80	/	/	/	/	6	10	/	11%	7*	13/24
	>80	/	/	/	/	2	10	/	5%	10*	
Pawa et al. [13]	<80	/	64%*	97%	9%*	3	7	2%*	9%	6	15
	>80	/	87%*	93%	26%*	2	8	16%*	6%	8	
Keller et al. [17]	<70	*	38%	NS	13%	8	3	0%	6%	4.47	17
	>70	*	60%	NS	17%	4	1	0%	5%	4.91	
Senagore et al. [15]	<60 o	NS	10%	0%	13%	1	0	0%	4%	6.1*	15
	<60 l	NS	20%	100%	10%	3	2	0%	9%	3.9	
	>70 o	NS	13%	0%	37%**	3	1	2%	6%	9.3	
	>70 l	NS	16%	100%	16%**	0	0	0%	6%	4.2	
Baek et al. [16]	<70	*	100%	100%	32%	8	/	0%	4%*	12	18
	>70	*	100%	100%	26%	3	/	0%	12%*	12	
Rumstadt et al. [18]	<80	*	65%*	39%*	23%*	3	/	1%	5%*	/	12
	>80	*	81%*	25%*	38%*	1	/	1%	2%*	/	
Naef et al. [19]	<70	/	100%	0%	33%*	2.8	7	2.6%	/	13.5	15
	>70	/	100%	0%	57%*	2.8	9.1	3.4%	/	/	
Feroci et al. [20]	<75	/	/	/	21%*	/	/	1.2%*	2.7%	5*	14
	>75	/	/	/	37%*	/	/	6.3%*	1.4%	7*	
<i>Non-comparative studies</i>											
Bardram et al. [21]	>70	—	90%	100%	16%	4	4	4%	4%	10 [§]	11/16
DiFronzo et al. [22]	>70	—	100%	0%	15%	0	/	0%	6%	4	11
Scharfenberg et al. [23]	>70 o	NS	78%	0%	22%	4	4	2%	16%	5	12
	>70 l	NS	78%	100%	14%	0	0	0%	12%	5	

ASA: American Society of Anesthesiologists score; Cancer: proportion of patients with cancer; MINORS score: methodological quality index [7]; NS: no statistically significant difference; /: not available; o: open laparotomy; l: laparoscopy.

* Statistically significant difference between the two groups.

§ Mean hospital stay in the group of patients without post-operative complications.

Table 2 Comparative studies of enhanced recovery programs in surgery vs. traditional management.

Studies	Mean age	ASA	Cancer (%)	Laparoscopy	Complications at 30 days (%)	Fistula (%)	Mortality	Re-admission at 30 days (%)	MDHS
Compagna et al. [24]	71/72	/	100%	100%	5/18 [*]	/	/	/	/
Wang et al. [25]	71/72	/	100%	100%	5/21 [*]	0/0	NS	/	5.5/7 [*]
Jia et al. [26]	76/75	/	100%	/	[§]	NS	/	/	9/13 [*]
Ostermann et al. [27]	80/78	3/3	65%/77%	59/51	35/65 [*]	0/6.6 [*]	1.3/2.6	8/7	7/12 [*]

Data are expressed as ERP/traditional care. ASA: American Society of Anesthesiologists score; MDHS: mean duration of hospital stay in days (ERP/traditional management); NS: non statistically significant difference; /: not available or no comparison made between the two groups.

^{*} Statistically significant difference between the two groups.

[§] Statistically significant difference found in incidence of pulmonary and urinary tract infections, and cardiac decompensation in favor of enhanced recovery but there are no data concerning the overall complication rate.

an overall morbidity of 15%. Of the 86 patients who had daily activity autonomy before the operation, 83 (96.5%) remained autonomous 15 days after the operation. Scharfenberg et al. [23] reported a series of 267 consecutive patients who underwent colorectal surgery in conjunction with an ERP, 74 of whom were older than 70. No statistically significant difference was found concerning the interval to refeeding or first bowel movement, or the rate of morbidity or mortality between the two approaches (laparoscopy or laparotomy). The re-admission rate was statistically significantly higher in the open colorectal group (16% vs. 12% for laparoscopy). The authors concluded that ERP was feasible in the elderly.

Efficacy of ERP in the elderly

The level of evidence for all three randomized studies [24,25,27] comparing ERP to traditional post-operative management in the elderly was marred by methodological shortcomings. Notwithstanding, the groups were comparable population-wise. Statistically significant differences were found in favor of ERP concerning shorter duration of hospital stay (7 vs. 12 days in the trial of Ostermann et al. [27]), fewer overall complications (5% vs. 21% [25] and 5% vs. 18% [24]), and a 45% decrease in post-operative morbidity (35% vs. 65%) [27] in favor of ERP. The outcomes of the non-randomized study of Jia et al. [26] were similar to those of the randomized studies.

Compliance with the ERP and correlation between the number of items implemented and efficacy

In more than 80% of the studies analyzed, the elements that were implemented included information to the patient, omission of the naso-gastric tube, early refeeding, analgesia, surgical approach, early removal of the urinary catheter, and early mobilization of the patient. In more than 50% of the studies, information concerning drainage, post-operative prevention of nausea and vomiting, post-operative prescription of laxatives, pre-medication and pre-habilitation was missing. Information concerning pre-operative colonic prep or reduction of pre-operative fasting was found in only 30% and 45% of studies, respectively. It was therefore not possible to study the relationship between the quality of implementation and the efficacy of ERP (morbidity, mortality and duration of hospital stay).

As concerns the proper implementation of the various items, only two studies [13,18] were able to show any statistically significant difference between the two age groups. Pawa et al. [13] showed that discontinuation of IV fluids and removal of the bladder catheter took place later in the elderly. For Rumstadt et al. [18], restriction of intra-operative intravenous fluids, systemic non-opioid basic analgesia, post-operative oral liquid intake, and mobilization were statistically significantly more difficult to enforce in the elderly. Last, in the Ostermann et al. study [27] (the complete results of which should be published soon), overall compliance of ERP items was 79%, with, in particular, 99% for carbohydrate loading, 62% for pre-operative nutritional support (if the nutritional risk screening ≥ 3), 57% for bladder catheter removal on day 1, 83% for oral liquid intake 6 h post-operative, 65% for early day 1 refeeding, and 65% for omission of abdominal drainage.

Medico-economic aspects of ERP in the elderly

Senagore et al. [15] compared the overall costs in relation to the surgical approach and found that there was no statistically significant difference between laparoscopy and laparotomy, independent of age. Likewise, Keller et al. [17] did not find any statistically significant difference in overall cost of hospitalization between the elderly and the younger group of patients treated according to an ERP. We were unable to locate any studies that undertook a formal economic analysis comparing patients with ERP or traditional management in the elderly.

Discussion

The ERP is the fruit of thinking founded on multiple elements (analgesia, re-feeding, drains, surgical approach, post-operative care). For all, or nearly, these elements, the literature provides recommendations with satisfactory levels of evidence [8].

This systematic analysis of the literature suggests that ERP is feasible in the elderly, with a benefit comparable to that obtained in younger patients. Post-operative morbidity remains relatively higher in the elderly compared to younger patients, but all the studies showed that it was lower when the ERP was implemented as compared to traditional management.

Even though the studies were found to be homogeneous according to the MINORS qualitative analysis index (Table 1),

Table 3 “Generic protocol” of enhanced recovery in patients over 70 undergoing colorectal surgery according to the GRACE protocol [30]. The elements of this protocol should be adapted to each practical situation and applied in each center after consensus between all members of the health care team.

Pre-operative phase	Intra-operative phase	Post-operative phase
Oral and written information provided to the patient and as necessary to the support person	Infusion of corticosteroids at anesthetic induction (e.g. 8 mg of dexamethasone)	Routine glycemia control
Detection of malnutrition and initiation of treatment	Anesthetic protocol with short-acting drugs, reducing the doses compared to younger patients	No routine bladder catheter
No routine pre-medication	Prevention of post-operative nausea and vomiting according to existing recommendations	systematic verification of absence of full bladder (by sonography)
Rules for pre-operative fasting: (6 h for solids, 2 h for clear liquids)	Routine use of support hose or pneumatic compression stockings if operative duration over 4 h	Multimodal analgesia protocol limiting the use of opioids
Pre-operative carbohydrate loading (respecting the contra-indications such as diabetes, gastro-esophageal reflux, gastric emptying disorders)	Prevention of hypothermia	Use of non-steroidal anti-inflammatory drugs with consideration of contra-indications, co-morbidities, and renal function
Thrombo-embolic and antibiotic prophylaxis according to existing recommendations	Minimal access surgical approach	Routine oxygen therapy
	No routine post-operative naso-gastric tube	Early re-feeding with adaptation of alimentary texture to mastication capacity
	Routine monitoring of intra-venous filling	Nutritional support if patient unable to cover at least 60% of needs
		Early mobilization on day 1

a selection bias cannot be eliminated in the prospective studies. In addition, clinical studies are more often proposed to patients with lesser co-morbidity and who are not dependent [28,29], and lastly, the elderly are less willing to participate in clinical trials [30]. The GRACE group has recently published a generic-specific protocol for surgery in the elderly on its website, including all surgical specialties (Table 3) [31]. This protocol takes into account the specificities of the elderly in terms of frailty, co-morbidity burden, and contra-indications for certain medications. The overall geriatric evaluation includes the diagnosis, evaluation of the severity of disease and their influence on nutritional, functional, affective, cognitive and social status. This allows implementation of personalized care, whether medication-related or not. In the elderly patient admitted for an emergency, geriatric evaluation (relative to usual care) allows an increased number of patients to be able to be at home 6 months later, while decreasing the rate of institutionalization and deaths [32]. ERP is unavoidable in the domain of colorectal surgery [32] because, by itself, it improves the post-operative course.

There are several tools available to detect patient frailty [33] and to evaluate the risks of complications such as mental confusion, dependency or mortality. Some of these have a specific place in geriatric oncology as underscored by Soubeyran et al. [34] (questionnaire G8). Of note, however, geriatric evaluation is time-consuming and interferes with the possibility of daily exchanges between colorectal surgeons and geriatricians, mainly because of lack of personnel [35].

The objective endpoints most often proposed to evaluate ERP efficacy are the complication rate and the duration of hospital stay. However, duration of hospital stay is highly dependent on contextual-sensitive criteria and hazards that particularly affect the elderly when it becomes necessary to implement time-consuming home-care personnel, and when the patient awaits being placed in a long-term care or skilled nursing facility. The literature review of colorectal surgery by Fiore et al. [36] cited alimentary tolerance, return of gastrointestinal transit, pain control and satisfactory

mobilization as secondary criteria; however, these criteria most often lack clinical precision. Post-operative complications have been evaluated variably in the literature, and there are few studies that have used a validated classification. The fact that ERP decreases the complication rates should in itself be enough to show its superiority over traditional management.

Geriatric evaluation could also be part of operative pre-habilitation with the goal of improving the management and outcomes in the elderly if the necessary pre-operative actions can be implemented [37,38].

Two meta-analyses on pre-operative pre-habilitation have been published [39,40]. The pre-habilitation items included nutritional assessment, protein supplementation, and physical exercise during the month preceding surgery. The results are neither homogeneous nor statistically significant in terms of ERP criteria, but the methodological quality of the studies included in the meta-analysis also affects the overall methodological evaluation. The efficacy of pre-operative immune-modulation in major carcinological surgery has never been studied in comparative trials, specifically with relation to patient age.

The relation between implementation of ERP items and efficacy has not been analyzed often. DiFronzo et al. [22] showed that the same efficacy could be obtained with both the open or laparoscopic approach in the context of an ERP. However, most of the studies included in our review included pre-operative information to the patient, multimodal opioid-sparing anesthesia, minimal access surgery, early removal of bladder catheter and early and active post-operative mobilization of the patient (as much as this was possible). Ostermann et al. [27] also found a good overall compliance rate with the ERP (79%) in unselected patients with substantial co-morbidity (median age: 80 years old, nearly half with an ASA score ≥ 3 or Charlson 3, more than 50% with prior surgical history, more than 30% of patients treated with platelet anti-aggregation/anticoagulant drugs, and 19% undergoing rectal surgery). The fact remains that early removal of the bladder catheter, routine pre-operative nutrition whenever indicated and post-operative refeeding

on day 1 are often problematic in this population. Along these same lines, the results of the study by Feroci et al. [20] do not challenge the conclusions of other studies, but emphasize that ERP should be adapted to the characteristics of this particular population of patients (Table 3).

Concerning the medico-economic aspect, the literature was extremely sparse. Intuitively, we can suppose that decreased duration of hospital stay and morbidity should lead to decreased health-care costs. However, it also seems easy to imagine that extra-costs for home-care might be needed in case of early discharge. Specific studies in the elderly on the need of longer post-operative follow-up, the rate of institutionalization, the loss of autonomy or delayed decompensation of pre-existing co-morbidities could be valuable assets for the economic argument in favor of ERP.

Conclusion

Elderly patients can benefit from ERP just as does the younger population, but the frequent co-morbidity burden and frailty status can explain the increased risk of post-operative morbidity. Nonetheless, all comparative studies point toward a significant reduction in morbidity when ERP is implemented. The goals run along the same lines as for younger patients but the endpoints should be specifically oriented to the elderly population including elements such as returning to the same domicile, maintaining a certain quality of life and avoiding loss of autonomy. Patient compliance with the items composing the ERP seems to be reduced in the elderly. Accordingly, studies are necessary exploiting criteria used in geriatrics to improve the management and lead to adaptation of peri-operative protocols to improve the efficacy of ERP in the elderly.

Disclosure of interest

The authors declare that they have no competing interest.

Essential points

- The feasibility and efficacy of enhanced recovery programs (ERP) in surgery for the elderly can indeed be questioned because of the frailty and increased morbidity related to their age and health status
- The literature provides a substantial number of comparative studies, including three randomized trials
- Post-operative morbidity is relatively higher in the elderly (compared to younger patients)
- All data converge toward the feasibility of ERP in the patients over 70 years old
- Reduction of duration of hospital stay and overall morbidity attest to the efficacy of ERP compared to traditional management
- Compliance with ERP measures is inferior to that of younger patients but this should not call into question their efficacy
- ERP should be adapted to the characteristics of the elderly
- It seems essential to include in the pre-operative workup (in the future) a rigorous geriatric-specific evaluation
- The place of pre-habilitation seems to be important and warrants further evaluation.

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