

# Clinical Outcome of the Implementation of Enhanced Recovery after Surgery Protocol in Colorectal Surgery

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## ABSTRACT

**Introduction:** The aim of this study was to present the benefit of implementing enhanced recovery after surgery (ERAS) protocol on all patients who underwent elective colorectal surgery and its influence on clinical outcome, by comparing this result with traditional perioperative care (TPC).

**Methods:** This is a retrospective analysis of a prospectively maintained database. All patients who underwent elective colorectal surgery at the colorectal unit from July 2014 to August 2018 for different colorectal diseases were included. Data collected were demographics, American Society of Anesthesia (ASA) score, body mass index (BMI), Clavien Dindo classification for grading of surgical complications, length of hospital stay, postoperative morbidity and mortality.

**Result:** Three hundred and fifty-four patients were included in this study, with a minimum follow up of 30 days. 227 patients managed after implementation of the ERAS program were compared with 127 patients managed with TPC. Half were females (49.4%) with a mean age of 54.6 years (range 16-84 years). The average length of stay decreased from 5.84 days SD+ 2.77 in TPC to 3.88 days SD+1.86 in the ERAS (P = 0.001) and morbidity decreased from 25.1% to 14.1%, (P=0.028) with the mortality slightly increased from 1.6% in TPC to 2.2% after implementation of ERAS (P =0.63).

**Conclusion:** Implementation of ERAS protocol is very useful to improve the healthcare outcome and reducing the length of stay in the hospital and postoperative morbidity, and this in keeping with the international literature. So we recommend using it on all patients undergoing elective colorectal surgeries specifically and on all surgical patients generally.

**Key Words:** ERAS, colorectal, complications.

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## Introduction

Cancer is the second leading cause of death in Jordan, and colorectal cancer is the 2<sup>nd</sup> cause of cancer related death in male and female<sup>(1)</sup>. Colorectal cancer is one of the most common cancers worldwide, 90% of cases occur after the age of 50 years.<sup>(2, 3)</sup>

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Significant improvements in outcomes after colorectal resection can be achieved by implementing a constant protocol on evidence-based medicine in all perioperative steps.<sup>(4)</sup> This method has merged into enhanced recovery after surgery (ERAS) pathway or 'fast-track surgery'. Over the last few years, ERAS programs have produced a real change in the management of colorectal surgery, vascular surgery, hepatobiliary and thoracic surgery patients. Initially introduced by Henrik Kehlet a surgeon from Denmark in the early 1990s<sup>(4)</sup>, ERAS is a multidisciplinary set of pathways that targets to diminish the stress response to surgery and improves postoperative outcome by controlling perioperative management process. The main aim of all perioperative programs is to decrease hospital stay and to quickly regain the complete well-being of the patient without increasing the rate of complications in comparison with traditional care for colorectal surgery.<sup>(5)</sup> (ERAS) protocols which are group of a twenty-one items divided to perioperative, intraoperative and postoperative care pathways programmed to achieve early recovery after surgery by maintaining preoperative organ function and decreasing the profound stress response after surgery.<sup>(6,7)</sup>

The traditional hospital stay following major colorectal surgery is 7 - 14 days. Strict adherence to ERAS protocol reduces hospital stay to 2 - 3 days.<sup>(8)</sup> ERAS consists from pre - admission component, Pre - operative component, intra operative, Anesthesia part and Post operative component .

The introduction of the ERAS program requires intensive education and multidisciplinary team. Our ERAS team consisted of colorectal surgeon; anesthesia doctor, ERAS nurses, psychotherapist, nutritionist and stoma care nurse.

The aim of our study was to compare our historical data of traditional care of patients following colorectal resection to patients who were managed using the ERAS protocol.

## Methods

This retrospective analysis of a prospectively maintained database done in the colorectal unit at King Hussein Medical Center in Jordan over a period of 50 months, between July 2014 and August 2018 .We analyzed 354 patients who underwent different elective colorectal surgeries for different causes such as malignancy, inflammatory bowel disease and FAP.

The ERAS protocol data were compared to historical (pre ERAS) records of patients. One hundred and twenty seven patients were managed in traditional perioperative care (TPC) in the period from June 2014 to July 2016 and 227 patients were managed after the introduction of ERAS program in August 2016.

Each patient had an inclusive discussion about the nature of the ERAS and details of the peri operative items of the care plan. Data collected from patients' profiles and follow up notes in the clinic within 30 days of follow up, and the results were compared to TPC.

Data collected were demographics, American Society of Anesthesia (ASA) score, body mass index (BMI), length of hospital stay, postoperative morbidity and mortality. Complications were classified according to Clavien-Dindo classification of surgical complications.<sup>(9)</sup> In addition, laparoscopic approach was compared to open surgery. Primary end point was to compare primary hospital stay in both groups. Secondary end points included postoperative morbidity and mortality.

Patient demographics and clinical characteristics were displayed as means, standard deviation (SD) and percentages. T-test and Chi square test were used to assess significance of the study, a P value of less than 0.05 was considered significant. The study was approved by the local ethics committee of the RMS.

The ERAS component starts with pre-admission counseling and comorbidities optimization. All patients are explained the purpose of ERAS, and what to expect in the peri-operative period. Patients asked to stop smoking at least two weeks before surgery.

On the day of admission, patients who are at risk of venous thrombo-embolism (VTE) are administered compressing stockings and low molecular weight heparin as a prophylaxis against VTE. Because of unavailability of carbohydrate drink, all patients are started on Ensure® 200ml three times daily. In cases

that needs bowel preparation we use full mechanical preparation with oral antibiotics to decrease the leak rate. <sup>(10)</sup> Single dose of antibiotics prophylaxis is given within 60 minutes of surgery. Stoma sitting is done by a stoma nurse.

Intra operation skin exposure was minimized with the aim of maintaining normothermia throughout the procedure. Anesthesia was titrated to minimize the use of inotropes- aiming to maintain systolic blood pressure no less than 25% from patients' baseline. Intra-operative fluid restriction was used to optimize cardiac output, while avoiding over resuscitation. In high risk patients, invasive methods (arterial and central venous lines) were used for more accurate hemodynamic monitoring and further guide fluid therapy. Nasogastric tube is removed in the recovery room. Intra-abdominal drains are used only after rectal resection and usually removed first day post-operatively. At the end of surgery, the incision wound is infiltrated with local anesthesia.

Post operatively all patients receive patient controlled analgesia (PCA) and convert the analgesia to oral form from day one postoperatively. Unless otherwise indicated, all patients start clear oral fluid on same day of surgery and if it is tolerated without nausea or vomiting soft diet added and then to start regular diet on day 2 post operation. Foleys catheter usually removed at day one after colonic and at day 2 after pelvic surgery.

Discharge criteria were considered from day two post-surgery. The patient is considered a candidate for discharge if he or she has minimal pain, freely mobilize, tolerate a regular diet, pass flatus, vital sign and lab result are within normal limits. After discharge, all patients are given written instructions about how to deal with stoma if a stoma was constructed and what complications to anticipate and the way to deal with them. All patients are seen in the clinic after two weeks after discharge.

## Results

Out of 127 patients managed as pre ERAS 71(55.9%) were female with average age 53.9(16-83) SD+15.6 while in post ERAS group 104(45.8%) were female and the average age was 55.4 (17-84) SD+15.4. the body mass index mean was 25.8(19-38) in pre ERAS and 26.7 in post ERAS group most of the patients were ASA score 2(59.8% vs 53.7%) in pre and post ERAS group respectively as shown in Table I, the postoperative hospital stay was 5.84 days SD of 2.77 and median of 5 with the shortest was 3 days and the longest one was 22 days, while in post ERAS the average hospital stay decrease to 3.88 days SD +- 1.86 and median is 4 (p =0.001) which is statistically significant, the shortest is 2 days and the longest is 16, the morbidity decrease from 25.1% to 14.1% ; (p <0.009), wound infection decrease from 22 patients (17.3% ) to 18 patients out of 227 (7.9%), mortality not increase significantly in both groups from ( 1.6% to 2.2% );(P 0.63).The introduction of laparoscopic surgery increase from 9.4% to 15.9% as recommended by ERAS guideline, as shown in Table II.

**Table I:** demographic and clinical characteristics of patients in pre and post ERAS

Characteristic		Pre ERAS (127)	Post ERAS (227)	P
Age		Average 53.9 Range 16-83 SD+ 15.6 Median 56	55.4 17-84 15.4 58	0.37
Gender	male	56 (44.1%)	123 (54.2%)	0.068
	female	71 (55.9%)	104(45.8%)	
ASA score*	I	46 (36.2%)	98(43.2%)	>0.05
	II	76 (59.8%)	122(53.7%)	
	III	5 (3.9%)	7(3.1%)	
BMI		Average 25.8 Range (19-83) Mode	26.7 19-46	0.001

\*ASA: American Society of Anesthesiologists physical status classification

**Table II:** clinical outcome of pre and post ERAS

Clinical outcome		Pre ERAS	Post ERAS	P value
Length of stay		Average 5.54 SD 2.77 Mode 5 Range 3-22	3.88 1.86 3 2-16	0.001
Morbidity	YES	32(25.1%)	32 cases (14.1%)	.009
	NO	95	195	
Mortality	YES	2 cases (1.6%)	5 cases (2.2%)	0.63
Lap open		12 cases (9.4%)	36 cases (15.9%)	0.09
		115	191	
Wound infection		17.3%	7.9%	.023

**Table III:** clavien dindo classification for grading surgical complication

GRADE	Pre ERAS complication 26.8% No complication 73.2%	Post ERAS complication 16.2% No complication 83.8%	P value 0.04
I	12.6%	7.9%	
II	11%	3.5%	
III	1.6%	2.6%	
V	1.6%	2.2%	

**Table IV:** comparisons our result with international published result

hospital	Number of patients	LOS pre ERAS	LOS post ERAS	Morbidity pre	Morbidity post
<b>KHMC</b>	354	5.84	3.88	25.1%	14.1%
<b>Muller et al 2009<sup>(25)</sup></b>	151	9	5	49%	21%
<b>Lonescu et al 2009<sup>(26)</sup></b>	96	9.1	6.4	22.9%	12.5%
<b>Cooper et al 2016</b>	140	10.8	5.6	41%	11%

## Discussion

ERAS protocol is one of the guidelines used to reduce the length of stay in the hospital, the rate of complications, readmissions and subsequently decrease the cost to the hospital and improve the quality of health care and patient's lifestyle. ERAS mostly used on colorectal surgery, but also can be used in different specialty and each one has their ERAS guideline.

According to our data and results after using ERAS protocol in the last 2 years, the length of hospital stay is less than international literature of 7-14 days and same to ERAS guideline which is 4 days, which significantly impacted hospital cost. <sup>(11)</sup> Miller TE et al in one of study which was done in a teaching hospitals in the USA to compare the effect of implementation of ERAS in reducing the length of hospital stay to patients who underwent elective colorectal surgeries, in this study there was a group of 142 patients who treated after implementation of ERAS and 99 patients in group with traditional perioperative care, result shows that the length of hospital stay decrease from 7 days in the traditional group to 5 days for the ERAS group. This verify that ERAS implementation reduce LOS, and other authors also in other studies also proof that ERAS introduction decrease LOS and cost on hospitals and the early discharge does not have a higher risk of readmission <sup>(12, 13,14)</sup>

According to ERAS guidelines for DVT and PE prophylaxis, we used the elastic stocking, early mobilization and LMWH and this decreased risk of thromboembolic events to 1.7 % compared to 30 % in some studies to patients who are not on ERAS. <sup>(6)</sup> A study was done in one of the surgical department in Hugesund Hospital from Norway review results of applying ERAS guidelines on 98 patients where most of them operated for colorectal cancer; patients were followed up 30 days after surgery. Results were one patient who had pulmonary embolism 1,3 % which near to our result and to ERAS guidelines result. Their conclusion was the principles in ERAS guidelines are sufficient to protect from thromboembolic events. <sup>(15)</sup>

Postoperative ileus and intestinal obstruction are the most common causes of increasing the length of hospital stay so they are tried to be prevented with early feeding postoperative, using epidural analgesia, remove NG tube, and to do more laparoscopic surgery as in ERAS guidelines reduce postoperative ileus in our patients to 3 % comparing to 11 – 15 % on patients not on ERAS protocol. <sup>(6, 16)</sup>. These maneuvers have taken by ERAS supported by many types of research written by Andrea Nemethova, Cathy Cailotto

et colleagues and J. Ahmed, S. Mehmood et colleagues as they decrease the stress response after surgery, enhance bowel movement and improve the physiologic reserve in operated patients.<sup>(17, 18)</sup>

Routine use of abdominal drains and nasogastric tube should be avoided as a nasogastric tube is associated with increased respiratory complication, delay early feeding, delay passage of flatus and increase hospital stay, so in our colorectal unit, we never put nasogastric tube and no abdominal drain in colon surgeries but just for one day in rectal surgeries.<sup>(19,20)</sup>

Wound infection is multifactor complication like the sterility of the instruments, theater, and the ward, so on ERAS protocol we give Antibiotics 1 hour before surgery and repeated dose of antibiotic is needed in prolonging operation if the type of antibiotic used before surgery is with short half-life, and no need for antibiotic post operation as routinely used in traditional perioperative care. Use all sterile techniques during surgery and during wound dressing in the ward, that reducing the rate of infection to 7.9 % comparing to 17.3 % when we didn't use ERAS protocol.<sup>(21, 22)</sup>

Also in our colorectal unit we focus in the nutritional state of patient preoperatively and try to optimize it by giving patient high protein high-calorie diet one week pre-operation till discharge day as malnourished patients are at high risk of complication as leak and wound dehiscence, also we ask all smoker to cease smoking eight weeks pre-operation and use incentive spirometry device for all patients to decrease the incidence of postoperative atelectasis.

in general, the patient underwent colorectal operation have a high risk of readmission due to multiple factors related to previous co morbidity or improper dealing with stoma and stoma complication especially dehydration, and there are no admission criteria<sup>(23,24)</sup>

Non-significant increase in the mortality rate in our result from (1.6 % to 2.2%) (P =0.63) can be explained by an increase in the number of complex cases; such as pelvic exenteration for locally advance rectal cancer with invasion to adjacent organs such as uterus, bladder and sacral bone. Previously these cases were not treated radically but as a palliative procedure. When we exclude the complex operations from this study, the mortality rate will drop to (0.8%) in both groups. In many studies the overall post-operative mortality rate was 6.7% and it is related to many factors such as age of patient, co-morbidities and stage of the disease at diagnosis.<sup>(27)</sup> Gatt et al and Basse et al in a study comparing traditional care with ERAS the mortality increase from 0 to 5% and from 3 % to 5% respectively.<sup>(28, 29)</sup>

## **Limitations of the study**

The limitations we had in our study is using historical controls. Best would be a randomized control study comparing two groups of patients managed by ERAS and conventional pathways. However, all our patients are currently managed through ERAS pathway which gave obvious positive result in patients recovery

## **Conclusion**

Implementation of ERAS protocol is very useful to improve the healthcare outcome and reducing the length of stay in the hospital and Postoperative morbidity and this in keeping with the international

literature. So we recommend using it on all patients undergoing elective colorectal surgeries specifically and in all surgical patients generally.

## Disclosure

The authors report no conflicts of interest in this work.

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