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# Peri-Operative Care in Colorectal Surgery in the Twenty-First Century

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## 1. Introduction

Under conventional circumstances, colorectal cancer resection has been associated with an often protracted recovery. Large published studies, randomized trials and meta-analyses suggest an average length of hospital stay of about ten days (Bokey et al., 1995; Abraham et al., 2004 & 2007). In an attempt to mimic the success of laparoscopic gall bladder surgery, laparoscopic colorectal resection was introduced in 1991 as a proposed less invasive alternative to the open technique (Jacobs, 1991; Redwine, 1991). Under conventional circumstances, in the first published series of 20 laparoscopic sigmoid colectomies, the authors reported that a five-day hospital stay was achieved in 70% of patients.

However, subsequent larger studies including randomized trials reported an average length of stay of about eight days which is still an improvement of about 20% compared with conventional open resections (Abraham et al., 2004 & 2007; Schwenk et al., 2005). The last published large randomized controlled trial of the topic (The ALCCaS) showed no statistically significant difference in postoperative complications, reoperation rate, or perioperative mortality between laparoscopic and open resections (Allardyce et al., 2010). However, a recent meta-analysis showed that laparoscopic colorectal resections were associated with higher intra-operative complication rates than open resections (Sammour et al., 2011). The ALCCaS group also reported that reviews show that the short-term advantages for laparoscopic resection for colorectal cancer are arguably relatively minor and often subjective (Allardyce et al., 2010).

In 1999, in a series of 16 open colectomies, the authors reported using a Fast Track (Enhanced Recovery after Surgery (ERAS)) Program with a median postoperative length of hospital stay of two days (Kehlet & Mogensen, 1999). However, subsequent larger studies reported a median length of stay of about five days (Abraham & Albayati, 2011). ERAS programs challenge the conventional approaches to peri-operative care in colorectal surgery in an evidence-based manner. These include conventional bowel preparation, peri-operative starvation, routine nasogastric decompression, routine prophylactic drainage, defunctioning ileostomy, vigorous intravenous hydration, narcotic analgesia, etc ... These traditional protocols and practices are replaced with evidence based protocols that enhance postoperative recovery.

## 2. General outline of an ERAS protocol

In an ERAS program, all the small steps that form the care package in colorectal surgery are "optimized" to achieve the best possible outcome. These include targeted preoperative interview to educate the patient on what to expect, preoperative nutritional assessment if required, minimal peri-operative starvation, preoperative carbohydrate and protein loading, no routine bowel preparation, transverse or oblique incision if seen fit by the operating surgeon, high oxygen concentrations and normothermia.

They also include avoiding excessive intravenous hydration and the routine use of nasogastric tubes and drains. Other important postoperative management issues include multimodal analgesia (epidural analgesia if seen fit by the anaesthetist, subcostal nerve block when possible, continuous wound infiltration with a local anaesthetic agent (wound soaker) and regular oral non-narcotic analgesia with minimal or no morphia and only using patient controlled applications.

Other elements of an ERAS protocol include the routline use of regular prokinetic agents, the routine use of regular anti-emetic drugs, a structured early postoperative mobilization program and early oral feeding (clear fluid intake on the evening of surgery, free fluid intake on day one and a soft diet on day two). This is all achieved through the co-operation of a team of clinicians, nursing staff, physiotherapists, stoma therapists, dieticians, etc … The general aim is to have the patient ready for discharge by postoperative day four or five.

## 3. Supportive evidence for the main ERAS practices

### 3.1 No routine bowel preparation

Mechanical bowel preparation was used for almost a century to cleanse the colon prior to surgery. The aim was to evacuate the colon, reduce the fecal load in the hope that this would – in a plausible way - reduce the bacterial load thus reducing the risk of postoperative infection and anastomotic leak rates. It was also believed that bowel preparation allowed better visualization of the lumen as well as making the anastomosis technically easier. Mechanical bowel preparation became "traditional". However, microbiological testing showed that bowel preparation did not reduce the microbial count in colonic mucosa (Jung et al., 2010). For a few decades, right hemicolectomies have been performed without bowel preparation.

Avoiding routine mechanical bowel preparation is an important component of any ERAS program. In the early seventies, Hughes showed that receiving preoperative bowel preparation made no difference to outcomes including anastomotic leak rates (Hughes, 1972). Multiple studies addressing the same questions have since been conducted (Scabini et al., 2010). A meta-analysis of outcomes following close to five thousand colorectal resections showed no evidence to suggest that bowel preparation reduced the incidence of anastomotic leakage (Guenaga et al., 2009). In fact there was a suggestion that routine bowel preparation could actually increase the risk of infections and overall complication rates associated with colorectal resections.

In an ERAS protocol, patients admitted for right sided resections receive no bowel preparation. For left sided resection, we use enema preparation the night before and the day of surgery to evacuate the rectum and the left colon to facilitate the surgery from the technical point of view. Others use normal saline enemas.

### 3.2 Minimal preoperative starvation

Preoperative starvation for eight hours or more before receiving an anesthetic has been implemented as an unchallenged rule for a very long time. This was meant to reduce the risk of aspiration pneumonitis if gastric contents were regurgitated during the course of induction of the general anesthetic. There is currently Level I evidence that shows that drinking clear fluids up to two hours prior to surgery does not increase the risk of aspiration or regurgitation as it does not increase gastric acidity or the amount of gastric secretions that could be regurgitated (Brady et al., 2003; Ljungkvist et al., 2003).

Patients were generally instructed to completely fast from midnight the night before their procedures are due to take place. This used to further complicate the semi-starvation state associated with bowel preparation. This could result in an increased catabolic state, dehydration and electrolyte imbalance especially if the procedure took place later in the morning or in the afternoon. This catabolic state is aggravated and complicated further by the surgery itself with the added negative nitrogen balance, insulin resistance and the release of stress hormones such as catecholamines, glucagon and cortisol (Nygren et al., 2001). Starvation also compromises the physiological response to hemorrhage and infection (Brady et al., 2003; Nygren et al., 2001). Patients receiving oral preoperative carbohydrate loading are more likely to have physiological postoperative insulin levels compared with those receiving glucose via the intravenous route and those fasting overnight and not receiving any carbohydrate loading (Kaska et al., 2010).

In an ERAS protocol, patients are typically allowed clear fluids up to two hours before the anesthetic and routinely "loaded" with oral carbohydrate and protein drinks and symbiotics preoperatively.

### 3.3 No postoperative starvation

Again, patients have traditionally been "fasted" postoperatively until they passed flatus. Even then, they were only allowed clear fluids until they had passed a bowel motion. It was believed that such practice would minimize the risk of an anastomotic leak or make such a leak more easily manageable than if the patient were allowed to eat. This further complicated any pre-operative malnutrition (Garth et al., 2010). Bowel preparation, the strict diet that goes with it and perioperative starvation further increase the catabolic state. Furthermore, the increased immediate postoperative need for nutrients is not met resulting in proteolysis, negative nitrogen balance and increased insulin resistance.

There is now Level I evidence that shows that there is no benefit in postoperative starvation in terms of reducing anastomotic leak rates (Lewis et al., 2009). It is likely that enteral nutrition reduces the overall risks of wound infection and intra-abdominal sepsis, probably through improving the capillary-intestinal barrier (Lewis et al., 2009).

In a standard ERAS protocol, patients are allowed clear fluids the evening after the procedure, free fluids on postoperative day one and a soft diet on postoperative day two regardless of the type of resection performed. We find this protocol to be well tolerated. We warn patients beforehand of the small risk of vomiting but reassure them that this would not be of serious consequence if it took place.

### 3.4 No nasogastric decompression

The traditional aim of routine nasogastric intubation is to achieve gastric decompression in order to reduce the risk of postoperative ileus, vomiting and abdominal distension. This

seemed to be a plausible means of improving postoperative peristalsis in an attempt to achieve an early return to bowel function. However, Cheatham et al showed in 1995 that routine nasogastric intubation did not reduce the risk of complications or length of postoperative stay in hospital following abdominal surgery (Cheatham et al., 1995). They also showed that for every patient requiring nasogastric intubation, 20 patients will not need it.
The results of this meta-analysis were reinforced by a recent Cochrane review of studies of close to six thousand patients (Nelson et al., 2007). Routine nasogastric decompression slowed the return of bowel function and did not reduce the risk of an anastomotic leak compared with no decompression. It was also associated with a more prolonged length of stay in hospital.

### 3.5 Consideration for a transverse or oblique incision

It has been suggested that a transverse or an oblique incision is an important part of the practices contributing to a quick recovery (Kehlet et al., 1999). A Cochrane review suggested an overall advantage in adopting a transverse over a midline incision (Brown & Goodfellow, 2005). This finding was supported by the results of a randomized controlled trial of transverse versus longitudinal incisions for cholecystectomy (Halm et al., 2009). Right hemicolectomies have probably been more commonly performed through a transverse rather than a vertical incision for a few decades.
A recent randomized trial suggested that there was no advantage in using a transverse incision over a longitudinal incision in terms of required analgesia, pain, pulmonary complications, median length of stay, median time to tolerating a diet or one year incisional hernia rates (Seiler et al., 2009). The sample size was small and a type II error could not be excluded. However, more wound infections occurred in the transverse incision group (15% vs. 5%, P = 0.02). It is the author's experience that left sided resections are overall easier to perform through a midline incision compared with an oblique incision. The choice between midline and transverse incisions may continue to be debated for some time yet.

### 3.6 No routine prophylactic drainage

It has been thought that prophylactic drainage of colorectal anastomoses would reduce the risk of anastomotic leakage. This was thought to be by a process of reducing the likelihood of a postoperative collection forming near the anastomosis with the plausible risk of infection and a subsequent anastomotic leak. The presence of a drain could also make it easy to detect an anastomotic leak guided by the amount and quality of drain output.
However, multiple randomized trials and a subsequent meta-analysis failed to demonstrate a benefit for routine drainage in colorectal surgery. The systematic review referred to above include the results of 1140 colorectal resections (Jesus et al., 2004). It showed no statistically significant difference between outcomes in patients receiving routine prophylactic drainage or no drainage for colorectal resections in terms of anastomotic leakage, wound infection and all complication rates (Qadan et al., 2009). There is probably no advantage for routine prophylactic drainage of low rectal or colo-anal anastomoses either (Merad et al., 1999; Yeh et al., 2005).

### 3.7 The limited role of a defunctioning ileostomy

A relevant randomised trial was published in 2008 (Chude et al., 2008). The authors compared routine defunctioning loop ileostomy versus no ileostomy for low rectal

resections within 5 cm of the anal verge. They reported clinically significant anastomotic leaks in 12 out of 120 (10%) in the "no ileostomy" group with two patients requiring Hartman's procedures. In the "ileostomy" group, clinically significant anastomotic leaks occurred in three out of 136 (2.2%) with no patients requiring a re-operation. The authors recommended the routine use of loop ileostomy for all anastomoses within five cm of the anal verge. Experience shows that this is particularly relevant if the patient has received neoadjuvant radiotherapy.

These results were confirmed in a Cochrane systematic review of six randomized trials of routine ileostomies for rectal resections with anastomoses within five cm of the anal verge (Montedori et al., 2010). A defunctioning ileostomy was associated with a reduced risk of reoperation for an anastomotic leak. In another systematic review of 27 retrospective studies and four randomized trials, the authors reported that the use of a defunctioning ileostomy after low rectal resections did not reduce the incidence of an anastomotic leak but was associated with improved outcomes in terms of a reduction in clinically significant leak rates (OR=0.32(0.17-0.59); (P<0.001)) and a reduction in associated reoperation rates (OR=0.27 (95% CI 0.14-0.51); (p<0.001)) (Huser et al., 2008).

### 3.8 Intravenous fluid restriction

The electrolyte imbalance, dehydration and hypotension resulting from preoperative starvation and the use of bowel preparation are often over-compensated for with the liberal use of perioperative intravenous isotonic fluids. However, this liberal use of perioperative intravenous rehydration has been shown to be associated with an increased risk of cardiopulmonary complications, a delay in the return of gastrointestinal function and an increased length of postoperative stay in hospital (Lobo et al., 2002). On the other hand, restricting perioperative intravenous fluid therapy has been shown to hasten gastrointestinal recovery, reduce postoperative complication rates and shorten the length of hospital stay (Nisanevich et al., 2005; Holte & Kehlet, 2006).

### 3.9 Multimodal postoperative analgesia

Routine spinal anesthesia was used in the original ERAS protocol described by Kehlet and his group in 1999 (Kehlet et al., 1999). However, this has evolved into the concept of multimodal analgesia as an integral part of the ERAS approach. The use of epidural analgesia with general anesthesia for major abdominal surgery has been shown to be associated with a reduced incidence of postoperative nausea and vomiting as well as lower rates of respiratory complications compared with intravenous narcotic analgesia, whether as a continuous infusion and/or patient-controlled boluses (White et al., 2007).

The use of a local anesthetic agent administered via an epidural catheter (usually as a continuous infusion and patient controlled boluses) following major abdominal surgery has also been shown to be associated with faster return of gastrointestinal function compared to intravenous and epidural narcotic analgesia to achieve the same analgesic effect (Jorgensen et al., 2000). Autonomic reflexes activated through a painful laparotomy incision cause inhibition of gastrointestinal functions. This is further aggravated by the use of narcotic analgesia and the nausea and vomiting associated with it.

### 3.10 Normothermia

Hypothermia is quite common with general anesthesia and abdominal surgical procedures. This is due to the combination of impaired thermoregulation, exposure and the use of air

conditioning and negative pressure ventilation in the operating rooms (Qadan et al., 2009). Hypothermia in a surgical setting is associated with an increased risk of bleeding due to coagulopathy as well as arrhythmias, myocardial ischemia and overall risks of complications (Diaz & Becker, 2010).
Under an ERAS protocol, hypothermia is actively prevented using warm and space blankets, warm intravenous infusions, avoiding unnecessary exposure, etc … The patient does not leave the recovery ward until normothermic.

## 4. Supportive evidence for ERAS protocols

As pointed out above, in the first published series of 16 open sigmoid colectomies under an ERAS (Fast Track) protocol, the authors reported a median postoperative length of hospital stay of two days (Kehlet & Mogensen, 1999). However, subsequent larger studies reported a median length of stay of about five days, three days longer than what was reported in the first series (Abraham & Albayati, 2011; Nygren et al., 2009).
Multiple published trials and systematic reviews have reported that ERAS protocols were associated with a faster recovery, reduced primary and overall lengths of hospital stay and complication rates after colorectal resections compared with the traditional approach. Wind et al reported that the use of an ERAS protocol in the care of patients having elective colorectal resections was associated with a reduced length of hospital stay by about one-and-half days as well as significantly reduced postoperative morbidity rates with no significant increase in readmission rates compared with conventional care (Wind et al., 2006).
These results have been further confirmed in a number of other meta-analyses. These reported a reduced overall length of postoperative hospital stay after elective colorectal resections by about 2.5 days with a reduced overall risk of postoperative complications with adopting an ERAS protocol compared with the traditional approach (Gouvas et al., 2009 & Eskicioglu et al., 2009).

## 5. Laparoscopic surgery under ERAS protocols

As pointed out above, meta-analyses of laparoscopic versus open colorectal resections showed that the postoperative length of hospital stay was reduced by about 20% by adopting the laparoscopic approach (Abraham et al., 2004 & 2007; Schwenk et al., 2005). The ALCCaS trial showed no statistically significant difference in postoperative complication, reoperation or peri-operative mortality rates between laparoscopic and open resections (Allardyce et al., 2010). The ALCCaS group also reported that reviews show that the short-term advantages of laparoscopic resection for colorectal cancer are arguably relatively minor and often subjective (Allardyce et al., 2010). They also reported that the benefit in adopting a laparoscopic approach in colorectal resections may be limited mainly to patients 70 years of age or older in whom the procedure was completed laparoscopically. An average length of stay of about eight days is common between those trials and meta-analyses. This is three days longer than what was initially reported in the first published series of laparoscopic colorectal resections (Jacobs 1991). A recent meta-analysis of the topic showed that laparoscopic colorectal resections were associated with higher intra-operative complication rates than open resections (Sammour et al., 2011).
To date, the role of laparoscopic resection within an ERAS protocol has not been established. Multiple studies have been conducted to assess whether adopting the laparoscopic

approach would complement ERAS rehabilitation programmes. In a small, 2:1 design, randomised trial of 62 patients (43 laparoscopic and 19 open resections), the authors reported an added benefit for adopting the laparoscopic technique in an ERAS protocol in terms of a reduced postoperative length of stay (King et al., 2006).

However, the results of a systematic review of two randomised controlled trials and three controlled clinical trials of laparoscopic versus open colorectal surgery under ERAS rehabilitation programs were inconclusive as no clear advantage for laparoscopic over open resection was demonstrated under ERAS protocols (Vlug et al., 2009). Further research was recommended.

Another recently published large review of 11 studies (four randomised trials and 11 controlled clinical trials) including 1021 patients reported a clear advantage for patients enrolled in an ERAS rehabilitation program in terms of length of hospital stay compared with those who were not (Gouvas et al., 2009). Although the authors reported that an added benefit to recovery rates in adopting the laparoscopic over the open approach was assumed, such a benefit could not be established. The authors concluded that ERAS programs should become a mainstay of elective colorectal surgery.

In a systematic review of three randomised trials and seven non-randomised studies of laparoscopic versus open colorectal resections under an ERAS protocol, Khan and colleagues reported that the currently available limited evidence suggests that the inclusion of laparoscopic surgery in ERAS protocols for colorectal resections does not confer an added benefit in terms of postoperative recovery rates and postoperative length of stay (Khan et al., 2009).

## 6. Standardisation of a colorectal ERAS protocol

A consensus statement on ERAS was published in 2005 (Fearon et al., 2005). The statement was written by colorectal surgeons and other specialists and professionals from five universities or tertiary hospitals in five European countries (Denmark, Scotland, Sweden, Norway and The Netherlands). The authors presented their methodology in the published article with a specific focus on colorectal resections. They also recommended their protocol as one that may provide a standard of care against which current and future novel elements of an ERAS approach can be tested or added to. Members of the same group published the outcomes of 169 colorectal resections under an ERAS protocol with very good results (Nygren et al., 2009).

Figures 1-4 show a summary of an ERAS colorectal program adopted at the Coffs Harbour Health Campus, a regional hospital in New South Wales, Australia in July 2006. The summary results of 111 ERAS consecutive open colorectal resections performed at that hospital by one surgeon have been recently published with outcomes similar to those in the North European experience (Abraham & Albayati, 2011).

The Australian Safety and Efficacy Register of New Interventional Procedures - Surgical (ASERNIP-S) under the auspices of the Royal Australasian College of Surgeons and the Department of Health and Aging – Victoria, assessed the experience of Australian and New Zealand surgeons with colorectal resection under ERAS protocols (Strum & Cameron, 2009). They concluded that ERAS programs can result in beneficial outcomes for patients by reducing the length of hospital stay with no significant increase in readmission rates. They also indicated that further work is required to assist in standardisation and implementation of ERAS protocols.

Protocol for Enhanced Recovery After Surgery (ERAS)
Coffs Harbour Health Campus
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**Preoperative Care:**

Surgeon's Rooms:

- Clinical pathway commenced
- Education brochure given to patient
- Nutritional screen
- Bowel preparation specified
  - Nil *or*
  - Enema preparation *or*
  - Colonoscopy preparation
- Referral to Cancer Co-ordinator, Dietician, Stoma Therapist as required

Preadmission Clinic:

- Preoperative investigations: FBC, UEC, LFTs COAG, CEA and others as required
- Preadmission process completed by RMO/RN.
- Once only medications prescribed:
  - Fleet enema the night before and the morning of procedure.
  - Carbohydrate loading: 6 tetra packs (4 between 9 and 10 pm the night before and 2 between 5 and 6 am the day of surgery)
- Anesthetic consultation: Anesthetic assessment and explanation of postoperative pain management.
- Perioperative nurse consultation: Patient education regarding symbiotics (e.g. Inner Health Plus), bowel preparation / enemas, low residue diet, carbohydrate loading drinks, postoperative pain management, etc …
- Other referrals: (cancer co0ordinator, stoma therapist, dietitian, etc )

Day Surgery Unit:

- Base line observations charted
- Skin preparation
- Enema if ordered
- Normothermia maintained

Fig. 1. Preoperative care in a typical ERAS program

**Intraoperative Care:**

Thoracic Epidural:
If planned

General Anesthetic: (guide only)

Induction Agent: Propofol

*Narcotic:* Fentanyl

*Maintenance:* 80% oxygen with air Sevo
Fentanyl as indicated

*Muscle Relaxant:* Rocuronium or Atracurium

*Antibiotics:* Ceftriaxone 1g, Metronidazole BP 500mg in 100mls

*Antiemetics:* Dolasetron (Anzemet) 12.5mg IVI stat plus
Dexamethasone 8mgs IVI

*NSAID:* Parecoxib sodium 40mgs IVI, single dose

**Urinary catheter,** TEDS & SCD

Fluid Replacement:

Hartmann's Solution 1-2mls/kg/hour (don't over hydrate)

Wound Soaker Placement:

Prior to wound closure, the fascia is grasped with two Moynihan tissue forceps and elevated. On each side of the incision, the introducer is placed at the superior end of the incision and tracks into the preperitoneal space. The introducer should be inspected through the parietal peritoneum to ensure the catheter is not placed deep into the muscle. Care must be taken to place the introducer greater than 1cm from the fascial edge to avoid incorporation with the fascial sutures. The introducer should be placed to its fullest extent. The needle is withdrawn and a soaker catheter is placed through the sheath.

**Normothermia:** not less than 36$^{o}$C

***No routine drains or NG tube used***

Fig. 2. Intra-operative care in a typical ERAS program

**Postoperative Care:**

Recovery Ward (PACU):

- Observations documented as per relevant chart or Recovery Ward protocol
- Maintain Normothermia
- Continue 80% Oxygen
- Maintain SCD
- Clexane as per anesthetic orders
- VAS score
- Commence i.v. PCA if no epidural
- Check Wound Soaker if no epidural

Thoracic Epidural:

- Clinician Initiated Dose/ Loading Dose: 5mls repeat after 20mins.
- Maintenance postoperatively: 0.2% Naropin with 2 mcgs Fentanyl /ml
- Dose Range: 2.5 to 5ml /hr continuous
- Patient Controlled (PCEA) Dose: 5mls with 20min lockout interval

Wound Soaker:

1. Bilateral Pain Buster for open abdominal wound: Naropin 0.375%: 270mls/5mls per hour each unit
2. Single Pain buster for laparoscopic wounds: Naropin 0.375%: 270mls/5mls per hour

Postoperative Medications:

- Movicol half sachet BD
- Ibuprofen 400mgs TDS for first 2 days then PRN oral
- Paracetamol 1gm QID oral
- Dolasetron PRN 12.5mgs BD IV
- Droperidol PRN 0.5 to 1.25mgs TDS IV
- Maxolon 10mgs TDS IV commence on arrival to ward
- Clexane 40mgs (at least 2 hours post epidural insertion) daily SC

Fig. 3. Early postoperative care in a typical ERAS program

## 7. Implementation of a colorectal ERAS protocol

A transverse incision has been used for right sided colonic resections for a few decades. There is an observation that many of the other components of ERAS protocols such as multimodal analgesia have been incorporated in traditional colorectal surgical care without necessarily implementing a complete protocol. The implementation of a structured complete ERAS program is less common (Lassen et al., 2005). The implementation of such a protocol requires coordinated training and a team approach by anesthetic, surgical, nursing and other staff (Fearon et al., 2005). This could explain the somewhat delayed uptake of the approach despite the available supportive evidence. It has been suggested that an ERAS protocol should be routinely implemented in colorectal surgical care (Gouvas et al., 2009).

As is the case with most innovations, it will probably take some time for the ERAS approach to be used widely.

**Ward Care:**

High Dependency Unit:

*Day of surgery (0-24h):*

- PCEA management as per epidural orders (if present)
- PCA/Wound soaker management (if present)
- Out of bed 6 hours postoperatively for 2 hours with physiotherapist
- Oral fluids and 2 protein drinks to 1000mls
- Bowel chart

*Postoperative day 1 (24-48h):*

- Daily weigh (day 1-4)
- Mobilize 8 hours, 100 meters of walking with physiotherapist
- Fluids: 2000mls including 4 protein drinks
- Normal diet and sit out of bed for all meals
- Bowel chart

Surgical Ward:

*Postoperative day 2 (48-72h):*

- Remove epidural 0600
- Remove wound soaker catheter when device is empty
- Remove urinary catheter 0800 (2 hours after epidural removal)
- Regular paracetamol & NSAID
- Maintain pain score <5
- Fluids, 2000mls including 4 protein drinks
- Mobilize 100 meters and out of bed 8hrs
- Bowel chart

*Postoperative day 3 (72-86h):*

- Maintain pain management, mobilization, fluids and diet.
- Remove IVC
- Bowel chart.
- Early Discharge Planner review and appointments confirmed

*Postoperative Day 4: Discharge*

*Postoperative Day 10:* Skin clips removed, histology Surgeon's Rooms

*Postoperative week 4:* Patient interview by phone

Fig. 4. Ward care in a typical ERAS program

## 8. Conclusion

In this chapter, the evidence (mainly Level I and II) against traditional peri-operative colorectal surgical practices was presented. These practices included mechanical bowel preparation, peri-operative starvation, the routine use of nasogastric decompression and prophylactic drainage, defunctioning ileostomy, aggressive IV hydration and the routine use of postoperative narcotic analgesia.

At the same time, supportive evidence for the individual aspects of an ERAS protocol and for such a protocol as a whole was also presented. The main emphasis was on avoiding mechanical bowel preparation and peri-operative starvation, ensuring nutritional support including preoperative carbohydrate and protein loading, transverse or oblique incisions if deemed appropriate by the surgeon, high oxygen concentrations, normothermia, minimal intravenous hydration, multimodal analgesia including non-narcotic epidural catheter analgesia if deemed appropriate by the anesthetist, prokinetic agents, anti-emetic drugs and early mobilization, feeding and discharge.

ERAS programs for colorectal resections have been shown to be associated with a faster recovery and a shorter length of hospital stay compared with traditional practices. Furthermore, a number of studies showed that ERAS programmes are also associated with reduced complication rates. Although further research may be required, the current evidence suggests that under an ERAS programme, there is no added benefit in adopting a laparoscopic approach over the open approach.

As with most other innovations, the use of ERAS programs might take some time to become widely spread. However, an ERAS protocol is recommended as a mainstay in colorectal surgical practice.

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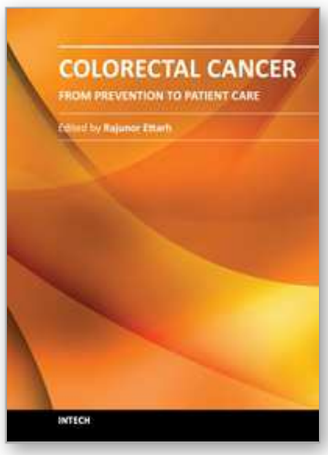


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The projections for future growth in the number of new patients with colorectal cancer in most parts of the world remain unfavorable. When we consider the substantial morbidity and mortality that accompanies the disease, the acute need for improvements and better solutions in patient care becomes evident. This volume, organized in five sections, represents a synopsis of the significant efforts from scientists, clinicians and investigators towards finding improvements in different patient care aspects including nutrition, diagnostic approaches, treatment strategies with the addition of some novel therapeutic approaches, and prevention. For scientists involved in investigations that explore fundamental cellular events in colorectal cancer, this volume provides a framework for translational integration of cell biological and clinical information. Clinicians as well as other healthcare professionals involved in patient management for colorectal cancer will find this volume useful.



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