Enhanced recovery after surgery: A consensus review of clinical care for patients undergoing colonic resection


Summary

Background & Aims: Clinical care of patients undergoing colonic surgery differs between hospitals and countries. In addition, there is considerable variation in rates of recovery and length of hospital stay following major abdominal surgery. There is a need to develop a consensus on key elements of perioperative care for inclusion in enhanced recovery programmes so that these can be widely adopted and refined further in future clinical trials.

Methods: Medline database was searched for all clinical studies/trials relating to enhanced recovery after colorectal resection. Relevant papers from the reference lists of these articles and from the authors’ personal collections were also reviewed. A combination of evidence-based and consensus methodology was used to develop the resulting enhanced recovery after surgery (ERAS) clinical care protocol.

Results and Conclusions: Within traditional perioperative practice there is considerable evidence supporting a range of manoeuvres which, in isolation, may...
improve individual aspects of recovery after colonic surgery. The present manuscript reviews these issues in detail. There is also growing evidence that an integrated multimodal approach to perioperative care can result in an overall enhancement of recovery. However, effects on major morbidity and mortality remain to be determined. A protocol is presented which is in current use by the ERAS Group and may provide a standard of care against which either current or future novel elements of an enhanced recovery approach can be tested for their effect on outcome.

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Introduction

The key factors that keep a patient in hospital after uncomplicated major abdominal surgery include the need for parenteral analgesia (persistent pain), intravenous fluids (persistent gut dysfunction), and bed rest (persistent lack of mobility). These factors often overlap and interact to delay return of function. Obviously, postoperative complications will also prolong the time until recovery and ultimately length of stay. Interestingly, recent findings suggest that the rate of complications can be unaltered or even reduced when actions are taken that support faster return of normal function. A clinical pathway to accelerate recovery after colonic resection based on a multimodal programme with optimal pain relief, stress reduction with regional anaesthesia, early enteral nutrition and early mobilisation has demonstrated improvements in physical performance, pulmonary function, body composition and a marked reduction of length of stay. A subsequent randomised trial using a similar protocol has demonstrated a significant reduction in median length of stay from 7 to 3 days. However, different surgical groups proclaim wide variation in the nature of their optimal ‘fast-track’ or enhanced recovery programmes. For example, apparently similar outcomes can be achieved with or without epidural anaesthesia/analgesia. This suggests that it is the combination of each of the different elements of an enhanced recovery programme that goes to make an effective regimen rather than any single element on its own. At present, the evidence on which to base a multimodal programme is taken that support faster return of normal function. A clinical pathway to accelerate recovery after colonic resection based on a multimodal programme with optimal pain relief, stress reduction with regional anaesthesia, early enteral nutrition and early mobilisation has demonstrated improvements in physical performance, pulmonary function, body composition and a marked reduction of length of stay. A subsequent randomised trial using a similar protocol has demonstrated a significant reduction in median length of stay from 7 to 3 days. However, different surgical groups proclaim wide variation in the nature of their optimal ‘fast-track’ or enhanced recovery programmes. For example, apparently similar outcomes can be achieved with or without epidural anaesthesia/analgesia. This suggests that it is the combination of each of the different elements of an enhanced recovery programme that goes to make an effective regimen rather than any single element on its own. At present, the evidence on which to base a multimodal programme is taken that support faster return of normal function.

Methods

The ERAS group was established in 2001 as a collaborative of five university or specialised Departments of Surgery from five Northern European Countries (Scotland, Sweden, Denmark, Norway and The Netherlands). Using the Medline database, an electronic search on ‘fast-track’ or ‘multimodal’ recovery was undertaken. Relevant papers from the reference lists of these articles and from group members’ personal collections were also reviewed. The committee met on several occasions to reach a consensus on a protocol, which was then documented by the present authors.

Results

Principles of the ERAS protocol

Conventional perioperative metabolic care has accepted that a stress response to major surgery is inevitable. This concept has recently been challenged with the view that a substantial element of the stress response can be avoided with the appropriate application of modern anaesthetic, analgesic and metabolic support techniques. Conventional postoperative care has also emphasised prolonged rest for both the patient and their gastrointestinal tract. Similarly, this concept has recently been challenged. In the catabolic patient, medium-term functional decline will ensue if active steps are not taken to return the patient to full function as soon as possible. These two concepts have been combined to produce a new view of how
surgical patients should be cared for (the ERAS protocol). Using a multidisciplinary team approach with a focus on stress reduction and promotion of return to function, the ERAS protocol aims to allow patients to recover more quickly from major surgery, avoid medium-term sequelae of conventional postoperative care (e.g. decline in nutritional status and fatigue) and reduce health care costs by reducing hospital stay.

**Preadmission information and counselling**

It is well established that intensive preoperative patient information can facilitate postoperative recovery and pain relief, particularly in patients who exhibit most denial and the highest levels of anxiety.\(^7,8\) A clear explanation of what is to happen during a patient’s hospital stay can also facilitate adherence to the care pathway and allow timely recovery to allow early discharge. In addition and importantly, at this first meeting with the patient, he or she should also be given a clear role with specific tasks to perform during the postoperative period.\(^9\) These include targets for intakes of food and oral nutritional supplements (ONS) and targets for staying out of bed.

**Consensus:** A patient should receive oral and written preadmission information describing what will happen during their hospital stay, what they have to expect, and what their role is in their recovery.

**Preoperative bowel preparation**

Many regimens have been used, with oral sodium phosphate probably being the most convenient method.\(^10\) Mechanical bowel preparation is stressful for the patient and can result in significant dehydration/fluid and electrolyte abnormalities (particularly in the elderly).\(^11\) A recent meta-analysis of all available data\(^12\) confirms earlier meta-analyses\(^13,14\) showing that bowel preparation has no benefit in colonic surgery. Furthermore, this most recent meta-analysis suggests that bowel preparation increases the risk for anastomotic leak. Bowel preparation may be essential in selected patients who require intraoperative colonoscopy.

**Consensus:** Patients undergoing colonic resection should not receive routine oral bowel preparation.

**Preoperative fasting**

To avoid pulmonary aspiration, fasting after midnight has been the standard in elective surgery. However, a review of recent studies has found no scientific support for this practice.\(^15\) Several National Anaesthesia Societies now recommend intake of clear fluids up until 2 h before initiation of anaesthesia and a 6-h fast for solid food.\(^16-18\) It has been proposed that patients should be in the fed state rather than fasted when they go to theatre. Provision of a clear carbohydrate-rich beverage (12.6%) at a dose of 800ml before
midnight and 400 ml 2–3 h before surgery reduces preoperative thirst, hunger and anxiety\(^1\) and significantly reduces postoperative insulin resistance.\(^2\) Thus, patients are in a more anabolic state to benefit from postoperative nutrition\(^2\) and with less risk of hyperglycaemia.\(^2\) Patients should have access to normal food on the day before surgery.

**Consensus:** Patients should only be fasted for liquids for 2 h and for solids for 6 h preoperatively. Patients should receive oral preoperative fluids and carbohydrate loading.

### Preanaesthetic medication

Beneficial effects of preanaesthetic medication on anxiety have not been established and preanaesthetic provision of anxiolytics increases postoperative sedation.\(^2\) Furthermore, a recent meta-analysis has demonstrated no effect on postoperative pain relief by starting analgesic treatment before the operation (so-called preemptive analgesia).\(^2\) Short-acting anxiolytics may be helpful in worried patients during placement of an epidural. In addition, the use of oral carbohydrate loading has been shown to reduce the level of preoperative anxiety.\(^1\) Patients who receive sleeping medication at home can continue in hospital.

**Consensus:** Patients should not receive preanaesthetic anxiolytic or analgesic medication.

### Anti-thrombotic prophylaxis

In colorectal surgery, there is a clear indication for anti-thrombotic prophylaxis, where unfractionated and fractionated low-dose heparin regimens are effective.\(^2\) Low molecular weight heparin (LMWH) (fractionated) is preferable due to compliance (once daily administration).\(^2\) Low dose (20 mg enoxaprim daily) is about as effective as higher doses in general surgery and higher doses should be avoided because of the risk of potential bleeding complications when using concomitant epidural analgesia. Treatment is usually initiated 2–12 h before the operation and continued until fully mobilised. There is no further advantage in general surgery by continued treatment for 4 weeks (in contrast to major orthopaedic surgery).\(^2\)

Concomitant use of LMWH and continuous epidural analgesia is debatable, due to reported cases of epidural hematoma in the USA, where double doses of thromboembolic prophylaxis have been used.\(^2\) Recommendations from USA authorities are: delayed administration until 1–2 h after epidural catheterisation and that the epidural catheter is removed 8–2 h after previous LMWH administra-

Concomitant administration of acetaminophen (paracetamol) does not add additional risk, while the risk of concomitant administration of nonsteroidal anti-inflammatory drugs (NSAID) and LMWH is considered safe, although debated. It should be emphasised that epidural analgesia per se reduces thromboembolic complications by 50% in lower body procedures, but this has not been demonstrated after abdominal procedures.

The use of graded compression elastic stocking is recommended and should be used to provide an additional advantage when combined with LMWH and epidural analgesia and mobilisation (combined effect unknown). Intermittent pneumatic compression is effective, but costly and may hinder early mobilisation and is therefore not recommended.

**Consensus:** Patients should receive antithrombotic prophylaxis according to the local peer-reviewed protocol.

### Anti-microbial prophylaxis

It is well established that anti-microbial prophylaxis is effective in reducing infectious complications in colorectal surgery.\(^3\) Key elements include (1) that prophylaxis should be active against both aerobic and anaerobic bacteria, (2) that administration should be before skin incision and (3) that single-dose prophylaxis is as effective as multidose regimens (although a repeat dose intraoperatively may be justifiable in case of prolonged (\(>3\) h) operations). The optimal anti-biotic combination regimen has not been established, but single-dose Metronidazole and Cefuroxime is suggested based upon cost considerations and avoidance of newer generations of antibiotics, which have not been demonstrated to be more effective than primary prophylaxis, and therefore may be used if secondary infectious complications occur.

**Consensus:** Patients should receive single-dose antibiotic prophylaxis against both aerobic and anaerobic pathogens.

### Standard anaesthetic protocol

There is no evidence as to the choice of the optimal anaesthetic method based on morbidity or recovery data from colorectal procedures. However, it is rational to use agents with short pharmacodynamic duration (propofol, remifentanil)\(^3\) thereby allowing pro-active recovery to start on the day of surgery. Thus, opioids with longer-lasting effect (morphine, fentanyl) should be avoided. Short-acting inhalation anaesthesia is a reasonable alternative to total intravenous anaesthesia. There is no
evidence that intraoperative epidural analgesia improves postoperative outcome in colorectal procedures, but its use will reduce the dosage of general anaesthetic agents. Also, a mid-thoracic epidural activated before the onset of surgery also blocks stress hormone release and attenuates postoperative insulin resistance.34 Epidural analgesia has been suggested for routine postoperative analgesia on the basis that it provides optimal pain relief and based on a meta-analysis may reduce postoperative mortality and morbidity.35 A recent large single study36 has questioned the benefits of epidural analgesia in terms of postoperative morbidity and mortality. One also has to consider the very small but significant risks of epidural haematoma or abscess or neurological damage (0.01–0.6%). There is, however, clear evidence that a thoracic epidural can block many of the components of the stress response to injury37 and has been proven to reduce the duration of postoperative ileus.38 The catheter is best placed in the mid-thoracic level at T7/8 for colonic surgery to achieve both analgesic block and sympathetic block preventing gut paralysis.39 The catheter is sited in the awake patient to establish the effectiveness of the block. During surgery the block can be maintained by continuous infusion of local anaesthetic (e.g. bupivacaine 0.1%) plus a low-dose opiate (e.g. 2 μg/ml fentanyl) at 4–10 ml/h. Epidural opioids in small doses have been shown to act in synergy with epidural local anaesthetics in providing analgesia, allowing reduced dosages of both agents.40 Furthermore, low-dose epidural opioids improve the analgesic effects without major systemic effects.40 Finally, addition of a small amount of adrenaline to the epidural infusion of local anaesthetic and opioid has been shown to markedly improve analgesia and decrease systemic opioid-related side-effects.41–43

Consensus: Patients should undergo anaesthesia avoiding long-acting opioids. Patients should receive a mid-thoracic epidural commenced pre-operatively and containing local anaesthetic in combination with a low-dose opioid.

**Surgical incisions**

It remains unclear if transverse or longitudinal incisions are to be preferred. There is evidence from some randomised trials that transverse or curved incisions reduce pain and pulmonary dysfunction following abdominal procedures,44,45 while other trials have found no advantage of transverse incisions.46,47 The fact that some Departments always use transverse or curved incision while other Departments always use midline incisions provides evidence that sufficient access to the surgical site can be obtained by either type of incision. However, it is clear that incision length affects patient recovery.48

Consensus: Patients should undergo laparotomy using an abdominal incision of minimum length.

**Nasogastric intubation**

There is good evidence from a meta-analysis49 that routine nasogastric decompression should be avoided after colorectal surgery since fever, atelectases and pneumonia are reduced. There is no clear rationale for routine insertion of nasogastric tube during surgery, except to evacuate air that may have been pushed down in the stomach during intubation for ventilation. If a tube is placed during surgery, it should be removed before the patient wakes up from anaesthesia.

Consensus: Nasogastric decompression tubes should not be used as a routine in the postoperative period.

**Prevention of intraoperative hypothermia**

Prevention of intraoperative hypothermia reduces endocrine-metabolic responses and sympathetic reflexes, and changes the fibrinolytic-coagulatory balance resulting in reduced bleeding. Subsequently, several randomised trials have demonstrated that preservation of normothermia by infusion of warmed fluids and using an upper-body forced-air heating cover reduces wound infections,50 cardiac complications51 and bleeding and transfusion requirements.52

Consensus: Intraoperative maintenance of normothermia with infusion of warmed fluids and an upper-body forced-air heating cover should be used routinely.

**Perioperative fluid management**

A proportion of patients who undergo bowel preparation with purgative laxatives and who are subject to conventional preoperative fasting protocols are subject to dehydration and electrolyte imbalance.53–55 Avoidance of bowel preparation, the use of preoperative oral carbohydrate loading and free access to fluids until 2 h before induction of anaesthesia are potential methods to reduce this problem. There is good evidence to support the safety of allowing access to fluids up to 2 h before surgery.15
With reference to intraoperative and postoperative intravenous fluids, modern resuscitation methodology has emphasised the concept that ‘wet is best’ and a patient therefore cannot be given too much intravenous fluid. With traditional care patients currently receive 3.5–5 l of intravenous fluids on the day of surgery and 2 l/day for the next 3–4 days with a resultant weight gain of 3–6 kg over the perioperative period. Recently, however, evidence has suggested that a policy of providing no more intravenous infusions than necessary to maintain fluid balance (i.e. body weight), may significantly reduce postoperative complications and shorten postoperative hospital stay. Clearly, the best way to limit postoperative intravenous fluid administration is to take the intravenous drip down. This can usually be achieved routinely on the first or second postoperative day.

Patients with an epidural can experience vasodilation leading to relative intravascular volume depletion and hypotension. Intraoperative and postoperative management of hypotension may include fluid loading. Alternatively, the judicious use of vasopressors can avoid excessive fluid administration.

There is increasing evidence that excess administration of salt solutions can delay the return of normal gastrointestinal function and can be associated with increased postoperative complications and prolonged hospital stay. Equally, for high-risk patients there is evidence that goal-directed preoperative conditioning (including fluid loading) can reduce postoperative complications. Clearly, there must be a balance between achieving adequate tissue perfusion versus overloading the patient with sodium and/or water. Trans-oesophageal Doppler ultrasonography during surgery offers a method of titrating fluids in relation to cardiac output and may be particularly useful in the high risk patient and may even result in reduced length of stay.

Consensus: Patients should commence oral fluids 2 h post surgery on day 0. Target intake should be > 800 ml oral fluids on the day of operation. Patients should have IV fluids discontinued as soon as adequate oral intake is established. The target should be during day 1.

Vasopressors should be considered for the intra- and postoperative management of epidural-related hypotension. A reduction in epidural infusion rate should also be considered. Target levels for blood pressure should be moderated. Intraoperative monitoring of fluid replacement with Doppler ultrasonography may help in the management of high-risk patients.

Drainage of peritoneal cavity following colonic anastomoses

The presence of an abdominal drain represents a significant impediment to achieving early and appropriate levels of mobilisation. Meta-analyses have demonstrated that use of drains after colonic anastomoses does not reduce the incidence or the severity of an anastomotic leak or other complications.

Consensus: Drains are not recommended following routine colonic resection.

Urinary drainage

Several randomised trials report that suprapubic bladder drainage as compared with urethral catheterisation is associated with lower urinary tract infection rates and/or lower discomfort in patients undergoing abdominal surgery while another showed no such benefits. Most trials have been undertaken in patients requiring prolonged periods of urinary drainage (i.e. 4–7 days). The risk of urinary retention after only 24 h urinary bladder catheterisation has been reported to be low after colonic resection during epidural analgesia. The presence of urinary drainage represents a significant impediment to achieving early and appropriate levels of mobilisation.

Consensus: It is recommended to use urinary bladder drainage for the duration of thoracic epidural analgesia. Earlier removal of urinary drainage may be considered before the epidural is stopped.

Postoperative nausea and vomiting

In order to attain the objective of early and sustained oral food intake it is important to have a defined strategy for the management of postoperative nausea and vomiting (PONV). Risk factors should be minimised including the avoidance of emetogenic drugs (neostigmine, opioids, certain gaseous anaesthetic agents, etc) with the substitution of agents that are less so. Patients at risk for PONV (e.g. non-smoking women with a history of motion sickness) should receive prophylactic treatment (e.g. ondansetron, dexamethasone or droperidol). If patients develop nausea and vomiting, treatment should be with a combination of such agents.

Consensus: Antiemetics should be used selectively and in a structured manner to diminish PONV and promote an early return of oral intake.
Ileus prophylaxis and promotion of gastrointestinal motility

Patients’ pattern of postoperative care should be integrated to try to prevent postoperative gut dysfunction. Strategies should include epidural analgesia, avoidance of opiates, avoidance of fluid overload and use of oral magnesium oxide (1g twice daily commenced on the evening of surgery and used until discharge).  

Consensus: Patients should undergo a structured pattern of care to avoid postoperative ileus and promote early oral intake.

Postoperative analgesia

It is well established from several controlled trials and a Cochrane Review that optimal analgesia allowing early mobilisation is best achieved by continuous epidural local anaesthetic or local anaesthetic–opioid techniques. Patient-controlled analgesia (PCA) using intravenous opioids does not provide the same efficient analgesia and has less beneficial physiological effects on surgical stress responses compared with epidural local anaesthetic techniques. Whilst it is possible to achieve almost the same pain scores with PCA at rest compared with epidural analgesia, this is done at the expense of the patient remaining sedated and at rest in bed. Randomised trials have demonstrated that continuous epidural local anaesthetic techniques reduce pulmonary morbidity, but not other types of morbidity or hospital stay or convalescence. The explanation here is probably that unimodal intervention does not take advantage of the efficient analgesia and positive effect on paralytic ileus provided by an epidural on its own. NSAIDs may provide some additional analgesia, but probably less than in minor procedures. The combination of paracetamol and NSAIDs provides superior analgesia in minor procedures but has not been demonstrated to be synergistic/additive in major (colorectal) procedures. The main principle for analgesia is opioid sparing thereby avoiding opioid-related side effects and enhancing recovery. The optimal duration of continuous postoperative mid-thoracic epidural analgesia has not been established in well-designed randomised trials, but large-case series suggest that two days may be sufficient in colonic resection. NSAIDs should not be given during a well-functioning epidural since there is no evidence that this improves analgesia.

Consensus: Patients should receive continuous epidural mid-thoracic low-dose local-anaesthetic/opioid combinations for 2 days after colonic resection. Paracetamol should be given as a baseline analgesic (4g daily) throughout the postoperative course. For break-through pain NSAIDs and bolus epidural bupivacaine should be given whilst the epidural is running. NSAIDs should be started just before removal of the epidural and continued until and/or after discharge.

Postoperative nutritional care

For normally nourished patients, restoration of normal GI function to allow adequate food intake and rapid recovery is one of the primary objectives of postoperative care. A meta-analysis of controlled trials of early enteral or oral feeding versus ‘nil by mouth’ after GI surgery concluded there is no clear advantage to keeping patients fasting after elective GI resection. Early feeding reduced both the risk of any type of infection and the mean length of stay in hospital. Furthermore, early feeding was not associated with an increased risk of dehiscence of an anastomosis distal to the site of feeding. However, the risk of vomiting increased in patients fed early and, in the absence of multimodal anti-ileus therapy, early enteral feeding was associated with intestinal bloating and impairment of mobilisation and pulmonary function.

For malnourished patients undergoing abdominal surgery, there is a clear advantage for the prescription of ONS in the postoperative period and for 8 weeks thereafter in terms of recovery of nutritional status, protein economy and quality of life. Positive clinical outcomes from oral nutrition supplements have also been documented in studies of elective surgical patients who were not screened specifically for malnutrition. However, oral supplementation in such studies (using traditional perioperative care) was commenced some 4–5 days after the day of surgery. In enhanced recovery programmes, ONS have been used successfully on the day prior to operation and for at least the first four post operative days to achieve recommended intakes of energy and protein.

When used in combination, preoperative oral carbohydrate loading, epidural analgesia and early enteral nutrition have been shown to result in nitrogen equilibrium without concomitant hyperglycaemia. This emphasises the importance of multimodal therapy in the maintenance of nutritional status following surgery.

Consensus: Patients should be encouraged to commence oral food intake 4h after surgery. ONS should be taken (approx 400ml energy dense ONS) from the day of surgery until a normal level of food intake is achieved. Continuation of ONS at
home is recommended for nutritionally depleted patients.

**Early mobilisation**

Bed rest not only increases insulin resistance and muscle loss but also decreases muscle strength, pulmonary function and tissue oxygenation. Moreover patients are exposed to an increased risk of thromboembolism. Effective pain relief using ambulatory thoracic epidural analgesia is a key adjuvant measure to encourage postoperative mobilisation. Organisation is essential, and a prescheduled care plan should be drawn up with goals for mobilisation listed each day. It is essential that the patient be nursed in an environment which encourages early mobilisation. In particular, whilst the patient has an epidural running it is helpful if patients are nursed in an ordinary ward or level 1 facility rather than a high dependency unit (level 2). The latter leads to suppression of the patient's independence. If possible, food and television facilities should be separate from the patient's bedside to encourage mobilisation. Another useful measure may be using a patient diary where patients document the time out of bed on a daily basis. The aim is that patients are out of bed 2 h on the day of surgery, and 6 h per day until discharge.

**Consensus:** Patients should be nursed in an environment that encourages independence and mobilisation. A care plan that facilitates patients being out of bed for 2 h on the day of surgery and 6 h thereafter is recommended.

**Discharge criteria**

Patients can be discharged when they meet the following criteria:

(a) good pain control with oral analgesia;
(b) taking solid food, no intravenous fluids;
(c) independently mobile or same level as prior to admission;
(d) all of the above and willing to go home.

The discharge process starts at the preadmission counselling session when it is determined if the patient lives alone and has any special needs (e.g. transport, social support etc). Problems that will delay discharge must be addressed at this time rather than once the patient has been admitted.

**Consensus:** Planning the discharge process should begin when the patient attends for preadmission counselling. Defined discharge criteria should be followed.

**Follow-up**

Patients entering an enhanced recovery programme will inevitably require more active supervision when they get home. In general, if length of stay is reduced to 2–3 days approximately 10–20% may require readmission or a few hours of observation and treatment as outpatients.\(^{3,82}\) Readmission in itself does not imply an overnight stay. Often patients can re-attend the hospital as an outpatient, receive treatment (e.g. anti-emetics/analgesia/fluids) and go home the same day. Ready access to medical and nursing advice either on the phone or on the ward must be structured into the Unit's working practice. Patients’ general practitioners should be alerted to their patients’ participation in an enhanced recovery programme and to their increased needs in the community. It is essential that there is a clear pathway for the prompt and safe readmission of the 1–3% of patients who will experience an anastomotic leak at home.

Once at home, patients should be contacted by phone within 24–48 h to ensure all is well and to provide advice. Many Units organise out-patient clinic review at 7–10 days following surgery when the wound can be checked, staples/stitches removed, pathology results discussed and, if necessary, future oncology therapy organised. A further clinical or telephone review at 30 days after surgery is recommended for patient reassurance and audit purposes.

**Consensus:** Surgical units undertaking an enhanced recovery programme must be restructured to provide adequate follow-up and continuity of care. An enhanced recovery programme should only be initiated once there is a clear pathway established for the prompt and safe readmission of the 1–3% of patients who will experience an anastomotic leak (or other major complications) at home.

**Audit**

All good surgical practice is based on ongoing audit of clinical outcomes. It is essential that outcomes be documented during the introduction of an enhanced recovery programme. This not only ensures that morbidity and mortality are optimal but that feedback is provided on aspects of the programme that may need further development of infrastructure/staff education.

**Consensus:** Audit is an inherent and essential component of every enhanced recovery programme.
Summary of core protocol elements

- **Patient information**: Essential before admission for surgery.
- **Preoperative bowel preparation**: No routine oral preparation for colon resections.
- **Preanaesthetic medication**: Not recommended.
- **Preoperative fasting and fluids**: Patients should be allowed to drink clear fluids up to 2 h prior to initiation of anaesthesia and should receive preoperative oral carbohydrate loading.
- **Standard anaesthetic protocol**: Intraoperative mid-thoracic epidural analgesia (local anaesthetic + low-dose opioid). Short-acting intravenous or inhalational anaesthetic agents, according to local traditions.
- **Prevention of intraoperative hypothermia**: Warmed IV fluids and upper body air-warming device.
- **Thromboembolic prophylaxis**: Low-dose LMWH started about 2 h after placement of epidural catheter and continued until full mobilisation.
- **Nasogastric decompression tubes**: Not recommended.
- **Prophylactic antibiotics**: Indicated with two drugs (anaerobic and aerobic prophylaxis) given before skin incision and single dose, may be repeated when surgery > 3 h.
- **Incision**: Short midline or transverse incisions recommended.
- **Drainage**: Drains should not be used routinely in colonic surgery.
- **Urinary bladder catheterisation**: Suprapubic or urethral catheterisation. Removal of catheter 24–48 h after surgery recommended.
- **Fluid therapy**: Avoid excessive intravenous fluids. Vasopressors recommended for treatment of epidural-related hypotension. Discontinuation of IV fluids on postoperative day 1.
- **Ileus prophylaxis and promotion of GI motility**: Continuous thoracic epidural analgesia for first 2 postoperative days (low-dose epidural local anaesthetic–opioid): Use of magnesium oxide twice daily recommended.
- **Postoperative analgesia**: Continuous thoracic epidural analgesia for 2 days postoperatively (low-dose epidural local anaesthetic–opioid), paracetamol as routine oral analgesic and epidural top up as rescue. Commence NSAIDs at end of epidural. Additional opioid only if other efforts fail.
- **Nutrition**: Postoperative nutrition includes ONS from the day of operation in addition to normal food. Malnourished patients should continue ONS at home.
- **Early Mobilisation**: A care plan that facilitates patients being out of bed for 2 h on the day of surgery and 6 h thereafter is recommended.
- **Discharge Criteria**: Good pain control with oral analgesics, taking solid food and no intravenous fluids, independently mobile, willing to go home.
- **Follow-up and audit**: Patients should be contacted 1–2 days after discharge, reviewed clinically at 7–10 days postoperatively and reviewed finally at 30 days postoperatively. Audit of results/endpoint/adverse events and protocol compliance is essential.

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