Fast-track surgery and anaesthesia

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Major surgery induces profound physiological responses; frequent sequelae include pain, nausea, ileus, increased cardiac demands, and impaired pulmonary function. These complications can lead to delayed mobilization, prolonged hospital stay, and significant postoperative complications.

‘Fast-track’ surgery was pioneered by Professor Henrik Kehlet in Denmark in the early 1990s.\(^1,2\) The term refers to a multimodal package of techniques which aim to decrease post-surgical organ dysfunction and complications, and hence to improve postoperative recovery. The centres that have pioneered this approach have achieved impressive reductions in hospital stay and surgical morbidity. The core principles of fast-track surgery (or enhanced recovery) programmes, as applied to major abdominal surgery, are reviewed here.

Preoperative assessment allows estimation of risk and an opportunity to stabilize co-existing disease and optimize organ function before surgery.

Preoperative management

Preoperative assessment

Postoperative organ dysfunction and complications are related to preoperative co-morbidity. Preoperative assessment allows estimation of risk and an opportunity to stabilize co-existing disease and optimize organ function before surgery.

Preoperative assessment also provides an opportunity for patient education. In fast-track programmes, patients are given information about their anticipated postoperative course, analgesia, mobilization programme, and discharge. Several studies have demonstrated that such information can reduce anxiety, analgesic requirements, and length of hospital stay.

Premedication

Consideration should be given to appropriate premedication. In the fast-track surgical setting, premedication is aimed at reducing the surgical stress response. In this respect, there is increasing interest in both \(\alpha_2\)-agonists and \(\beta\)-blockers. \(\beta\)-Blockers suppress the surgically induced increase in circulating catecholamines and can therefore reduce perioperative cardiovascular morbidity. They also have analgesic-sparing and anticalcatabolic properties, which may facilitate recovery from surgery. \(\alpha_2\)-Agonists such as clonidine and dexmedetomidine can have opioid-sparing effects when used as premedication. There is also evidence that they reduce perioperative myocardial ischaemia, intraoperative blood loss, and postoperative nausea and vomiting (PONV). Furthermore, clonidine, when given both i.v. and epidurally, can shorten the duration of ileus and improve pain control after colorectal procedures.\(^3\)

Preoperative hydration status

Traditionally, patients for elective surgery are fasted overnight to reduce aspiration risk, which may lead to significant dehydration. There is evidence that avoidance of preoperative dehydration can reduce postoperative pain and nausea. Clear fluids taken orally up to 2 h before surgery have been shown to have no effect on gastric volume and pH, and therefore no effect on aspiration risk. Clear carbohydrate fluids given before operation may also have a role. They reduce the sensations of thirst and hunger, and in smaller trials have been shown to reduce anxiety levels. There is a reduction in perioperative insulin resistance, and a small reduction in perioperative muscle catabolism. Whether this translates into an effect on length of hospital stay requires further study.

Bowel preparation is traditionally administered to all patients before colorectal surgery. However, a recent meta-analysis has demonstrated that, at least for segmental resections, bowel preparation may not be necessary and can increase perioperative morbidity.

Key points

Enhanced recovery after surgery (fast-track surgery) entails a multidisciplinary approach to perioperative care to permit earlier discharge from hospital.

Patient education and motivation, early feeding and mobilization, and a multimodal analgesic regime are all essential.

A corporate approach should be developed; education of surgical, anaesthetic, nursing, and physiotherapy staff is vital.

A significant reduction in length of hospital stay may be achieved without any increase in perioperative morbidity.
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may increase the risk of septic complications and aggravate preoperative dehydration.4

Intraoperative management

Surgery initiates a complex metabolic, neuroendocrine, and inflammatory stress response, which results in stimulation of the sympathetic nervous system, profound catabolism, and retention of sodium and water. These changes are not beneficial to the patient and indeed most postoperative organ dysfunction and morbidity can be attributed at least in part to the stress response. Intraoperative management is aimed at reducing the stress response to surgery, and facilitating early feeding and mobilization after operation.

Surgical technique

The use of minimally invasive surgical techniques reduces the inflammatory component of the stress response but does not appear to have significant effects on the neuroendocrine and metabolic response. However, minimally invasive surgery is generally associated with reduced pain and shorter hospital stay when compared with open techniques. This difference is most marked where the open procedure requires a long vertical incision. Pain and pulmonary dysfunction are reduced where transverse or oblique incisions are used instead of vertical, presumably due to the reduced number of dermatomes affected.

Minimally invasive surgical approaches may not always be the best technique. When fast-track surgical principles are applied to perioperative care, the differences in median length of hospital stay between minimally invasive and open surgical techniques become less marked. Particularly, in procedures where a long vertical incision is not necessary, such as colonic resection, the advantages of a minimally invasive approach are not clear-cut. Kehlet5 has repeatedly argued that laparoscopic approaches to abdominal surgery need to be evaluated within a fast-track programme to accurately assess their impact on length of stay and postoperative morbidity.

Avoidance of routine nasogastric tubes and drains

Nasogastric tubes have long been part of the routine care of patients after major abdominal surgery. However, there is increasing evidence that, at least for mid-to-lower abdominal procedures, their use is not routinely indicated. Indeed, they may actually hinder recovery by prolonging paralytic ileus and predisposing to pulmonary aspiration.6 Similarly, surgical drains may slow recovery of bowel function and make pain control difficult.

Anaesthetic technique

Anaesthetic technique should be geared towards rapid recovery with minimal carry over of opioid effects into the recovery period. For this reason, short-acting anaesthetic and analgesic agents are ideal. In order to minimize the incidence of PONV, total i.v. anaesthesia (TIVA) is often favoured. In major abdominal surgery, serious consideration should be given to the use of thoracic epidural analgesia. Although there is no definitive evidence that epidural analgesia reduces mortality, it has a number of other significant benefits in this population. In comparison with i.v. opioid-based patient-controlled analgesia regimes, epidural local analgesia better preserves exercise capacity after laparotomy, reduces time to ambulation, provides better static and dynamic pain relief, and reduces postoperative pulmonary complications after upper abdominal procedures. Thoracic epidural analgesia can reduce ileus after colorectal surgery, although not consistently after upper gastrointestinal tract surgery.

There has recently been some debate of the need for routine use of epidurals for major abdominal surgery.7 The MASTER trial8 showed that there was no reduction in mortality after major abdominal surgery in the epidural group (although there was a reduction in the incidence of respiratory failure when compared with i.v. analgesia). However, the MASTER trial did not address the issue of length of hospital stay, and was ambiguous regarding early feeding, early mobilization, and other features of a fast-track programme. If mortality outcomes are not different in fast-track programmes, but median length of stay is reduced by 3 days, our view is that, at a time when healthcare is threatening to consume an ever greater proportion of our national income, a safe technique which reduces length of hospital stay is a priority. This of course brings its own benefits, including a reduction in hospital-acquired infections.9

Fluid management

Ideal perioperative fluid management has been the subject of much debate. 'Liberal' fluid administration can reduce nausea and vomiting, dizziness, drowsiness, thirst, and hospital stay, particularly in minor-to-moderate and ambulatory surgery. However, overhydration can lead to cardiac and pulmonary dysfunction. Excess fluid may also reduce tissue oxygenation leading to impairment of wound healing. Healing of the surgical anastomosis is a particular concern. The salt and water retention induced by the surgical stress response can exacerbate these problems. Conversely, fluid restriction can reduce effective circulating volume and lead to inadequate perfusion of organs.

Preoperative volume status varies greatly, and the magnitude of the surgical insult (and the resulting stress response) can lead to very different fluid requirements. Hence, individually tailored goal-directed fluid therapy would appear to be the optimal approach, the goal being maintenance of tissue perfusion and cellular oxygenation. This strategy is based on the assumption that the optimal blood volume for a given individual is defined by that preload which is required to produce a maximal cardiac output (or stroke volume). Starling’s law of the heart shows that successive fluid challenges (i.e. increasing preload) will increase the stroke volume until a given point (the flat portion of the curve). Beyond this,
further increases in preload will cause a reduction in stroke volume. Therefore, the goal for fluid therapy for an individual would be that point where a fluid challenge no longer produces an increase in stroke volume. Stroke volume can be estimated using a number of non-invasive methods, including oesophageal Doppler and forms of pulse pressure analysis. Typically, successive fluid challenges of 250 ml colloid are given until this no longer produces an increase in stroke volume of at least 10%. This is thought to represent optimal circulating volume. Several recent studies have demonstrated a reduction in morbidity measures, particularly length of stay and duration of ileus by using such an individualized approach. Ultimately, it would be ideal to use a more direct measure of tissue perfusion to guide fluid therapy. Various techniques such as gastric tonometry and near-infrared spectroscopy have been studied, but have not yet been well validated.

Prevention of postoperative nausea and vomiting

Nausea and vomiting is a common complication of anaesthesia and surgery. It causes patient distress and discomfort, and delays resumption of a normal diet. Multimodal strategies to reduce the incidence of PONV include adequate hydration, balanced analgesia to minimize perioperative opioid use, avoidance of volatile anaesthetic agents (although the effect of TIVA wears off after a few hours), avoidance of nitrous oxide, and the administration of different types of antiemetic drugs. In particular, glucocorticoids (e.g. dexamethasone) reduce the risk of nausea and vomiting, have an effect on reducing tissue swelling, and a small analgesic effect.

Temperature control

Prevention of intraoperative hypothermia is important in minimizing the stress response. Hypothermia is associated with increased wound infection, blood loss, and coronary events. Hypothermia also increases patient discomfort. Catecholamines and cortisol are also increased, which can further contribute to the stress response. Forced-air warming devices, warmed i.v. fluids, and warmed humidified gases should be used, and patient temperature should be monitored continuously during surgery.

Postoperative management

Balanced analgesia

Good analgesia is essential for postoperative mobilization and resumption of normal activities. A cornerstone of fast-track surgery programmes is the use of multimodal or balanced analgesia. The principle of this is to gain additive analgesic effects from different modalities of pain control while minimizing side-effects, particularly those of opioids. A recent systematic review of postoperative analgesia concluded that due to the low incidence of complications, there was insufficient evidence to confirm or deny the ability of specific postoperative analgesic techniques to affect major postoperative mortality or morbidity. However, there was consistent evidence that epidural analgesia with local anaesthetics is associated with faster resolution of postoperative ileus after major abdominal surgery. Consideration should be given to a combination of local or regional anaesthetic techniques (including continuous infusion of wounds with local anaesthetic), paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and other agents such as gabapentin, clonidine, and ketamine. By using such an approach, the need for opioids should be reduced; this should minimize their side-effects (e.g. sedation, nausea, ileus, and urinary retention) all of which hamper the aims of early mobilization and enteral nutrition.

If a thoracic epidural is chosen as the main analgesic technique, the appropriate level should be chosen to match the surgical incision. For example, for most colorectal surgery, the level of the incision lies between T8 and T11 dermatomal levels. An epidural sited at T8/9 will spread easily upwards if the drug is injected manually through a syringe. However, once connected to a volumetric pump, the local anaesthetic seeps slowly into the epidural space, and the influence of gravity then becomes important in the postoperative period. With the patient sat up, the block will tend to sink. An epidural sited at a lower thoracic level will thus struggle to cover the upper level of the incision, but the lumbar roots may be persistently blocked, causing lower limb weakness, and impeding mobility.

The importance of acute pain medical and nursing team review cannot be overemphasized. At least twice daily review is needed, as a patchy epidural, or one not covering the wound incision can be improved substantially, or even re-sited. It is crucial to maintain the confidence of the patient in their pain relief if early mobilization is to follow. We establish the block with either bupivacaine 0.5% or in the elderly bupivacaine 0.25%, and then continue the epidural infusion with bupivacaine 0.15% and fentanyl 2 µg ml⁻¹. Once connected, we try at all costs not to disconnect the infusion again, as this increases the risk of infection. Most epidural catheters are removed at 48 h, and all by 72 h. The risk of infection increases substantially if epidural catheters are left >72 h. Pain not covered by the epidural (e.g. shoulder tip pain) is treated with paracetamol or a NSAID. If the epidural does not cover the incision, despite boluses from the pump, and an increase in the rate of infusion, the epidural is either re-sited or a patient-controlled analgesia opioid infusion started.

After epidural removal, the patient takes regular NSAID and paracetamol, with severe breakthrough pain treated with oral morphine or tramadol. Severe pain at 72 h should raise the possibility of intra-abdominal complications, and the patient must be carefully reviewed by the surgical team. Our practice is normally to remove the urinary catheter on the same day as the epidural catheter.

Early enteral nutrition

Oral intake has traditionally been limited in the postoperative period and, when allowed, has involved a gradual progression from liquid to solid food. However, adequate nutrition is important to enhance wound healing, reduce infection, and maintain muscle strength for mobilization and to counter fatigue. Reduced
Postoperative care Multimodal analgesia
Surgery Oblique/transverse wounds
Anaesthesia Air/O₂/TIVA or quick-onset volatile agents
Premedication α₂-agonists β-blockers
Anaesthesia Air/O₂/TIVA or quick-onset volatile agents
Anti-emetics Targeted fluids
Surgery Oblique/transverse wounds
Minimally invasive approach
Minimal drains/no NG tubes
Postoperative care Multimodal analgesia
Acute pain team managing epidural
Early feeding
Early mobilization

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### Table 2 Fast-track programme outcomes (adapted from Kehlet)²

- Decreased ileus duration
- Decreased cardiopulmonary morbidity
- Increased muscle strength and exercise capacity
- Decreased length of hospital stay and reduced hospital costs
- No effect on readmission rate

Nutritional intake contributes to catabolism and muscle wasting. Caution has been exercised with oral feeding after abdominal surgery, particularly in the presence of a surgical bowel anastomosis. However, early enteral nutrition reduces gut permeability when compared with either late enteral feeding or parenteral nutrition. This reduction in gut permeability is thought also to reduce bacterial translocation and hence infection. Several studies have shown that early oral intake is safe even after bowel resection.¹³

Postoperative ileus is common after abdominal surgery. It increases pain and discomfort, hinders mobilization, and delays oral nutritional intake. Strategies to reduce the incidence of ileus include the use of minimally invasive surgical techniques to reduce the stress response and minimizing bowel handling, and also avoidance of the routine use of nasogastric tubes as discussed above.

## Early mobilization

Prolonged bed rest after surgery is undesirable as it increases muscle loss and weakness, predisposes to venous stasis and thromboembolism, and impairs pulmonary function. Ambulation can enhance gut mobility and therefore reduce any ileus. Effective analgesia is vital to allow early mobilization.

## Outcomes and implementation of fast-track programmes

Where fast-track surgical programmes have been pioneered, postoperative inpatient stays have been reduced significantly, down to 2–4 days for resection of the colon. Concerns have been raised that this may have been achieved at the expense of increased readmission rates or an increased burden on community healthcare providers. However, this does not appear to be the case.

Successful implementation of a fast-track surgical programme requires multidisciplinary collaboration between anaesthetists, surgeons, nurses, and physiotherapists. It requires a team approach involving the pre-assessment clinic and clinical nurse specialists and also ward and theatre staff. All staff involved need to understand and be motivated by the principles of the fast-track approach (Table 1). A clear care pathway is vital in setting out expected progression through the perioperative journey and defining clear discharge criteria. Roles of the anaesthetist include: appropriate case selection; type and size of incision; minimizing the use of drains; ensuring drains or catheters used are removed promptly; early feeding; and early mobilization. Roles of the anaesthetist include: the use of an anaesthetic technique with rapid recovery (consideration of TIVA); optimal fluid balance; prevention of PONV; and a balanced analgesic regime ideally including thoracic epidural analgesia for abdominal surgery.

## Conclusion

Fast-track surgical programmes involve implementation of a package of multidisciplinary evidence-based interventions which have the potential for significant reductions in postoperative complications and length of hospital stay (Table 2). Anaesthetists have a key role to play in many of these interventions. There are still areas of uncertainty where best practice remains to be elucidated. These include the role of minimally invasive surgical techniques and the place of epidural analgesia.

### References


Please see multiple choice questions 1–4