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1

Postoperative pain management in the era of ERAS: An overview

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Enhanced recovery after surgery (ERAS) programmes are increasingly becoming standard of care for several surgical procedures. However, compliance with ERAS protocols including pain management protocols remains poor. The PROSPECT (PROcedure-SPEcific Postoperative Pain ManagemenT) collaboration provides evidence-based, procedure-specific pain management recommendations presented as preoperative, intraoperative and postoperative interventions as well as surgical interventions that are easy to access, transparent and relevant to clinicians. This approach should facilitate incorporation of pain management recommendations in an ERAS protocol and improve compliance with the protocols. This article presents an improved approach to developing pain management guidelines as well as a pragmatic approach to procedure-specific perioperative pain management that could be incorporated in an ERAS pathway.

Introduction

Enhanced recovery after surgery (ERAS) programmes are increasingly becoming popular, as they have been shown to reduce perioperative complications and accelerate recovery [1,2]. These procedure-specific pathway guidelines from the ERAS Society include approximately 20–25

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interventions (elements or components) distributed over the preoperative, intraoperative and postoperative period (http://erassociety.org). One of the major elements of an ERAS pathway is provision of dynamic postoperative pain management, as optimal pain management facilitates early postoperative ambulation and rehabilitation, which should reduce hospital length of stay [3,4]. In contrast, higher postoperative pain scores and unacceptable pain are associated with higher incidence of postoperative complications [5]. Furthermore, inadequate postoperative pain relief may have long-term consequences such as increase in readmission rate [6] and development of chronic pain [7].

In this article, we discuss the possible reasons for failure of conventional pain management guidelines in improving postoperative pain relief and the reasons for lack of compliance with pain management within the ERAS programmes. In addition, we present an improved approach to developing pain management guidelines as well as a pragmatic approach to procedure-specific perioperative pain management that could be incorporated in an ERAS pathway.

Failure of conventional pain management guidelines

Despite publication of several comprehensive evidence-based guidelines [8,9], large-scale observational studies and administrative database analysis performed outside the ERAS setting have reported that optimal post-operative pain management remains a challenge [10–12]. One of the reasons for failure of these guidelines to impact day-to-day clinical practice is that the recommendations provided are too broad and generalized. Another reason could be that these recommendations are not procedure-specific probably because they are derived from data pooled from several surgical procedures. Because these conventional guidelines lack a procedure-specific approach, they are not suitable for integration in a procedure-specific ERAS protocol [3,4].

Lack of compliance with pain management recommendations within the ERAS programme

Several studies and systematic reviews assessing implementation of ERAS programmes have reported poor compliance with ERAS protocols including non-compliance with pain management [13]. A large multicentre study evaluating implementation of enhanced recovery after bariatric surgery found that although the overall compliance with ERAS elements was good (i.e. more than 80%), adequate pain management was insufficiently applied [14]. The reasons for the lack of compliance are not precisely known, but it may be because the recommendations are vague and not presented across all the stages of the perioperative period [13,15]. For example, the American College of Surgeons' National Surgical Quality Improvement Program (NSQIP) enhanced recovery protocol for colectomy suggests the use of two or more non-opioid analgesics such as paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), gabapentinoids, ketamine, intravenous lidocaine infusion, thoracic epidural, spinal analgesia, regional blocks and continuous wound infusion with local anaesthetics [13]. Similarly, the guidelines from the ERAS Society and the European Society of Thoracic Surgeons also provide broad recommendations for lung surgery [15]. The lack of guidance presented as preoperative, intraoperative and postoperative analgesic interventions confuses the practicing physicians who may not be able to implement them in day-to-day practice leading to lack of compliance [3,4,16].

Another limitation that may influence compliance is that recommendations do not reflect the rapidly changing clinical practice. Further, the recommendations may be based essentially on the statistical analysis of the available evidence, without critical assessment of the included studies [3,4]. For example, ERAS Society recommendations, which are guidelines for postoperative care in gynaecologic surgery, suggest intrathecal morphine for patients undergoing vaginal hysterectomy, which is increasingly being performed on a day care basis [17]. Thus, a clinician would hesitate using intrathecal morphine due to concerns of side effects (e.g. respiratory, nausea, vomiting and pruritus) that can delay recovery and concern of respiratory depression after discharge at home. Importantly, addition of intrathecal morphine may not be necessary, as adequate pain relief might be achieved with combinations of simple, effective, non-opioid analgesics such as paracetamol and an NSAID or a cyclooxygenase (COX)-2-specific inhibitor, with only a few patients requiring rescue opioids [18]. Similarly, for patients undergoing abdominal hysterectomy, the authors recommend analgesic techniques such as thoracic epidural anaesthesia, spinal anaesthesia with intrathecal morphine, truncal nerve blocks

(transversus abdominis plane [TAP] or ilioinguinal blocks) or continuous wound infiltration of local anaesthetic [17] These recommendations also are vague and do not balance the efficacy of the analgesic technique with potential adverse effects. Most abdominal hysterectomy are being performed using a laparoscopic approach, and adding invasive techniques such as intrathecal opioids may not be beneficial over the analgesic regimen consisting of combinations of paracetamol, NSAID or COX-2-specific inhibitor and port site infiltration [19]. These patients are also commonly discharged home within 24 h postoperatively, and thus, analgesic techniques such as thoracic epidural analgesia and continuous wound infusion of local anaesthetics may not be appropriate.

The updated guidelines for elective colorectal surgery developed by the ERAS Society recommend thoracic epidural analgesia for the open surgical approach and TAP blocks for the minimally invasive approach. In addition, the authors recommend spinal anaesthesia with low-dose opioids as an adjunct to general anaesthesia in laparoscopic surgery. Furthermore, lidocaine infusions are also recommended [20]. Similar to the recommendations for gynaecological surgery, these guidelines also do not take into consideration the balance between efficacy and adverse effects. The recommendations for laparoscopic colorectal surgery developed for the Agency for Healthcare Research and Quality safety programme are also limited due to lack of critical assessment of available evidence [21]. Overall, it is clear from the above-mentioned examples that ERAS recommendations with regard to choice of analgesia have several limitations, which are clinically confusing and clinically inappropriate.

The PROSPECT methodology for guideline development is unique

The PROSPECT (PROcedure-SPEcific Postoperative Pain ManagemenT) collaboration consists of anaesthesiologists and surgeons with broad international representation. The working group provides evidence-based, procedure-specific pain management recommendations presented as preoperative, intraoperative and postoperative interventions as well as surgical interventions that are easy to access (www.postoppain.org), transparent and relevant to clinicians [3,4]. This approach should facilitate incorporation of the pain management recommendations in an ERAS protocol and improve compliance with the protocols.

The PROSPECT methodology for development of recommendations is unique. Although a conventional well-recognized approach to identifying available evidence is used, the included studies undergo critical analysis for relevance to current practice as well as assessed if the analgesic evaluated would improve postoperative pain relief and/or outcome when added to the simple, non-opioid analgesics such as paracetamol and NSAIDs (i.e. 'basic' analgesic regimen) or would be beneficial if the 'basic' analgesic technique is not possible or is contraindicated [16]. In addition, it is determined whether the invasiveness of the analgesic intervention outweighs the degree of pain after the surgical procedure in question. Finally, the balance of benefits and risks of the analgesic intervention is assessed. Because early mobilisation is key to enhanced recovery, any recommendation must consider the effects of an analgesic intervention on ambulation. Thus, any intervention that impedes ambulation (e.g. lumbar epidural analgesia due to postural hypotension or catheters and pumps or lower extremity peripheral nerve blocks that cause quadriceps weakness) should be avoided even though they may provide excellent pain relief. Such a rigorous approach to analysing the available evidence differentiates the PROSPECT methodology from others.

Pragmatic approach to procedure-specific pain management

Preoperative considerations

Preoperative identification of patients at high risk of postoperative pain (i.e. patients who experience pain disproportionate to the surgical insult) improves perioperative pain management, as it allows provision of patient-specific approach. Preoperative predictors of postoperative pain include presence of preoperative pain, preoperative opioid use, previous postoperative pain experience, inappropriate patient expectations, inappropriate anxiety of surgical outcome, psychological factors (e.g. low self-esteem, severe anxiety, major depressive disorder, pain catastrophising or hypervigilance

[i.e. strong attention bias towards pain], functional pain states [e.g. fibromyalgia]) [8,9]. Once identified, the baseline issues should be addressed. For example, patients with psychological disorders could receive coping and cognitive-behavioural therapy (e.g. relaxation, distraction, imaging, virtual reality).

Patients should be educated with regard to the analgesic options for their surgical procedure, and realistic expectations should be set. The aim would be to reduce pain intensity to an acceptable level that would improve functionality and allow ambulation rather than achieve a certain pain score [22]. Patients' preoperative pain should be addressed, and if an analgesic must be discontinued before surgery (e.g. NSAIDs), it should be replaced by another analgesic (e.g. COX-2-specific inhibitor) to maintain adequate pain control.

Analgesic options for preoperative administration include paracetamol, COX-2-specific inhibitors and gabapentinoids (i.e. gabapentin and pregabalin). In addition, regional/local anaesthetic techniques are critical components of an optimal multimodal analgesic approach.

Paracetamol, although considered a weak analgesic, contributes to postoperative analgesia [23,24] and has negligible potential adverse effects with appropriate dosing (i.e. maximum 4 g per day). The potential adverse effects of short-term perioperative use of NSAIDs include increased perioperative bleeding, renal dysfunction and bronchospasm in patients with reactive airway disease, while that for COX-2-specific inhibitors include renal dysfunction. PROSPECT recommends that a combination of paracetamol and NSAIDs or COX-2-specific inhibitors should be administered preoperatively or intraoperatively and continued into the postoperative period, unless contraindicated.

Gabapentinoids are frequently administered preoperatively, as they have been reported to reduce postoperative opioid consumption and pain scores, particularly for surgical procedures with a high propensity of persistent postoperative pain (e.g. cancer surgery, thoracotomy and lower limb total joint arthroplasty) [25,26]. However, recent studies have questioned their analgesic benefits [27,28]. In addition, there are increasing reports of adverse effects such as sedation, dizziness and visual disturbances [29,30]. Thus, gabapentinoids should be used with great caution and at the lowest possible dose. PROSPECT recommendations for gabapentinoids are only for major breast surgery and open prostatectomy. Of note, both these surgical procedures are under review for updates.

Despite the overwhelming evidence of their benefits, the utilization of regional analgesia in day-to-day clinical practice remains limited [11,31]. The role of epidural analgesia is on a decline because it can delay ambulation and discharge home, and an alternative non-opioid analgesic approach can provide similar recovery outcomes [19,32]. Thus, in the era of ERAS programme, epidural analgesia is being replaced with more distal regional analgesia techniques such as fascial plane blocks or surgical site infiltration. Similar to epidural analgesia, intrathecal morphine is inappropriate, especially in ambulatory settings, because of its high risk/benefit ratio based on the increased potential for adverse effects (e.g. nausea, vomiting, pruritus, urinary retention and respiratory depression) and availability of alternative analgesic techniques that can provide similar pain relief as well as similar recovery outcomes [3]. PROSPECT recommends epidural analgesia in high-risk surgical patients undergoing major open thoracic and major open abdominal surgical procedures.

In recent years, fascial plane blocks (e.g. TAP blocks [33], serratus plane block, quadratus lumborum block [34], erector spinae plane block [35,36] and pectoral nerve blocks [37]) are increasingly used for patients undergoing torso surgery (e.g. thoracic surgery, breast surgery, abdominal wall surgery and intra-abdominal surgery), as they avoid the adverse effects of neuraxial blocks (e.g. sympathetic blockade and postural hypotension) as well as can be administered in the presence of prophylaxis for venous thromboembolism. However, they may not be necessary for minimally invasive approaches (e.g. laparoscopic procedures) [19].

The role of peripheral nerve blocks, particularly the lower extremity blocks (e.g. femoral nerve block), is significantly reduced in recent years owing to concerns of delayed recovery [3]. In addition, single-injection peripheral neve blocks are limited by their duration of action and concerns of the abrupt termination of analgesia with rebound pain [38]. Nevertheless, brachial plexus blocks and popliteal sciatic nerve blocks may be appropriate for major upper limb surgery and major foot and ankle surgery, respectively [39,40]. However, every effort must be made to address the rebound pain due to the short duration of single-injection techniques. Continuous peripheral nerve blocks extend the duration of analgesia [41], and their use is limited due to technical challenges and the need for resources.

Surgical site infiltration is a simple and safe technique that is rapidly evolving and growing [42]. Meticulous and extensive infiltration of all layers of the surgical incision with large volumes of local anaesthetic has been shown to be effective in reducing pain and opioid requirements, as well as enhance ambulation. Because of the short duration of single-injection techniques, local anaesthetic infusion *through* catheters placed in the surgical wound has been performed and shown to be effective [43,44]. Intraperitoneal instillation of local anaesthetic could be considered a viable option for early postoperative analgesia in certain laparoscopic operations [45]. PROSPECT recommends surgical site infiltration for most surgical procedures assessed (e.g. laparoscopic surgery [cholecystectomy and sleeve gastrectomy], hernia repair and total knee arthroplasty).

Intraoperative considerations

Several systematic reviews and meta-analyses have revealed that a single intraoperative dose of dexamethasone provides excellent pain relief as well as reduces postoperative nausea and vomiting [3]. Additionally, several large studies have shown that concerns such as hyperglycaemia and delayed wound healing are unfounded [46,47]. Therefore, dexamethasone may be considered as an integral component of multimodal analgesia and antiemetic prophylaxis. However, procedure-specific dose-finding studies are required to provide final recommendations [48].

Opioids are commonly used intraoperatively. However, opioid-related adverse effects (e.g. dizziness, drowsiness, nausea and vomiting, itching, ileus, urinary retention, constipation, respiratory depression, acute tolerance and hyperalgesia [49,50] and dependence) can delay recovery. A recent study found that high intraoperative opioid use influences long-term outcomes (i.e. increases 30-day readmission) [51]. Therefore, it is imperative that anaesthesia practitioners limit the intraoperative opioid dose. In recent years, there is a trend towards eliminating intraoperative opioid use (i.e. opioid-free anaesthesia) [52,53]. In an effort to avoid intraoperative opioids, several analgesic adjuncts are often used either alone or in combination (i.e. ketamine, dexmedetomidine and magnesium). However, opioid-free anaesthesia has thus far not been shown to influence postoperative outcome [54]. Even with complete elimination of intraoperative opioid, avoiding opioids completely in the postoperative period is unrealistic for major surgical procedures [55]. Furthermore, the alternative analgesics are not devoid of adverse effects (e.g. ketamine = hallucinations, nightmares and sleep disturbances; dexmedetomidine = bradycardia, hypotension, excessive sedation, delayed recovery and ambulation; magnesium infusions = potentiation of residual muscle paralysis).

Intraoperative intravenous lidocaine infusion has been shown to reduce postoperative pain and opioid requirements. Several meta-analyses have reported that intravenous lidocaine infusion reduces pain and opioid requirements as well as reduces postoperative ileus, gastrointestinal recovery time and length of hospital stay [3]. Lidocaine infusion appears to have analgesic efficacy comparable with that of epidural analgesia and could be recommended in patients undergoing open abdominal surgery with contraindications to commonly used analgesics (e.g. acetaminophen and NSAIDs) but not laparoscopic procedures.

Postoperative and post-discharge considerations

Opioids remain the on-request mainstay in managing postoperative and post-discharge pain despite concerns of increased postoperative morbidity and mortality from opioid-related adverse events including opioid dependence, contributing to the 'opioid epidemic'. Patients should receive paracetamol and NSAID or COX-2-specific inhibitor as scheduled (i.e. round the clock), unless there are any contraindications and opioids reserved for rescue use. One of the reasons for the opioid epidemic is diversion [56]. Limiting the opioid prescription should reduce the availability of opioids for diversion [18,57].

Summary

Adequate perioperative pain management is imperative for ERAS. The aim of an optimal analgesic technique should be to facilitate early ambulation and physical therapy. Postoperative pain continues

to be poorly managed even within the ERAS setting. The PROSPECT collaboration provides evidence-based clinically relevant procedure-specific pain management guidelines. Even if an analgesic technique provides excellent pain relief, it may not be clinically beneficial if the associated adverse events delay recovery. In this context, more focus in the future should be placed on experiences with fully implemented ERAS programmes such as outpatient hip and knee replacement, colonic, breast cancer, kidney surgery and short-stay video-assisted lung cancer surgery, to name a few.

The ultimate aim is to encourage practitioners to incorporate these recommendations that are relevant to their practice into procedure-specific clinical pathways, which should improve overall postoperative outcomes. Finally, for improved compliance with the ERAS elements, collaboration is necessary between various healthcare providers involved in perioperative patient care (e.g. anaesthesiologists, surgeons, nurses and physiotherapists) as well as involvement of the patient.

Practice points

- Enhanced recovery after surgery (ERAS) programmes are increasingly becoming standard of care for several surgical procedures.
- Optimal pain management guidelines would be evidence-based, procedure-specific recommendations presented as preoperative, intraoperative and postoperative interventions as well as surgical interventions that are easy to access, transparent and relevant to clinicians.
- The aim of an optimal analgesic technique should be to facilitate early ambulation and physical therapy.
- Even if an analgesic technique provides excellent pain relief, it may not be clinically beneficial if the associated adverse events delay recovery.
- Preoperative identification of patients at high risk of postoperative pain allows patient-specific approach to pain management and improves pain relief.
- Patients should be educated with regard to analgesic options, and realistic expectations should be set.
- The aim of an analgesic strategy should be to reduce pain intensity to an acceptable level that would improve functionality and allow ambulation rather than achieve a certain pain score.
- Use of opioids (intraoperative and postoperative) should be reduced by using opioid-sparing analgesic approaches. However, the role of opioid-free anaesthesia remains questionable.
- Combination of paracetamol and an NSAID or COX-2-specific inhibitor should be administered preoperatively or intraoperatively and continued into the postoperative period, unless contraindicated.
- Use of gabapentinoids for surgical pain management remains controversial, and there are concerns of potential adverse effects. Therefore, they should be used with high caution and at the lowest possible dose.
- Local/regional analgesia techniques should be a part of an optimal pain management strategy. Role of neuraxial blocks in the ERAS setting is decreasing owing to concerns of adverse events that might delay ambulation and availability alternative analgesic techniques that can provide similar pain relief as well as similar recovery outcomes. Peripheral regional analgesia techniques such as fascial plane blocks and surgical site infiltration techniques are increasingly becoming popular owing to their high success rate and minimal adverse effects.

Research agenda

- There are several areas where evidence is insufficient including the lack of high-quality procedure and patient-specific evidence regarding efficacy and safety with basic analgesics' integrated into a fully implemented ERAS pathway.
- Most studies of analgesic interventions do not assess their effects on clinically relevant outcome measures, such as pain scores during activity, mobilisation, hospital length of stay and return to activities of daily living.

- It is also necessary to follow up patients for a prolonged period (i.e. 3–6 months) to determine the role of multimodal analgesic techniques in influencing persistent postoperative pain.
- Future studies should assess the effect of incorporating PROSPECT pain management recommendations in fully implemented ERAS pathways in improving compliance with protocols and assessing effects on perioperative outcomes.
- Future ERAS recommendations of analgesic techniques should include data from optimised, fully implemented ERAS programmes often using a simple, pragmatic analgesic approach.
- There is a need to identify optimal analgesic combinations and duration of administration that would provide the optimal balance between improved outcomes and adverse effects.
- Collaboration is necessary among various healthcare providers involved in perioperative patient care (e.g. anaesthesiologists, surgeons, nurses and physiotherapists) as well as involvement of the patient.

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