An Insight about Multimodal Analgesia as Part of Enhanced Recovery after Surgery

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Conflict of interest: None declared.

Funding: No funding sources

Abstract

By enhancing preoperative organ function and reducing the stress response caused by surgical trauma, enhanced recovery after surgery (ERAS) programs aim to achieve and improve quick recovery following surgical procedures, enabling patients to resume their regular activities as soon as possible. The idea of ERAS is put into action by creating and publishing protocols that are based on evidence. Although specifics may differ from one healthcare facility to the next, the preoperative, intraoperative, and postoperative phases are always essential. A patient's quality of life and the speed and severity of their postoperative recovery are both affected by the pain they experience. Thus, ERAS relies heavily on multimodal analgesia (MA) for good postoperative pain management (PPM). Paracetamol, nonsteroid anti-inflammatory medicines (NSAIDs), various adjuvants, regional approaches, and other opioid-sparing treatments are reviewed in this article, which primarily aims to examine the notion of MA in PPM.

Keywords: Multimodal Analgesia, Enhanced Recovery after Surgery

TobRegul Sci. ™ 2023; 9(1): 8473 - 8481

DOI: doi.org/10.18001 /TRS.9.1.599

Introduction

The goal of enhanced recovery after surgery (ERAS) programs is to help patients recover faster from major surgeries by reducing the stress response to trauma and restoring prior organ function [1,2,3,4,5]. Professor Henrik Kehlet of Copenhagen executed his ideas for major reforms to hospital healthcare systems in the 1990s [1]. As a consequence, in 2005, the first evidence-based ERAS procedure for patients having colonic surgery was produced and published by the research group that had been established [1,6]. Based on data from evidence-based studies, the ERAS protocol has been revised and adjusted since its first publication. These trials have covered a wide range of surgical specialties, including colorectal surgery [7], spine surgery [8], gynaecologic surgery [9], radical cystectomy [10], oncology procedures [11], and orthopaedic surgery[12]. Supporting and accelerating the restoration of capabilities that enable patients to get back to normal activities

fast, the ERAS protocol is based on a multimodal approach that involves three basic components: preoperative, intraoperative, and postoperative [1,2]. Patients, surgeons, anesthesiologists, physiotherapists, occupational therapists, and nursing staff must work together as a multidisciplinary team to successfully follow the enhanced recovery protocol (ERP) [2,10]. The aforementioned critical components are still the bedrock of ERPs, even though they differ among healthcare facilities [11]. Despite the fact that medical professionals are aware that good postoperative pain management (PPM) through the use of multimodal analgesia may contribute to faster recovery, better outcomes, and a shorter length of hospital stay (LOHS) following major surgery, this is easier said than done [11,12].

Postoperative Pain Management (PPM)

The duration and severity of postoperative pain (PP) affects patients' ability to recover from surgery and, therefore, their overall well-being [11,12]. Multimodal analgesia (MA) appears to be the best modality for achieving adequate PP control, which is a key component of ERAS [11]. Professional correctness and objectivity are essential for the difficult task of PP assessment [12]. Pre-operative patient education (PPM) is crucial to informing patients about PP control measures before surgical procedures. As a result, you and the patient need to work together to choose the best course of treatment for the pain. Whether it's the visual analogue scale (VAS) or the numerical rating system (NRS) [12], the patient needs to be educated to use the pain assessment tool correctly so that the PPM may be carried out. It is necessary to establish a pain threshold beyond which analgesia or another analgesic approach must be chosen.

Multimodal Analgesia

To effectively reduce PP, it is now necessary to use more than one analgesic modality [11,13]. Improved pain relief and reduced opioid consumption may be achieved with the systemic injection of two or more medications that deliberately block pain perception at several places in the peripheral and central nervous systems to provide analgesia [3,14,15]. To further reduce systemic analgesic doses, regional procedures such as the epidural analgesia, rectus sheath block, paravertebral block, continuous wound infiltration (CWI), or the transversus abdominis plane (TAP) block are also an integral aspect of MA [16,17,18,19,20,21].

MA allows for more effective analgesia with less adverse effects and faster recovery after surgery, both of which may be associated with better outcomes and results [11,12]. Opioid or nonopioid pharmacological treatments, such as nonsteroid anti-inflammatory medications (NSAIDs) with acetaminophen, together with extra regional anesthesia, may be used for postoperative MA. Although the reduction in PP and opioid intake is most noticeable in the first two days following abdominal surgery, there is substantial evidence to justify the use of the TAP block throughout the procedure [22]. Reducing opiate intake and LOHS after laparoscopic colorectal surgery was reported to be possible with the addition of the bilateral TAP block [3]. After orthopaedic procedures, such as arthroscopic, total hip, or knee replacement surgeries, local intra-articular infiltration, or continuous intra-articular infusion through wound catheters, decreases PP and opioid intake and shortens LOHS [3, 15,23,24].

1. Epidural Analgesia (EDA)

For thoraco-abdominal and lower limb surgeries, EDA has been an integral part of most ERAS protocols since the outset [8,24,25,26,27,28,29]. Clinical trials have shown that continuous epidural analgesia (EDA) during open abdominal operations is associated with greater pain alleviation and fewer respiratory system problems than intravenous opioid administration [22]. In colorectal surgery, EDA is associated with a faster recovery from bowel function impairments, less insulin resistance and stress response, and a lower risk of cardiovascular and respiratory problems compared to intravenous patient-controlled analgesia (PCA) [1]. The recovery of bowel function was allegedly improved by thoracic EDA, according to Khan et al. [28].

Nevertheless, the limited study conducted by Hübner et al. [16] indicates that EDA influences hemodynamics and highlights the importance of providing temporary hemodynamic support. As a result of the sympathetic trunk block, this could show up [22]. Epidural haematoma and epidural abscess are also possible, albeit in very small numbers [30, 31, 32, 33]. There has been a worldwide demand for evidence-based alternatives to EDA's PPM approaches that provide similar analgesia without the side effects, and this has led to questions about EDA's place in the ERAS context [32].

2. Non Opioid Systemic Analgesics

Important medication included in ERAS procedures is intravenous lidocaine (IL). It appears that IL is the perfect medicine for pain control because of its analgesic, antihyperalgesic, and anti-inflammatory actions [34]. Patients undergoing abdominal surgery were found to have a shorter duration of ileus, LOHS, nausea, and vomiting when IL was administered during the perioperative period, as well as a significantly lower postoperative pain score and reduced need for postoperative analgesics (McCarthy et al., [35]). According to Naik et al. [34], patients having colorectal surgery can benefit from IL when taken before and after the procedure, following established procedures, which reduces pain scores and the need for opioids.

When given intravenously, ketamine is said to provide analgesic and antihyperalgesic effects. During open cholecystectomy under general anesthesia, Kaur et al. [36] discovered that a low-dose intraoperative infusion of ketamine (0.1 mg/kg/h following bolus 0.2 mg/kg) effectively reduced opioid consumption in the first 24 hours after surgery ($p = 0.001$) and only five patients (12.5%) needed rescue analgesic. The analgesia was effective in the first six hours postoperatively. Nevertheless, ketamine is still a contentious drug because of its side effects; thus, it is crucial to provide the correct dosage.

As an additional tool for postoperative pain management (PPM), gabapentinoids such as pregabalin and gabapentin have been widely utilized in orthopaedics and major gynecological surgeries [37,38,39]. More helpful in lowering PP following spine surgery was a large dose (>900 mg) of gabapentin, according to Peng et al. [40]. Patients given medications from the gabapentinoid class or a placebo reported similar levels of pain following total knee arthroplasty, according to a meta-analysis [37].

3. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) and Paracetamol (Acetaminophen)

In order to suppress the formation of prostaglandins and thromboxanes, NSAIDs competitively block both isoforms of cyclooxygenase (COX-1, COX-2) [41]. Inhibiting COX-2 produces anti-

inflammatory, analgesic, and antipyretic effects; inhibiting COX-1 is associated with an increased risk of postoperative bleeding, gastrointestinal tract ulcers, and renal impairment [42,43]. It is also asserted that NSAIDs have negative side effects and should not be prescribed to people who have both NSAID use and cardiovascular pathology. The risk of cardiovascular events like myocardial infarction (MI) or stroke is raised with long-term, high-dose usage of nonsteroidal anti-inflammatory drugs (NSAIDs) [44,45,46]. When patients with a history of myocardial infarction (MI) were given nonsteroidal anti-inflammatory drugs (NSAIDs), even for brief periods of time, Olsen et al. [47] found an elevated risk of mortality and recurrent MI. However, there is evidence that these analgesics, when administered in the right doses as part of multimodal regimens, can lessen the need for narcotics and their negative side effects [11,12,14,48].

To determine the impact of nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and opioid consumption on postoperative pain (PP), Sharma et al. [49] analyzed twenty-five trials. They stated that most of the trials found that these analgesics decreased morphine intake after surgery and greatly improved PP management in the first two days after surgery.

Arthroscopic knee surgery patients may expect less pain, a shorter LOS, and quicker rehabilitation after receiving NSAIDs in conjunction with local anaesthetic or morphine, according to Amin et al. [50]. This is due to a synergistic action that reduces the inflammatory response caused by surgical trauma. This study examined the intra-articular analgesic effects of ropivacaine and morphine with or without lornoxicam, as well as the requirement for rescue intravenous morphine at rest and during movement, in 45 patients who had undergone anterior cruciate ligament restoration under spinal anesthesia. Patients were able to begin walking sooner following surgical procedures, there was a decrease in opioid consumption, a decrease in the occurrence of side effects, and a notable improvement in pain scores (as measured by VAS and the Western Ontario and McMaster Universities Arthritis Index, or WOMAC) as a result of the addition of lornoxicam. One nonsteroidal anti-inflammatory drug (NSAID) that has been on the market since the 1990s is lornoxicam. It has been compared to narcotics like morphine, pethidine (meperidine), and tramadol in terms of its ability to alleviate postoperative pain (PP) after gynaecological or orthopaedic procedures, and its efficacy after oral surgery is comparable to that of other NSAIDs [50,51,52]. It is more effective than other nonsteroidal anti-inflammatory drugs (NSAIDs), has few adverse effects (particularly when administered intravenously) [50], and, when used with other NSAIDs, may be a safer alternative to opioids for the treatment of moderate to severe pain [51,52].

Some people are worried that nonsteroidal anti-inflammatory drugs (NSAIDs) could cause anastomotic leaks after gastrointestinal surgery [53]. Anastomotic leak was found to be more common in a recent meta-analysis of six RCTs; however, this increase was not statistically significant (Peto odds ratio (OR) 2.16 (95% confidence interval (CI) 0.85-5.53, p = 0.11) [54]. Anastomotic leak risk was marginally elevated in a rat study that examined the impact of Lornoxicam on colonic anastomosis integrity [55]. In the ERAS scenario, brief perioperative NSAID treatment is not discouraged due to the overall lack of conclusive proof [56].

In addition to its efficacy in decreasing mild to moderate pain, acetaminophen is believed to have a very favourable safety profile and very rare adverse effects, such as nausea, vomiting, skin irritation, thrombocytopenia, and enlarged liver [11,14]. Patients undergoing spinal or orthopaedic surgery may also benefit from intravenous paracetamol to lessen postoperative pain,

according to certain writers [12,57]. When used at the recommended dosage and in conjunction with nonsteroidal anti-inflammatory drugs (NSAIDs) or COX-2 inhibitors, its efficacy can be greatly enhanced, according to Rosero and Joshi [14]. For instance, compared to taking either medicine alone, a mixture of single-dose paracetamol (0.5-1 g) and ibuprofen (200-400 mg) following dental surgery significantly reduces postoperative pain [11].

Based on twenty-one clinical trials, Ong et al. [58] compared the effectiveness of paracetamol plus an NSAID to that of either medication alone in different models of acute pain. In 85 percent of the trials, paracetamol alone provided better analgesia than NSAIDs alone, while 64 percent of the studies found the opposite to be true.

According to the systematic Cochrane review [59], the analgesic effect of oral ibuprofen and paracetamol at fixed doses is better than that of each medication alone at the same doses, and the likelihood of needing additional analgesic over eight hours in PPM is reduced when taken together.

According to Nelson et al. [9], unless there is a contraindication, all patients undergoing gynaecologic or cancer surgery should frequently take paracetamol and NSAIDs together. This guideline is based on a high degree of evidence.

4. Opioid Systemic Analgesics

When dealing with moderate to severe pain following surgery, opioids are still the go-to medication [11,12,14]. Nausea, vomiting, urine retention, intestinal blockage, pruritus, and respiratory depression are some of the short-term and long-term side effects that can be associated with dosage [1,11,12,14]. In addition to increasing the likelihood of central and peripheral sensitization as well as the development of abnormally elevated pain sensitivity, long-term opioid use increases the risk of experiencing stronger postoperative pain, increased opioid need, a longer postoperative recovery period, and LOHS, all of which are problems for patients with chronic pain [60,61].

The concept of opioid-free surgery had been introduced and trialed at selected institutions, although overall adoption has been slow and inconsistent. Some proposed indications for opioid-free surgery include obesity, obstructive sleep apnea, chronic obstructive pulmonary disease, complex regional pain syndrome, cancer, and opioid tolerance[62]. Therefore, efforts have been made to improve ERAS protocols' multimodal regimens in order to decrease the demand for opioids and the negative effects associated with them.

Conclusions

Improved and accelerated postoperative healing is the goal of ERAS procedures. Medical professionals have a significant obstacle in achieving this objective, though. One of the main factors influencing postoperative recovery is acute postoperative pain. In order to increase the quality and speed up the convalescence process, it is vital to have effective postoperative pain control. Recent concerns about opioid epidemic and greater awareness of opioid-related adverse events, which could slow down patients' recoveries. As a result, patients report faster recovery and higher levels of satisfaction following surgery when multimodal analgesia, which includes compination of nonopioid analgesic drugs in conjunction with regional nerve blocks or wound infiltration, is used. This approach supposedly offers good postoperative analgesia while reducing the need for opioids.

No Conflict of interest.

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