

Introducing the Enhanced Recovery After Surgery Approach

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Enhanced recovery after surgery (ERAS) is a set of guidelines aimed to standardize perioperative care in an attempt to minimize variability, reduce errors, decrease postoperative pain, decrease length of hospital stay, and save healthcare dollars. ERAS protocols have been formulated for numerous specialties. Initially, ERAS was defined for patients undergoing colonic surgery but have evolved to meet demands of other surgical patients. The ERAS guidelines tie together results and recommendations of high-level literature and over time have gained popularity as results demonstrate clinical outcome advantages. Key perioperative categories that ERAS aim to improve and standardize include prophylactic use against thromboembolic events, postoperative fluid therapy, perioperative nutritional care, prevention of postoperative ileus, postoperative glucose control, and postoperative analgesia management.

Given the current opioid crisis, perioperative pain management practices have recently been more strictly regulated by the Drug Enforcement Administration, insurance companies, and healthcare providers. The use of opioid alternatives is a topic of growing interest. Mitigating the effects of opioid addiction starts with prevention. In an effort to decrease opioid use, the ERAS approach utilizes adjunct medications and a multimodal approach to minimize opioid needs. This area of research is not just clinically significant but crucial for the welfare of society. According to the Centers for Disease Control and Prevention, drug overdose deaths from prescription opioids quadrupled between 1999 and 2014 (1). In 2018, 42,000 deaths were reported to be related to opioid overdoses (2).

Despite the worsening opioid epidemic, opioids are still the most frequently prescribed postoperative medication for the management of pain following orthopedic surgeries. Different patients have various pain tolerances and anticipated pain levels depending on the extent of the surgery. It is ultimately the prescribing physician's responsibility to select the most appropriate drugs, their dose, the quantity prescribed, and to regulate the duration of refills.

Opioid dependence and addiction affect individuals differently and the length of time it takes to become dependent or addicted also differ, but there has been substantial evidence showing that the longer time that individuals take opioids, the greater their risk of developing physical dependence (3). Opioid addiction and physical dependence can lead to worsening substance abuse of

harder drugs such as heroin, exponentially worsening the situation (3).

To minimize opioid demands, ERAS uses adjunct medications and a multi-modal approach. Acetaminophen (Tylenol), gabapentin (Neurontin), celecoxib (Celebrex) and regional nerve blocks have been found to synergistically reduce postoperative pain and thus opioid needs. The regional block provides a pre-analgesic effect and continues to provide anesthesia and control pain for hours following surgery. The 3 adjunct medications have different mechanisms of action to target different intermediate steps along the complex pain pathways, which link the peripheral and central nervous systems (4) (Figure 1).

Several publications have shown that gabapentin, as a solo adjunct, decreases postoperative pain. Gabapentin is a synthetic analogue of γ -amino butyric acid. It reduces neuron excitability and inhibits pain transmission through the spinal cord. A study published in 2015, reported that preoperative gabapentin resulted in opioid and pain reduction 24-hours postoperatively in lower extremity orthopedic surgery (5). Although gabapentin recently has been designated a controlled substance, the risk of abuse and dependency is significantly less compared to opioids (5).

Inflammation plays a necessary role in healing,

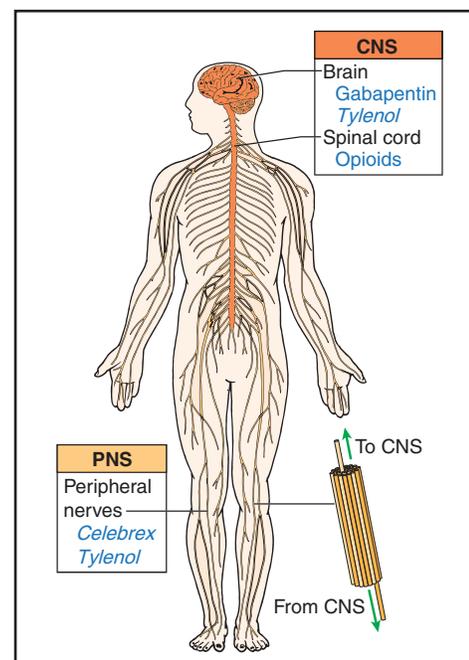


Figure 1. Different mechanisms of action of the three medications.

however, excessive inflammation following surgery is a large contributor to postoperative pain. Inflammation can be controlled with icing and elevating the extremity but even more so via the use of nonsteroidal anti-inflammatory drugs (NSAIDs). NSAIDs inhibit the rate-limiting cyclooxygenase (COX) enzyme in prostaglandin synthesis, which is a major precursor of inflammatory signaling. Although there has historically been some question as to whether NSAIDs influence bone healing, there has been no compelling evidence to substantiate those concerns, especially when considering prescribing only a 3-day oral NSAID course. Celebrex, an NSAID with COX-2 specific inhibition, has been reported to be a reliable NSAID for postoperative pain control (6). A 2017 report demonstrated that preoperative administration of Celebrex significantly improved pain control 12 and 24 hours after surgery (4).

Acetaminophen (Tylenol), is a very weak anti-inflammatory but offers analgesic and anti-pyretic effects. It has also been found beneficial in postoperative pain management. The mechanism of action of acetaminophen is not fully understood but it is believed that it has a central and peripheral site of action. In 2017, Yang reported a significant reduction in pain and opioid usage with the use of intravenous acetaminophen (Ofirmev) after total hip arthroplasty. This significant pain reduction had its effect for 3 days postoperatively, presumably when the pain would be the worst following surgery. The effect of route of administration of acetaminophen (oral versus intravenous) has not been shown to have an impact on efficacy (7), however, oral administration is certainly less expensive. These areas have not been studied specifically following foot and ankle surgery but we assume the conclusions can be generalized to other orthopedic surgeries.

The ERAS protocol also guides peri-operative nutrition supplementation with the use of nutrition shakes, specifically Ensure (Mountain View, CA) at our institution. Traditionally, decreased oral intake prior to surgery, tissue injury during surgery, and pain following surgery result in relative insulin resistance and subsequently a hyperglycemic

sate. Nutritional shakes provide carbohydrate loading and reduce insulin-resistance. In reducing the postoperative hyperglycemic state, there have been reported decreased lengths of hospital stays, fewer wound healing complications, and lower infection rates (8). Reduction in insulin resistance also results in better postoperative pain control (8). Recommendations have differed on the number of shakes preoperatively and postoperatively but a mainstay recommendation is to ingest 1 protein shake 2 hours prior to surgery.

As discussed, the ERAS protocol is not a set of absolute mandates but merely an evidence-based guide that can be customized for each specific patient. There may be contraindications to medications and clinical scenarios where the ERAS approach may not be best. Patients who have a known allergy to any of the adjunct medications should obviously have the protocol altered to avoid that medication. Also, specific considerations must be taken when dealing with pediatric, elderly, or pregnant patients, patients with liver or kidney disease, those with GERD or a history of stomach ulcers, patients with sensory neuropathy, or patients taking non-compatible medications, etc. The effects of ERAS have not been specifically studied in the pain management patient population.

Currently, there are no published ERAS guidelines specific for foot and ankle surgery. Compelled by ERAS outcome studies in other areas of orthopedic surgery, the senior author adopted a modified ERAS protocol and found excellent anecdotal results with decreased pain reported from his surgical patients (Table 1). Many patients who previously had contralateral foot/ankle surgery reported less pain with the ERAS approach. Several patients even called the office for refills of the adjunct medications after they completed the 3-day postoperative adjunct course because they reported that pain increased at postoperative day 4 when the adjunctive medication prescriptions were completed (Table 2).

Patients receive education of the ERAS approach in the office during their surgical consultation. Preoperative medication doses are ordered to be administered by the hospital when the patient is in the preoperative unit. Not all patients elect to purchase the nutritional drinks so this may

Table 1. ERAS guidelines adopted for our foot and ankle surgery patients

Preoperative doses of the following:

- Tylenol 1000 mg PO, given 1 hour prior to surgery
 - Celebrex 200 mg PO, given 1 hour prior to surgery
 - Gabapentin 600 mg PO, given 1 hour prior to surgery
 - Nutritional drinks (Ensure shakes). It is suggested that patients drink 2 nutritional drinks daily for 3 days prior to surgery, one nutritional drink 2 hours prior to surgery and 2 nutritional drinks daily for the 3 days following surgery.
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Table 2. Discharge medication prescriptions

- Acetaminophen 500mg #18, two PO taken every 8 hours x 3 days
 - Celebrex 200mg #6, one PO, taken every 12 hours x 3 days
 - Gabapentin 600mg #6, one PO taken every 12 hours x 3 days
 - Opioid of choice (Oxycodone or Hydrocodone)
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be a limitation. Although we understand the rationale for how nutritional drinks can help our foot and ankle surgery patients, we also realize that the nutrition shakes may also have a greater impact in other surgery patients (colonic surgery, etc.).

Our hospital institution and the anesthesia department broadly utilize the ERAS approach and supports it (including drinking a nutritional shake 2 hours prior to surgery). We have not experienced any anesthesia events or aspiration episodes related to pre-operative shake consumption. A large review study from Brady et al in 2003 assessed 22 randomized control trials and concluded that there was no evidence to suggest shortened fluid fasts result in an increased risk of aspiration (9). This is also our experience.

The authors present this update as an introduction to the ERAS approach, which we believe will be adopted by other podiatric surgeons, providers, and healthcare systems in the future. If the reader approaches this concept with an open mind, we believe the patient outcomes will be convincing enough to adopt this approach and ERAS will continue to benefit our patients, our healthcare systems, and society. Next, the authors will prepare a prospective, randomized clinical study to objectively assess the influence that the ERAS approach has on postoperative pain levels and opioid demands following foot and ankle surgery.

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