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Review of Pain Management in Thoracic Surgery Patients, 2018

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Abstract

Thoracic surgical procedure results in severe pain. The pain presents a unique challenge to surgeons and pain management teams. A variety of techniques have been employed with variable success. Currently, thoracic epidural represents the "gold standard" of pain control. However, problems exist with this approach. Problems include cost, constant management/adjustment and exclusion of certain patients, hypotension, urinary retention and possible hematoma. Liposomal bupivacaine provides a long acting local anesthetic. It provides multiple potential benefits. The benefits include single application, decreased overall cost, no catheter related problems, and limited opioid use. We provide an update on thoracic surgery pain control with an emphasis on new long acting liposomal bupivacaine.

Keywords: Thoracic surgery; Pain management; Liposomal bupivacaine

Introduction

Pain after thoracic surgery is severe. The pain experienced after thoracotomy represents one of the most severe of all surgical procedures. The incision, manipulation of muscles and ligaments, retraction of the ribs with compression, stretching of the intercostal nerves, possible rib fractures, pleural irritation, and postoperative tube thoracostomy contribute to the severity of the pain. Breathing is essential and the constant movement exacerbates the postoperative discomfort. Many strategies have been investigated for pain relief after thoracotomy and thoracoscopy. We wish to review the current management of postoperative analgesia in these patients with an emphasis on reduced cost, early patient mobilization, and reduction of opioid use.

Review

The mainstay of postoperative pain management for many years was the use of patient controlled analgesia with narcotic medications, and use of parenteral or oral anti-inflammatory agents. After chest tubes removal, the patient transitioned to oral medications. Multiple additional pain control adjuncts have been employed with varying degrees of success.

One of the most successful approaches involves the use of thoracic epidural anesthesia. It is regarded by many as the “gold standard” for thoracic pain control and preferred method in many countries [1]. A small catheter is placed into the epidural space using an introducer needle in the patient’s back. Improvement in postoperative pulmonary morbidity and pain scores have been observed [2-4]. The catheter is normally left in place for 3 or 4 days. Epidural catheters require constant attention to catheter placement, pump function, and the amount and composition of the local anesthetics being administered. A percentage of the catheters malfunction and require removal versus replacement [4]. Patients are generally not allowed to bathe or shower until the catheter is removed. Patient concerns include neurologic injury and bleeding around the spinal cord. Hypotension and urinary retention are common side effects. Significant time commitment is required by the nurses and anesthesiologist and often includes a dedicated pain team. The bedside pump attached to the patient, in addition to IV fluids and chest tube drainage system, and epidural infusion system, and indwelling urinary catheter discourage postoperative mobilization.

Variations in surgical technique demonstrated reduced post procedure pain. Muscle sparing incisions, reduction or elimination of rib spreading, avoidance of intercostal nerve compression or retraction improved postoperative pain scores [5]. Minimally invasive techniques, such as video assisted thoracic surgery (VATS), demonstrated improved pain scores, and patients took less pain medication [6,7]. Another study demonstrated shorter hospital stays for VATS [8].

Topical anesthetics, such as Lidoderm patches, are used as adjuncts in thoracotomy patients without specific support in the literature. A recent study demonstrated no difference in neuropathic pain using lidocaine patches in cancer patients [9]. A recent randomized trial in robotic thoracic surgery did not demonstrate any difference in acute pain scores [10].

Cryotherapy, placing a -60C probe against each intercostal nerve for 2 min, along 5 intercostal spaces centered on the incision has been investigated by numerous groups. Although effective for up to 3 weeks, studies showed an increased incidence of chronic neuropathic pain [2,11].

Transcutaneous electrical nerve stimulation may also be effective but is not universally available and is prohibitively expensive. This modality is primarily used for chronic post-thoracotomy pain syndromes.

Continuous infusion of local anesthetics, through intrathoracic fenestrated catheters along both sides of the thoracotomy incision, has been favored by some (On-Q system). This method does provide limited pain relief at the local site of the incision, but does nothing to address the muscular manipulation, rib retraction and pleural irritation. Another novel approach places the catheter in a vertical orientation posteriorly, allowing multiple nerves on the operated side

to be treated with the local anesthetic. The same limitations apply and these catheters represent a second line modality [12].

Another successful approach to manage post-thoracotomy pain involves the intraoperative paraverterbral (sub-pleural and intercostal) administration of long acting local anesthetic agents. The paravertebral blocks are used in combination with patient controlled administration of intravenous opioids and anti-inflammatory medications. The technique proves most helpful in patients who are not candidates for a thoracic epidural: patients undergoing decortication for empyema or another infectious complication and patients on anticoagulation. The blocks generally last 18 to 24 h and are very effective and considered by some equivalent to an epidural in the first 24 h [2,13].

In addition to paravertebral blocks, serratus anterior blocks have been proposed as alternatives to thoracic epidural analgesia. Case reports showed their initial effectiveness to provide anesthesia to the thorax after thoracotomy [14]. The effectiveness was demonstrated in a small randomized control trial comparing serratus anterior block with thoracic epidural analgesia [15]. Pain scores and morphine usage were similar in both groups [15]. Other blocks, such as pectoralis blocks, are predominantly used in breast surgery.

Liposomal Bupivacaine represents a new agent administered either using a transcutaneous or intrathoracic technique. In limited series, it has been shown to produce pain relief similar to the thoracic epidural and better than the shorter acting agents [13,16]. Investigators have demonstrated shortened hospital stay and improved ambulation with Liposomal Bupivicaine versus standard Bupivicaine [17]. It demonstrated decreased postoperative narcotic administration versus thoracic epidural analgesia [18]. Overall in studies it demonstrated less narcotic administration, shorter hospital stays, and better pain scores in the patients receiving Liposomal Bupivacaine (Exparel®) versus thoracic epidural [13].

Exparel®, Liposomal Bupivacaine, presents a novel local anesthetic with prolonged local anesthetic effect for up to 72 h. Standard Bupivacaine or Ropivacaine maintain local anesthetic effects for approximately 18 h. The prolonged duration of effect may offer significant cost benefit compared to thoracic epidural, earlier ambulation, and a reduction of opioid use as compared to the standard local anesthetics [19]. Exparel® is approved for local administration in surgical incisions, however, subpleural paravertebral blocks is an off label application. Many thoracic surgeons are using this medication for paravertebral blocks. Retrospective studies have demonstrated equivalence and in some instance superiority [13]. If used alone, however, many patients experience a period of increased pain approximately 10 h postoperatively before the liposomal agent takes effect. To address this problem, a mixture of liposomal bupivacaine and standard bupivacaine is favored. It has been used in thoracic surgical patients, shoulder surgery patients, joint replacement, abdominal and inguinal operations, breast surgery, and even posterior spinal surgery. There is ever more pressure to have a postoperative pain regimen that limits opioid use. Premedication with acetaminophen 975 mg, gabapentin 300 mg, and celecoxib 200 mg, use of liposomal and regular bupivacaine blocks, then administration of this same oral regimen in a T.I.D scheduled format during the in-patient stay is extremely effective in limiting postoperative opioid use. The administration of acetaminophen in patients with liver disease and celecoxib in patients with renal dysfunction may have to be adjusted or eliminated. A combination of these medications and/or tramadol can be prescribed upon discharge, working toward the elimination of opioid administration.

Conclusion

Thoracic surgical procedures cause significant postoperative pain to patients. Multiple modalities provided variable degrees of success. Thoracic epidural analgesia represents the current gold standard. However, it has limitations. Certain patients with active infection and on anticoagulation are excluded from epidural placement. Hypotension and urinary retention are common side effects. Spinal hematoma embodies a rare but possible catastrophic side effect. A limited but growing body of evidence suggests liposomal bupivacaine (with the addition of regular bupivacaine and a non-narcotic oral pain regimen) is equivalent and possibly superior to thoracic epidural. It does not require a separate pain team or continuous catheter infusion. It can be administered by the surgeon at the time of operation without any discomfort to the patient and limits narcotic use. The absence of an intravenous device for a PCA, or epidural infusion pump, or indwelling urinary catheter permits early ambulation, and bathing.

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