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Case Presentation

Alleviating Thoracotomy Pain With Intercostal Liposomal Bupivacaine: A Case Report

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Abstract

Thoracotomy pain is common after chest surgery and may result from injury to the lung pleura, intercostal muscles, costovertebral joint, or intercostal nerves. Inappropriately controlled postoperative pain can hinder recovery and increase the risk of complications such as infection, atelectasis, blood clots, and development of post-thoracotomy pain syndrome. A number of treatment options for acute pain are available, most of which require systemic medications or indwelling catheters that may be contraindicated in patients on anticoagulants. We present the case of a patient with post-thoracotomy pain that effectively was treated with an ultrasound-guided nerve block with liposomal bupivacaine. The patient experienced pain relief without adverse event. Liposomal bupivacaine may be considered a potential treatment option for patients with severe acute post-thoracotomy pain in whom other modalities have not worked or are contraindicated.

Introduction

Poorly controlled pain after surgery has many implications for patient recovery, including depressed immune function, poor wound healing, and sympathetic activation [1]. After chest surgery, pain may lead to respiratory failure due to splinting, inability to clear secretions resulting in pneumonia, and facilitation of chronic pain such as post-thoracotomy pain syndrome [2]. The pathology of post-thoracotomy pain is multifactorial and includes rib, muscle, and nerve injury with inadequate pain relief during the postoperative period [3]. Appropriate treatment of acute post-thoracotomy pain is therefore critically important to promote mobility, prevent future complications, and improve hospital performance.

There are many methods of controlling pain in the acute postoperative period, including parenteral opioids, patient-controlled analgesia (PCA), patient-controlled epidural analgesia (PCEA), intrapleural analgesia, cryoanalgesia, nerve blocks (single injection or catheter-assisted infiltration), paravertebral blocks, transcutaneous nerve stimulation, and nonsteroidal anti-inflammatory drugs. As such, an individual's pain treatment often reflects the resources available at the facility and the surgeon's preference. At our institution, we performed intercostal nerve blocks because they expose the patient to less risk than neuraxial blocks, especially in the context of ongoing anticoagulation in which hemorrhage can produce significant spinal cord compression.

For this case study, we present a patient who was evaluated by the Inpatient Pain service for severe pain after thoracotomy surgery. Given that the patient was on multiple anticoagulants, neuraxial blockade and indwelling catheters were felt to pose too high a risk for adverse event and the decision was made to trial liposomal bupivacaine. This medication uses liposomes that allow diffusion of bupivacaine over an extended period of time, prolonging the analgesic half-life of the drug.

Case Report

A 66-year-old man with history of left pleural mesothelioma underwent a radical pleurectomy, decortication, and thoracotomy. His intraoperative course was complicated by myocardial infarction; thus, he was started on heparin, aspirin, and clopidogrel by the Cardiology Service. On postoperative day 2, he reported severe incision-related, left-sided chest pain exacerbated by inspiration and coughing despite the appropriate use of intravenous hydromorphone PCA. The dosing of his hydromorphone PCA was not increased

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secondary to concern for decreased ventilation and increased somnolence.

On examination, his incision was found to be located along the seventh intercostal space extending from the mid-axillary line to the tip of the scapula. His surgical procedure had included resection of the seventh rib and placement of multiple chest tubes, likely resulting in damage to the intercostal nerves. In our evaluation, he was found to have pain in a band-like distribution over the left thoracic seventh to 11th dermatomes. Because the pain appeared primarily neuropathic, the goal was to block nerve input at these 5 intercostal levels. Given his current ongoing treatment for myocardial infarction, placement of a thoracic epidural catheter for pain control was contraindicated [4]. Therefore, an intercostal nerve block with liposomal bupivacaine was performed to assist with pain relief and allow for improved respiratory function.

A Fujifilm Sonosite ultrasound (Bothell, WA) with a 13-6 MHz linear array transducer at 10 MHz was used for this procedure. The patient was placed in the prone position with a pillow underneath the chest. The transducer's long axis was placed in the sagittal plane approximately 6 cm lateral to the first vertebral body where the first left rib was identified. Color Doppler was performed with visualization of the intercostal artery and vein. The pleural space was identified as the hypoechoic window deep to the thoracic rib. The transducer was then moved caudally until the left seventh, eighth, ninth, 10th, and 11th thoracic ribs were identified and marked with a marking pen. The transducer subsequently was removed and the left chest wall was prepped and draped in the usual sterile fashion with chlorhexidine gluconate/isopropyl alcohol solution. A sterile cover was then placed over the ultrasound transducer and sterile gel was placed on the skin. Via an in-plane axial approach, 6 cm lateral to the seventh vertebral body on the left posterior chest wall, a 3.5-inch, 22-gauge spinal needle was advanced under direct ultrasonic guidance slightly deep to the inferior border of the thoracic rib. After negative aspiration for heme, 3 mL (39.9 mg) of liposomal bupivacaine was injected with ultrasound visualization. The procedure was repeated for the eighth, ninth, 10th, and 11th thoracic ribs. After the needles were withdrawn, the injection sites were cleaned and bandages were applied.

Before the procedure, the patient's left chest wall pain was assessed at 7 of 10 at rest and 10 of 10 when coughing on the Verbal Numeric Rating Scale. This assessment was taken while the patient was on a hydromorphone PCA, which he was using appropriately but without significant relief. Five minutes after the procedure, his pain was assessed as 0 of 10 at rest and 5 of 10 with coughing. Follow-up evaluation at 24 hours demonstrated 4 of 10 pain on the Verbal Numeric Rating Scale at rest and with coughing. He denied any significant adverse reactions (including nausea, vomiting, pruritus, excessive sedation, or somnolence). At 48 hours, the patient reported sustained pain relief and was able to transition from the Hydromorphone PCA to oral oxycodone and acetaminophen. He demonstrated improved pulmonary toilet and had minimal pain with coughing.

Discussion

Effective pain control after surgery can shorten hospitalization, decrease the need for opioids, and decrease mortality [5]. In relation to thoracotomy surgery, poorly controlled postoperative pain can lead to respiratory failure due to splinting, inability to effectively clear secretions, and facilitation of chronic pain such as in post-thoracotomy pain syndrome.

Despite appropriate titration of hydromorphone PCA, our patient's acute post-thoracotomy pain was controlled poorly. Although bupivacaine HCl intercostal blocks can reduce post-thoracotomy pain, the relatively short duration of action would require repeat blocks needing to be performed. Because the patient's pain was spread across multiple levels, multiple blocks would be required. Consequently, to minimize the risk of adverse events and utilize a medication that provided a long duration of relief we optioned for liposomal bupivacaine.

A standard method to circumvent bupivacaine's short half-life is by placement of an epidural catheter for continuous drug infusion. A chief consideration in this case, however, was the patient's ongoing post−ST-segment elevation myocardial infarction anticoagulation Q3 regimen with intravenous unfractionated heparin and oral clopidogrel. Although interventional forms of anesthetic delivery (eg, perineural catheters) can manage acute thoracotomy pain for extended periods of time, they carry a greater risk of infection, dislodgement, and hemorrhage [6]. The American Society of Regional Anesthesia guidelines state that in neuraxial blockade, combination therapy with unfractionated heparin and antiplatelet agents has demonstrated increased spinal hematomas, bleeding at puncture sites, and other spontaneous hemorrhagic complications [4]. With regard to peripheral nerve blocks, the guidelines conclude that too few studies have examined the frequency and severity of hemorrhagic complications, leaving insufficient evidence for consensus.

Although the majority of liposomal bupivacaine research (and basis for approval from the Food and Drug Administration [FDA]) has been in surgical wound sites (eg, inguinal hernia repair, total knee arthroplasty, breast augmentation), we sought to determine its efficacy for intercostal nerve block. The liposome enables bupivacaine to slowly diffuse, resulting in a bimodal plasma concentration profile with peaks between 0.25 and 2 hours and 12 and 24 hours [7]. A meta-analysis