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Case Report

Compartment syndrome in a patient treated with perineural liposomal bupivacaine (Exparel)

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Abstract Acute compartment syndrome is a condition that may result in sensorimotor deficits and loss of function of the affected limb as a result of ischemic injury. It is considered a surgical emergency and prompt diagnosis and treatment results in more favorable outcomes. The use of regional anesthesia is controversial in patients at risk for compartment syndrome due to concern of its potential to mask symptoms of the condition. A 44-year-old African American male presented to surgery for open reduction and internal fixation of a comminuted distal radius fracture. As part of an off-label, investigator-initiated, and institutional review board–approved study, he received a perineural injection of liposomal bupivacaine (Exparel) around the median, ulnar, and radial nerves at the level of the proximal forearm. The following morning, his initial complaints of numbness and incisional pain progressively evolved into worsening numbness, diffuse discomfort, and pain with passive movement. A diagnosis of compartment syndrome was made and he underwent an emergency fasciotomy. The diagnosis of compartment syndrome requires a high index of suspicion and prompt treatment. This patient's changing pattern of symptoms—rather than his pain complaints alone—resulted in the diagnosis of compartment syndrome treated with emergent fasciotomy in spite of finger numbness that was initially attributed to the liposomal bupivacaine. While the use of liposomal bupivacaine did not preclude the diagnosis of compartment syndrome in our patient, it should be used with caution in patients at risk for compartment syndrome until additional data, particularly regarding block characteristics, are available.

1. Introduction

Acute compartment syndrome is a rare condition associated with serious patient morbidity and its prognosis relies on timely diagnosis and treatment. According to Leversedge et al. (2011), "a compartment syndrome exists when the interstitial tissue pressure within an osteofascial envelope rises to levels that impair cellular function and, when sustained, can lead to irreversible changes in the contents of the compartment. Progressive tissue ischemia occurs when arterial perfusion is diminished because of increasing interstitial tissue pressure that constricts or collapses the arterial inflow. Such a decrease in pressure gradient occurs with an abnormal elevation in intracompartmental tissue pressures (such as from injury), a relative decrease in arterial perfusion pressures, or both" [1]. The use of regional anesthesia in patients at risk for compartment syndrome continues to be a matter of debate, as the current

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literature is conflicted regarding the role of regional anesthesia in this patient population.

Liposomal bupivacaine (Exparel) is a novel formulation of bupivacaine that may provide postoperative analgesia for up to 72 hours via tissue infiltration techniques [2,3]. Its role in patients at risk for compartment syndrome is currently unknown, and because it is not approved for peripheral nerve blockade at this time, data regarding block characteristics are lacking.

We report our experience with a patient who received a peripheral nerve block using liposomal bupivacaine and subsequently developed acute compartment syndrome.

Witnessed verbal consent was obtained from the patient prior to the preparation of this case report. Additionally, the Ochsner Clinic Foundation Institutional Review Board (IRB) determined that IRB approval was not necessary for the formulation and submission of this case report.

2. Case Report

A 44-year-old African American man presented to the Emergency Department (ED) complaining of left wrist pain after falling from the back of a semi-trailer truck. After clinical evaluation and imaging studies, he was diagnosed with a comminuted distal radius fracture. He underwent an uneventful closed fracture reduction in the ED and was subsequently evaluated in the orthopedic clinic. The swelling in his fingertips was appropriate and the patient did not complain of pain disproportionate to his injury. The patient was scheduled for surgery the following day.

Upon arrival in the preoperative area, the patient was examined by the orthopedic service and deemed to be at low risk for compartment syndrome. He reported his pain as severe and various postoperative pain control options were discussed. While he declined a continuous perineural brachial plexus catheter, he expressed interest in participation in a liposomal bupivacaine study currently underway at our institution (ClinicalTrials.gov identifier: NCT02058303). The risks and benefits of the nerve block and the study were discussed in detail and his questions were addressed prior to provision of consent.

He was placed on continuous electrocardiogram, pulse oximetry, and non-invasive blood pressure monitors prior to administration of intravenous sedation and block performance. Per our investigator-initiated, IRB-approved study protocol, 5 mL of undiluted 1.3% liposomal bupivacaine (Exparel, Pacira Pharmaceuticals, Inc, Parsippany, NJ) was injected around the median, ulnar, and radial nerves at the level of the mid to proximal forearm under ultrasound guidance, corresponding to a total of 15 ml (195 mg) of liposomal bupivacaine. In accordance to the study protocol, an ultrasound-guided supraclavicular single-injection block was also performed using 30ml of 1.5% mepivacaine immediately after the liposomal bupivacaine blocks. Sensory blockade was evaluated by a blinded research assistant at 5-minute intervals post block, and was found to have absent sensation to pinprick in the median, ulnar, radial, and musculocutaneous nerve distributions of the hand within 10 minutes.

At the conclusion of the block procedure, the splint was removed and significant swelling at the wrist and distal forearm was immediately observed. The splint was not previously removed to maintain fracture reduction. No swelling was observed at the level of the mid to proximal forearm and his compartments were soft prior to surgery.

In the operating room, examination of the fracture pattern revealed extensive comminution and several fracture lines with intraarticular extension. Two Kirschner wires were used for preliminary fixation of the major fracture fragments and a long volar plate was then applied and secured. Final intraoperative fluoroscopy images revealed good fixation and position of the fracture fragments. The wounds were irrigated, and the skin was closed without difficulty.

At the conclusion of the surgical procedure, the patient's forearm was still significantly edematous although the compartments remained soft. The orthopedic team decided to admit the patient postoperatively for observation and serial compartment checks given the extent of his injury and associated swelling. His postoperative splint was windowed to facilitate compartment checks during the acute postoperative period.

The duration of surgery was approximately 3½ hours and he complained of incisional pain on the lateral aspect of his forearm in the post anesthesia care unit. The arm was covered with a sugartong splint and cast padding, which was windowed generously to facilitate thorough examination of the upper extremity. This allowed access to both the medial and lateral aspects of the forearm to examine both the sensation and swelling of these areas. During Orthopedic evaluation in the post anesthesia care unit, he was able to wiggle his fingers and motor function involving the median, radial, ulnar, and anterior and posterior interosseous nerves appeared grossly intact. He exhibited diminished sensation in the median, ulnar, and radial nerve distributions of the hand and this was attributed to the liposomal bupivacaine block. During surgery, a flexor carpi radialis incision was made in the lateral forearm (commonly used for treatment of distal radius fractures), and he localized his pain to this area at this time. A hydromorphone PCA was initiated and his pain improved. He was serially examined overnight, and no acute changes were found with his compartment checks or his subjective reports.

The following morning, however, he reported increased pain and swelling in the left distal forearm and hand. He complained of worsening paresthesias in the distribution of the median nerve throughout the hand. On examination, his compartments were noted to be taut, and he was unable to move his fingers. Severe pain was elicited with passive movement. A diagnosis of acute compartment syndrome of the left forearm and acute carpal tunnel was made, and he was transported emergently to the operating room for fasciotomy and carpal tunnel release.