CASE REPORT

Safety of Multiple, Simultaneous Continuous Peripheral Nerve Block Catheters in a Patient Receiving Therapeutic Low-Molecular-Weight Heparin

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ABSTRACT

Objective. The application of continuous peripheral nerve block (CPNB) has been an important anesthetic tool in the management of combat soldiers wounded from current conflicts. Placing and maintaining CPNBs becomes a challenge in this patient population due to concomitant prophylactic and therapeutic anticoagulation.

Case Report. A 32-year-old male sustained multiple traumatic injuries from an improvised explosive device, including a right tibial fracture, a left tibial fracture, and a left ulnar fracture. His pain was originally well controlled with a left infraclavicular CPNB (0.2% ropivacaine at 10 mL/h with 3 mL bolus every 20 minutes) and an epidural (0.2% ropivacaine at 10 mL/h with 5 mL bolus every 30 minutes). He subsequently developed a common femoral vein thrombus and was treated with low-molecular-weight heparin. His epidural catheter was discontinued; however, his pain was not well controlled with intravenous and oral pain medication. We elected to place bilateral, tunneled sciatic CPNBs and a left, tunneled femoral CPNB. We started infusions of 0.2% ropivacaine at 10 mL/h in each catheter, in addition to 5 mL every 30 minutes demand dose in each sciatic catheter. The patient’s serum ropivacaine levels were analyzed 24 hours after the start of the infusions and were found to be 5.8 mg/L and <0.1 mg/L for total and free concentrations, respectively.

Conclusions. This case highlights the application of simultaneous CPNB techniques in a patient with multiple extremity injuries receiving anticoagulant therapy.

Key Words. Continuous Peripheral Nerve Block; Anticoagulation; Trauma; Pain Management

Introduction

Casualties from the conflicts in the Middle East often have severe traumatic injuries involving multiple limbs, necessitating frequent operative procedures and innovative pain management techniques. Regional anesthesia, both neuraxial and continuous peripheral nerve blocks (CPNBs), has become an important tool for the surgical and pain managements of these casualties at our institution. Along with this increase in the use of regional anesthesia has been a concomitant increase in the use of low-molecular-weight heparin (LMWH) in the prophylaxis and treatment of thromboembolism and deep venous thrombosis. These patients pose a unique challenge to the introduction,
Continuous Peripheral Nerve Block and Anticoagulation

Case Report

A 32-year-old male (ASA II, 106 kg, 190.5 cm) sustained multiple traumatic injuries from an improvised explosive device, including a right tibial fracture, a left tibial fracture, and a left ulnar fracture. While in Iraq, the patient underwent irrigation and debridement (I&D) of his bilateral lower extremity injuries and had external fixators placed. He also had an I&D of his left upper extremity injury. The patient’s pain was initially treated with a morphine patient-controlled anesthesia (PCA) pump during his air evacuation to a tertiary medical center. The patient was noted to have significant pain in his three injured extremities, with a verbal analog pain score (VAS) of 9/10 (zero = no pain, 10 = worst imaginable pain). The patient was scheduled to have multiple operative procedures on all injured extremities. Initially, a left infraclavicular CPNB and an epidural catheter were placed to facilitate management of both acute surgical and postoperative pain. Both catheters were tunneled, with the expectation of prolonged analgesic therapy. The patient received significant pain relief from these catheters, with an average VAS of 3–4/10, over the following 24 hours. The patient’s family also related to our Acute Pain Team that the patient had become more interactive and appeared less sedated. The patient underwent several surgical procedures on his lower extremities over the subsequent 2 weeks, with good pain relief from the catheters. The infraclavicular catheter was discontinued after 14 days, when the patient no longer required further surgical intervention on that arm. Thirteen days post catheter placement, the patient was found to have a thrombus in his left common femoral vein and was prescribed weight-based therapeutic enoxaparin at 100 mg twice daily. Previously, the patient had been on enoxaparin 40 mg once daily [1,7]. By institutional protocol, based on the ASRA Consensus Conference guidelines, the epidural catheter was discontinued before LMWH was initiated [1]. The patient’s pain management regimen was adjusted to a hydromorphone PCA (0.8 mg with a 6-minute lockout) in addition to oral methadone 10 mg three times daily, gabapentin 1,200 mg three times daily, nortriptyline 50 mg once daily, quetiapine 50 mg once daily, and acetaminophen/oxycodone 325/5 mg every 4–6 hours as needed. Despite this multimodal medication therapy, the patient’s VAS was consistently 8/10. The patient localized his pain mostly to areas in the tibial nerve sensory distribution of his right leg, as well as the tibial nerve and saphenous nerve sensory distribution of his left leg. In an effort to better control the patient’s pain, the Acute Pain Team placed tunneled, bilateral sciatic nerve catheters and a tunneled, left femoral nerve catheter after withholding his LMWH medication for a 24-hour period. All three blocks were performed with neurostimulation without complication as previously described [8]. Infusions of 0.2% ropivacaïne at 10 mL/h were begun in each catheter, with a demand dose of 5 mL every 30 minutes in each sciatic catheter for a total dose of 30 mL/h plus 10 mL every 30 minutes. The patient’s VAS decreased to 3/10 following CPNB catheter placement. The patient was monitored daily for signs of bleeding, changes in neurological function, and trends in hematocrit. The patient’s blood was drawn from a peripheral intravenous line 24 hours after the infusions were started. The plasma was separated and analyzed for ropivacaïne levels. He remained on therapeutic LMWH for the following 2 weeks while the catheters remained in place, without evidence of bleeding complications. When operative procedures were no longer required, the catheters were removed after the LMWH was held.
Discussion

The war-wounded patient population poses a significant challenge to traditional pain management strategies. Many patients suffer from multiple orthopedic injuries amenable to regional anesthesia. Injuries often involve bilateral lower extremities, and neuraxial anesthesia has been an important anesthetic option to facilitate both the acute surgical and postoperative courses. Unfortunately, these multi-trauma injuries also place our patients at higher risk for venous thromboembolism. This has resulted in an increased use of LMWH, both therapeutically and prophylactically, in our patients. The use of neuraxial anesthesia in these patients cannot be supported by available literature. Little information is available regarding the safety of maintaining CPNB catheters in patients on therapeutic LMWH. Several case reports have described hematomas involving lumbar plexus block and prophylactic anticoagulation [9,10].

This case report highlights several challenges faced when treating wounded soldiers with poly-trauma. We are fortunate at our institution to have a dedicated Acute Pain Team with extensive regional anesthesia experience that provides daily acute pain follow-up, enhancing our ability to provide novel pain care options. The management of multiple CPNB catheters can be confusing for both the patient and the nursing staff. Our Acute Pain Team provides extensive education for the patient, the patient’s family, and the nursing staff caring for the patient.

Of particular concern in this patient was the relatively high rate of ropivacaine local anesthetic infusion used. Although we were concerned of the possibility of local anesthetic toxicity in this patient, the availability of our Acute Pain Team and patient education efforts allowed us to manage this risk. The anatomy of the femoral and sciatic areas is relatively less vascular than other sites for regional anesthesia (e.g., intercostal, caudal), which provides an additional margin of safety with regard to the rate of absorption of local anesthetic. Several authors have reported cases of ropivacaine toxicity. Ruetsch and colleagues [11] reported a case of convulsions and cardiac dysrhythmia after a sciatic nerve block. The first measured total and unbound plasma concentration performed 7 minutes after completion of the injection were 3.6 and 0.69 mg/L, respectively. Burm et al. [12] evaluated the pharmacokinetics of ropivacaine administered by 72-hour epidural infusion. They found total plasma concentrations of ropivacaine to increase steadily during the infusion after a constant rate of 10 mL/h of 0.2% (Group 1) and 0.3% (Group 2), but unbound ropivacaine concentrations reached average steady state levels of approximately 0.06 and 0.07 mg/L. Knudsen et al. [13] showed the threshold to be 2.2 (0.5–3.2) mg/L and 0.15 (0.01–0.24) mg/L for total and unbound venous plasma concentrations, respectively, after continuous intravenous infusion.

Much of the current literature focuses on single injection or short term infusions of ropivacaine. Many of our patients are receiving prolonged continuous infusions via CPNBs. Our patient had CPNBs maintained for greater than 2 weeks without signs or symptoms of systemic absorption. The plasma of our patient was analyzed [14], resulting in total and unbound ropivacaine levels of 5.792 mg/L and <0.1 mg/L, respectively. Although not measured, alpha-1-acid glycoprotein is an acute phase reactant and was most likely elevated in this trauma patient. This may partially account for the high total ropivacaine concentration.

Finally, due to experience gained in managing casualties through years of conflict, we have developed institutional observational data and pain management resources to safely support the routine extended use of multiple CPNB catheters during simultaneous LMWH therapy [15]. In contrast to the neuraxial space, the sciatic space is relatively avascular, and concern for hematoma formation while on therapeutic LMWH has not been a major obstacle in our decision to place CPNBs. Our patient’s pain was inadequately controlled with intravenous and oral pain medications. His development of a thrombus and subsequent requirement for high dose LMWH precluded the use of neuraxial analgesia. In this case, multiple CPNB catheters were the most effective option. This technique may not be a viable option in institutions that lack the 24-hour Acute Pain Team services available. Although this case report demonstrates the successful placement and maintenance of multiple CPNBs in a difficult pain management case, unique due to therapeutic anticoagulation, further research is needed to define the risks of multiple peripheral catheter placement concurrent with therapeutic anticoagulation.

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References


