Bilateral infraclavicular brachial plexus nerve blocks in an ambulatory surgery center

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Abstract

The approach for upper extremity surgery brachial plexus blocks depends on the specific nature of the surgery. Interscalene and supraclavicular brachial plexus blocks can cause phrenic nerve palsy. Our aim was to explore the safety of bilateral parasagittal infraclavicular brachial plexus blocks (BPBBs) in an outpatient surgery center. Identical BPBBs were performed in two patients with 20 mL of 0.25% bupivacaine. Neither patient developed respiratory or cardiovascular distress. Brachial plexus blocks on multiple locations are infrequently employed for fear of phrenic nerve paresis. However, given both patients' success, bilateral parasagittal infraclavicular brachial plexus blocks may provide a safe approach.

Keywords: Nerve block, brachial plexus blocks, phrenic nerve, anesthesia, pain

Introduction

The best approach for brachial plexus blocks used for upper extremity surgery depends on the specific nature and location of the surgery. To prevent possible complications, the lowest risk approach is preferred by most clinicians. Interscalene brachial plexus blocks and supraclavicular brachial plexus blocks may result in phrenic nerve palsy, causing some patients to have dyspnea or even respiratory distress. Infraclavicular brachial plexus blocks have been a topic of research and discussion to avoid phrenic nerve paresis. A common approach is the parasagittal infraclavicular brachial plexus block, which is regarded as safer and easier. This article presents two bilateral parasagittal infraclavicular brachial plexus block cases conducted at an outpatient surgery center without intra-operative or post-operative signs of respiratory distress. Ethical approval was waived by the University of South Florida Morsani College of Medicine Institution Review Board; the purpose of this study was educational. Verbal HIPAA consent was obtained by two healthcare professionals, as written consent is not required due to the nature of this study, namely a retrospective chart review of two cases at an ambulatory surgery center. This manuscript adheres to the applicable EQUATOR guideline.

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Cases

Case 1

A 37-year-old man (75 kg, 185 cm), classified as American Society of Anesthesiologists (ASA) physical status 2, was scheduled for bilateral radial head open reduction with internal fixation and a left elbow lateral ulnar collateral ligament (UCL) repair secondary to bilateral radial head displacement and possible left sided type one coronoid fracture and left lateral UCL rupture. His past medical history consisted of a 10.5-pack year smoking history and the presence of a pacemaker placed due to a catheter ablation treatment for his Wolff-Parkinson-White syndrome. Blocks were performed identically on each side of the patient. Four mg of intravenous midazolam was given for sedation. A Pajunk 21-gauge 4-inch needle was used with ultrasound and neurostimulation to perform the

parasagittal infraclavicular block. One cubic centimeter (cc) of 1% lidocaine was injected followed by 20 mL of 0.25% bupivacaine. Ultrasound guidance along with neurostimulation (Pajunk) was used to place the local anesthetic around the axillary artery. Approximately half of it was placed posterior to the artery with the remaining anesthetic placed near the lateral and/or medial cords. He was then given general anesthesia using sevoflurane with a laryngeal mask airway. The duration of the operation was 180 minutes. Post-operatively, the patient had a self-reported pain assessment of 0/10, an oxygen saturation (SpO_2) of 94% with a respiratory rate of 16 breaths per minute, and a regular pulse of 88 beats per minute. He was initially drowsy but in no apparent distress. Prior to discharge, he had an SpO_2 of 96% with a respiratory rate of 16 breaths per minute and a regular pulse of 73 beats per minute.

Case 2

A 68-year-old woman (83 kg, 170 cm), classified as ASA physical status 3, was scheduled for bilateral distal radius fracture open reduction and internal fixation and brachial radialis secondary to bilateral Colles' fractures (Figure 1). Her past medical history included a 13-pack year history of smoking, sleep apnea, radiation treatment for cancer, and obesity. She reported limited ability to perform physical activity but was able to walk up a flight of stairs.

Bilateral infraclavicular blocks were placed identically on each side. The patient was given 6 mg of intravenous midazolam as a premedication. A 21-gauge Pajunk needle was used to perform the parasagittal infraclavicular block along with ultrasound and neurostimulation (Pajunk). One cc of 1% lidocaine was injected followed by 20 mL of 0.25% bupivacaine. Ultrasound guidance was used when performing the block to deposit local anesthetic around the axillary artery. Approximately half of the local anesthetic was placed posterior to the artery with the remaining anesthetic placed near the lateral and/or medial cords. She was then given general anesthesia using sevoflurane with a laryngeal mask airway. The duration of the operation was 100 minutes.

Post-operatively, the patient had a self-reported pain assessment of 0/10 and an SpO_2 of 100% with a respiratory rate of 16 breaths per minute and a regular pulse of 80 beats per minute. She was awake, alert, oriented ×3, comfortable, and in no apparent distress. Prior to discharge she had an SpO_2 of 100% with a respiratory rate of 16 breaths per minute and a regular pulse of 80 beats per minute.

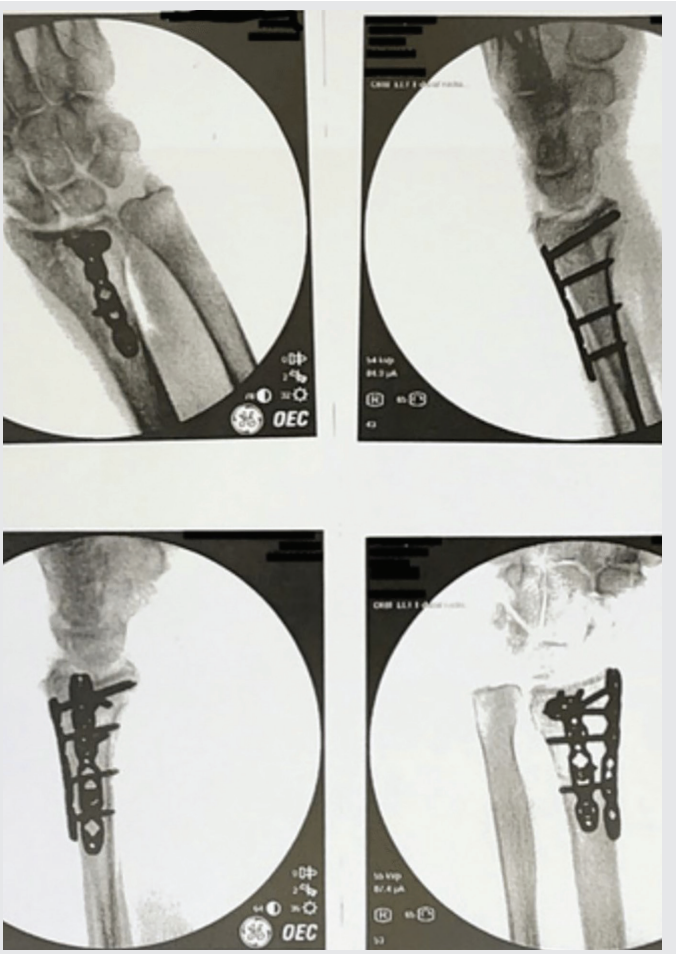

Figure 1. Bilateral distal radius fracture open reduction and internal fixation surgical repair (Case 2).

Discussion

Previously, it was believed that performing a block at multiple locations represented an increased risk of systemic toxicity. This, combined with perceived limited clinical utility and other possible risks, like pneumothorax and phrenic nerve paresis, has led to limited use

of bilateral brachial plexus blocks in clinical practice. One additional risk associated with interscalene, supraclavicular, and infraclavicular brachial plexus blocks is phrenic nerve palsy. This is a common complication with interscalene blocks as there is a reported 100% incidence in such cases.[1] In addition, a 50–67% incidence has been reported with the supraclavicular approach.[1] It is worth noting, however, that recent literature suggests a reduced risk from the supraclavicular approach, which can be seen when ultrasound guidance is effectively used.[2] In theory, the risk of phrenic nerve paresis should be even lower with a parasagittal infraclavicular block; the location of the local anesthetic is anatomically distal to that of the phrenic nerve, so proximal migration of a moderate amount of local anesthetic sufficient to cause phrenic nerve paralysis is unlikely. Moreover, it is suggested that the local anesthesia remains in the infraclavicular fossa with no effect on respiratory function. While current literature supports a lack of diaphragmatic paresis associated with infraclavicular blocks, there are cases of its occurring in clinical practice.[3]

Recent advances in anesthesia have led to an increase in the safety and frequency of bilateral upper extremity blocks, which were previously thought to be too risky. The increased use of ultrasound guidance has reduced the need to rely on consistently reproducible external landmarks, and a reduction in the volume of local anesthesia results in significantly fewer respiratory complications without any measurable change in effectiveness of analgesia. In addition, the concentration of local anesthetic necessary for effective postoperative analgesia can be decreased for most operations, which further improves the safety of the block.[4] This further increase in safety potentially addresses previous concerns in which uncommon anatomical variance can lead to potential risk of ipsilateral diaphragmatic paresis secondary to infraclavicular brachial plexus blocks.[4] Some studies studies show that a reduction of volume and concentration of local anesthetic can reduce the incidence of clinically significant phrenic nerve paresis following an interscalene block.

The absence of intra-operative or post-operative respiratory distress in these cases adds to the evidence of the safety of bilateral parasagittal infraclavicular blocks, even in the setting of pre-existing risk factors, such as an extensive smoking history or a history of sleep apnea. A moderate reduction of local anesthetic volume and concentration may be an important factor for avoiding phrenic nerve paresis when performing parasagittal infraclavicular blocks.

In addition, the lack of reported pain post-operatively demonstrates the efficacy of using 20 mL of 0.25% bupivacaine as a local anesthetic. Higher volumes of local anesthetic, e.g., 40 mLs combined with 0.5% bupivacaine, may cause phrenic nerve paresis in some patients following this type of block.[4] Typically, a high volume of local anesthetic is the most associated factor with clinically significant postoperative dyspnea after an infraclavicular block. No dyspnea related to the anesthesia occurred in either of the cases in this report, nor was there any decrease in oxygen saturation post-operatively or at time of discharge. Of note, an experienced regional anesthesiologist placed the blocks for these patients.

This brief report demonstrates that bilateral parasagittal infraclavicular brachial plexus blocks can be conducted safely, without inducing phrenic nerve paresis, in an outpatient surgery center. The combination of ultrasound guidance, a parasagittal infraclavicular approach, and a reduction in volume and concentration of anesthetic helps reduce any risk. Proper understanding of pharmacokinetics and recent advances in anesthesia are essential for minimizing the risk of brachial plexus blocks.

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