Bilateral Brachial Plexus Block and Avoiding its Complications: A Case Report

Minura Hapugoda[1*], Lewan Priyanjith Kariyawasam[1]

[1]Teaching Hospital Anuradhapura, Sri Lanka

Literature on bilateral brachial plexus blocks is rare as it's seldom performed due to its complications. We present a case of a patient with anticipated difficult airway who underwent bilateral upper limb surgery where brachial plexus blocks were used as the sole mode of anaesthesia. Blocks were performed with plain 0.5% bupivacaine below its maximum safe dose under ultrasound guidance. A good postoperative 24-hour patient satisfaction was noted with no opioid consumption. Potential complications of diaphragmatic paralysis, local anaesthesia systemic toxicity and pneumothorax were mitigated with ultrasound guidance, correct patient selection, while using the knowledge on different types of brachial plexus blocks and local anaesthetic pharmacokinetics.

Key words: Bilateral, brachial plexus block, complications

Introduction

Evidence on the use of bilateral brachial plexus blocks is rare due to many anesthesiologists being reluctant to perform it due to the fear of associated complications. These are diaphragmatic paralysis[1], local anaesthesia systemic toxicity (LAST), pneumothorax[2] and block failure, which can be minimized by using ultrasound guidance, choosing the correct patient and application of local anaesthetic pharmacokinetics. We present a patient who underwent bilateral upper extremity surgery under bilateral brachial plexus block due to anticipated difficult airway and the patient's preference.

Case description

A 21-year-old healthy (American Society of Anesthesiologists (*ASA*) physical status 1 male presented following a fall from a bike with facial trauma resulting in, missing teeth and loose teeth which were replanted and Essig's wiring done to stabilize them, awaiting restorative dentistry. He had right distal humerus fracture and left distal radius fracture which the orthopaedic team planned for open reduction and internal fixation. With his facial trauma leading to orofacial swelling and loose teeth, he had an anticipated difficult airway. Bilateral brachial plexus block was considered appropriate. Patient preferred being awake during surgery and was informed of the procedure and consented for surgery under regional anaesthesia.

He was 180 cm in height and weighed 79 kg (BMI 24.3 Kgm^{-2}). His basic blood investigations, electrocardiogram and chest x-ray were normal. Intravenous access was secured on the left foot. Respiratory examination was normal, mouth opening was two fingers breath and Mallampati airway grade was 3. Pre-operative diaphragmatic excursion was measured using a phased array probe positioned in the subcostal margin in the mid-clavicular line, with the use of M-mode, diaphragmatic excursion in quiet breathing (QB) and deep breathing (DB) (Right QB=2.20cm, Right DB= 6.95cm. Left QB=2.43cm, Left DP=6.80cm). Difficult airway trolly with equipment and drugs was kept ready.

Standard ASA monitors were applied, and supplemental oxygen was provided through nasal cannula. The patient was kept supine comfortably with the head turned away from the surgical site. Under strict aseptic conditions a 50 mm 22-gauge Stimuplex A 30-degree bevel insulated needle was used with a linear array high frequency ultrasound probe.

*Correspondence: Minura Hapugoda
E mail: minura1988@gmail.com

https://orcid.org/0000-0001-6238-7827

Received: 23/05/2021
Accepted: 24/03/2022

DOI: http://doi.org/10.4038/slja.v30i1.8850

Right supraclavicular brachial plexus block (SCB) was performed first with 0.5% bupivacaine 15ml. It was injected with frequent aspirations in between and satisfactory surgical anaesthesia was achieved in 30 minutes. Open reduction of the right distal humerus fracture and internal fixation were done in 2 hours 15 minutes without any complications.

Following which, left axillary brachial plexus block was performed with 15 ml of 0.5% bupivacaine. Satisfactory motor and sensory block were achieved following 30 minutes. Left distal radius fracture open reduction and internal fixation was performed in 1 hour 15 minutes.

No features suggestive of LAST were noted. Patient did not complain of difficulty in breathing or pain and no rescue analgesia was used during surgery. Visual analogue scale (VAS) for pain during surgery was 0.7/10. Post-surgery diaphragmatic excursion was measured in QB and DB (Right QB=1.95cm, Right DB= 6.05cm. Left QB 2.3cm, Left DB= 6.5cm) and no ultrasound evidence of pneumothorax was noted. 24-hour post-operative VAS was 2.3/10 with no opioid analgesics being prescribed. Patient was satisfied with the anaesthetic management and the surgery and was willing to undergo similar type of regional anaesthesia in the future.

Discussion

Brachial plexus block is a useful alternative to general anaesthesia, but its bilateral use is not commonly documented due the potential complications and steps need to be taken to mitigate them.

To reduce the incidence of phrenic nerve block, ultrasound guidance was used, which was found to reduce the rate to nearly 0% [3] from 67% [1] . Phrenic nerve blockade was noted to be volume dependent without any differences in block success using the minimum effective volume (MEV) of the local anaesthetic [4]. Thus, the MEV of local anaesthetic for each block documented in prior research was used. 15ml of 0.5% bupivacaine[5] (7.5ml each at intersection of the first rib and subclavian artery "corner pocket" and neural cluster) was deposited in the SCB. 2- 4 ml of 0.5% bupivacaine was used to around radial, median, musculocutaneous and ulnar nerves each [6] with a total of 15ml for the axillary block. No evidence of phrenic nerve paralysis following axillary block was found in previous reports.

Studies also found diaphragmatic paresis following SCB results in no reduction in pulmonary function tests and healthy subjects were asymptomatic, however it may result in significant pulmonary dysfunction in patients with underlying lung disease [7]. Studies to examine clinical predictors of symptomatic phrenic nerve palsy after brachial plexus block are lacking, thus careful selection of patients is needed.

Incidence of local anaesthetic toxicity can be reduced by calculating the total dose according to ideal body weight and using up to the maximum safe dose for the anaesthetic. We used 150mg of 0.5% bupivacaine compared to the maximum safe dose of 158mg (2mg/kg). Using ultrasound-guided technique facilitates a reduction in the MEV of local anaesthetic. Pacing the procedures adequately apart thus preventing a rapid rise in plasma concentration, frequent aspiration, and visualizing the needle position through ultrasound guidance to prevent inadvertent intravascular injection of local anaesthetic are also useful [8,9]. Ultrasound-guided technique also appears to reduce the risk of pneumothorax following SCB to 0.04% from 6.1% without ultrasound guidance [2].

Conclusion

Bilateral brachial plexus block still remains a controversial issue due to the modest amount of evidence in the form of only case reports. Complications of bilateral diaphragmatic paralysis, LAST, pneumothorax and block failure can be mitigated by ultrasound guidance, choosing the correct patient, and utilizing the appropriate brachial plexus block. Further research on this topic needs to be done to come to a clear consensus. We would like to present this clinical experience where two regional blocks were combined successfully while mitigating these complications.

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