Anesth Pain Med. 2015 December; 5(6): e24025. doi: 10.5812/aapm.24025

Published online 2015 November 30. **Case Report**

Above Elbow Amputation Under Brachial Plexus Block at Supraclavicular and Interscalene Levels

Hassan Ahmad,[1,*] Manjula Yadagiri,[1] Duncan Macrosson,[1] and Amer Majeed[2]

[1]Pennine Acute Hospitals NHS Trust, Oldham, UK
[2]Tameside Hospital, Ashton-Under-Lyne, UK

*Corresponding author: Hassan Ahmad, Pennine Acute Hospitals NHS Trust, Oldham, UK. Tel: +44-7886556220, E-mail: drhassaan@gmail.com

Received 2015 June 21; **Revised** 2015 July 29; **Accepted** 2015 August 12.

Abstract

Introduction: The brachial plexus block is a commonly performed procedure in the anesthetic practice today. It is performed for analgesia as well as anesthesia for upper limb procedures. It has been used for amputation and replantation surgeries of the upper limb.
Case presentation: We present the case of a 68-year-old gentleman who had brachial plexus block at supraclavicular and interscalene levels as the sole anesthetic for undergoing above elbow amputation. He was deemed to be very high risk for a general anesthetic as he suffered from severe chronic obstructive pulmonary disease (COPD) and a very poor exercise tolerance (NYHA Class III). The supraclavicular brachial plexus block was supplemented with an interscalene brachial plexus block due to inadequate surgical anesthesia encountered with the former. The procedure was successfully completed under regional anesthesia.
Conclusions: The brachial plexus block can be performed at different levels in the same patient to achieve desired results, while employing sound anatomical knowledge and adhering to the maximum safe dose limit of the local anesthetic.

Keywords: Brachial, Plexus, Anatomy, Limit

1. Introduction

The brachial plexus block is a routinely performed procedure in the anesthetic practice today. It is one of the essential competencies to be gained by the anesthetic trainees in the UK as per the Royal College of Anesthetists (RCOA) curriculum (1). It is commonly performed with the use of ultrasound and a nerve stimulator. It is widely used for achieving perioperative anesthesia and analgesia for the operations performed on the upper limb as a sole technique or in combination with sedation or general anesthetic.

It can also be used as analgesia for phantom upper limb pain, upper limb digital amputation (2), traumatic upper limb amputations (3-5), chronic cancer pain of the upper limb (6), and replantation surgery of the upper limb (7, 8). It can be used as a single shot injection or as a continuous infusion for analgesia (1, 2). It has been successfully used as the sole anesthetic for upper limb amputations and revision amputations in Haiti earthquake victims (9).

2. Case Presentation

We would like to present the case of a 68-year-old gentleman who had a brachial plexus block performed at two levels as the sole anesthetic to undergo an above elbow amputation. He was a frail gentleman and suffered from severe COPD and peripheral vascular disease. He presented with a severely ischemic left forearm at the Royal Albert Edward Infirmary, Wigan, UK. He previously had an axillo-femoral bypass for the affected upper limb which failed followed by a subclavian artery stent insertion which blocked subsequently. He was consented him for a left above elbow amputation by the vascular surgeons as his forearm ischemia was rapidly worsening. He had severe ischemic pain in his left forearm, which was controlled with a supraclavicular brachial plexus block the night before his operation.

His forced expiratory volume in 1 second (FEV1) was measured as 1.6 liters and his echocardiogram showed moderate left ventricular dysfunction. General anesthesia deemed to carry a very high risk of cardio-pulmonary complications. Therefore, it was planned to perform this procedure under regional anesthesia as the sole anesthetic technique after obtaining patient's consent. He was very restless due to the severe pain in his left hand and forearm and was not very cooperative.

The initial plan was to perform an axillary brachial plexus block to control his severe ischemic forearm pain but the axillary block could not be performed as he could not position his arm due to the severity of the pain. Therefore, the supraclavicular brachial plexus was technically easier to perform in this case and was performed using

20 mls of 0.375% bupivacaine under ultrasound guidance to control his pain and to perform surgery if the block proved adequate. The block was tested to cold and pinprick prior to the surgery but only provided adequate surgical anesthesia in the forearm up till the level of elbow, not above it.

We assumed that the block had been inadequate most probably due to technical difficulty to perform the block as the patient had not been able to lie still owing to the severe pain below his elbow. Having waiting for forty minutes after performing supraclavicular brachial plexus block, it was eventually decided to perform the rescue interscalene brachial plexus block. We were aware of the fact that performing an interscalene block could cause postoperative respiratory complications as the patient had severe COPD. However, as general anesthesia was considered to carry a very high risk, we decided to perform a supplementary low volume interscalene block using 7 mls of 0.375% bupivacaine under ultrasound guidance and nerve stimulation. The patient, thus eventually had adequate surgical anesthesia using the combined supraclavicular and interscalene approaches. He was cooperative throughout the surgical procedure and had the above elbow amputation completed successfully and uneventfully. He was pain free in the recovery and did not suffer from any postoperative respiratory complications.

3. Discussion

The brachial plexus block is a very useful adjunct for upper limb surgeries. It provides a favorable alternative to other anesthetic techniques, particularly when general anesthesia is considered to carry a very high risk. It may become important where general anesthesia is deemed unsuitable. Similarly, regional anesthesia is also a good option in those cases where extreme hemodynamic compromise is expected. Advantages of regional anesthesia include a relative lack of hemodynamic side effects (9), reduced incidence of PONV and thromboembolism, early mobility, good post-operative analgesia, and assistance in physiotherapy. Regional anesthesia is especially important for diabetic patients who can resume their normal treatment regime more quickly as compared to general anesthesia. Also, regional anesthesia is associated with a favorable risk profile when serum electrolytes levels and coagulation status are unknown but disturbances are highly expected (9). Likewise, regional anesthesia takes a very crucial rule for providing surgical anesthesia in remote locations with minimum facilities such as a lack of oxygen supply, medication, and equipment including ventilators and sophisticated monitoring.

The supraclavicular nerve block is ideal for procedures of the upper arm, from the mid-humeral level down to the hand. The brachial plexus is most compact at the level of the trunks formed by the C5-T1 nerve roots, so blockade here has the greatest likelihood of blocking all of the branches of the brachial plexus. This results in rapid onset times and, ultimately, high success rates for surgery and analgesia of the upper extremity (excluding the shoulder). This block can be performed using anatomical landmarks (with the use of a nerve stimulator) or ultrasound (with or without the use of nerve stimulator). The volume of local anesthetic used depends on the concentration of local anesthetic and the weight of the patient but typically a volume of 20 to 25 mls of 0.5% bupivacaine or 0.75% ropivacaine is used. Major side effects include diaphragmatic hemiparesis due to phrenic nerve block which occurs in about half of patients and pneumothorax which occurs in about 1 - 4% of the patients with the landmark technique. Ultrasound guidance allows the operator to visualize the first rib and the pleura, thereby helping to ensure that the needle does not puncture the pleura; this presumably reduces the risk of pneumothorax (10).

The interscalene block is performed by injecting local anesthetic to the nerves of the brachial plexus as it passes through the groove between the anterior and middle scalene muscles, at the level of the cricoid cartilage. This block is particularly useful in providing anesthesia and postoperative analgesia for surgery to the clavicle and shoulder. However, the 100% incidence of phrenic nerve block limits the use of an interscalane brachial plexus block in patients with limited pulmonary reserve (11). In certain patients with severe COPD, this can result in respiratory failure which might require tracheal intubation and mechanical ventilation (12). The volume of local anesthetic used for an interscalene block usually varies from 5 to 20 mls. However Riazi S et al. (11), have shown that use of low volume ultrasound guided interscalene brachial plexus block is associated with fewer respiratory complications as compared to large volume technique. We still have to be cautious even with the use of a low volume technique for an interscalene block especially in patients with low pulmonary reserve. Another significant side effect of an interscalene block is the Horner's syndrome which also occurs in 100% of the patients due to ipsilateral paralysis of sympathetic cervical chain (stellate ganglion) (13).

Adequate knowledge of the anatomy of the brachial plexus is essential to perform a brachial plexus block with or without the use of ultrasound. An important aspect to note whilst performing peripheral nerve blocks is to be careful in calculating the actual dose of the local anesthetic to be injected, in order not to exceed the maximum safe dose of the local anesthetic which is different for different local anesthetic drugs.

Regional anesthesia provided favorable conditions for this patient who was deemed to be very high risk to undergo general anesthesia. Performing a brachial plexus block in this patient proved to be difficult because he was unable to position himself appropriately and lie still due to the severe ischemic pain in his forearm. It proved useful to avoid the use of a very high volume of local anesthetic for a supraclavicular block (20 mls used in this

case) as this allowed us to use further dose of local anesthetic if required and hence, a low volume interscalene block (7 mls used in this case) was performed after an inadequate supraclavicular block. Using a low volume for an interscalene block therefore proved useful for this patient and he did not suffer from any postoperative respiratory complications.

We conclude that it is possible to perform a brachial plexus block at more than one level to achieve the desired level of anesthesia provided the maximum safe dose of local anesthetic is not exceeded.

Footnote

Authors' Contribution: Manjula Yadagiri was the senior anaesthetist who managed this case, did literature search, and reviewed the manuscript. Hassan Ahmad was the junior anaesthetist involved in this case, wrote the manuscript and submitted it online. Duncan Macrosson reviewed, the manuscript and corrected grammatical mistakes. Amer Majeed reviewed the manuscript as a whole at the end before re-submission.

References

1. The Royal College of Anaesthetists. *Certificate of Completion of Training in Anesthetics - Higher Level Training*. 2010. Available from: http://www.rcoa.ac.uk/training-and-the-training-programme/the-stages-of-training.
2. Abd-Elsayed AA, Seif J, Guirguis M, Zaky S, Mounir-Soliman L. Bilateral Brachial Plexus Home Going Catheters After Digital Amputation for Patient With Upper Extremity Digital Gangrene. *J clin med res.* 2011;**3**(6):325. [PubMed: 22393345]
3. Meola S, Olivieri M, Mirabile C, Mastrandrea P. Anesthetic management for right upper extremity amputation due to recidivous cutaneous carcinoma and acute postoperative pain control in patients affected by epidermolysis bullosa. *Minerva Anestesiol.* 2010;**76**(2):144–7. [PubMed: 20150856]
4. Mislovic B. Multimodal analgesia including infraclavicular block in perioperative management of upper extremity amputation in neonate. *Paediatr Anaesth.* 2011;**21**(12):1272–3. doi: 10.1111/j.1460-9592.2011.03675.x. [PubMed: 22023423]
5. Granville-Chapman J, Tennant M, Aldington D, Smith SR, Nott DM. Direct placement of a brachial plexus neural catheter for analgesia after traumatic upper limb amputation. *Pain Med.* 2009;**10**(6):1132–5. doi: 10.1111/j.1526-4637.2009.00638.x. [PubMed: 19496958]
6. Theodorou E, Tsiaka K, Vretzakis G, Stamatiou G. Peripheral nerve blockade for chronic cancer pain. *Regional Anesthesia and Pain Medicine.* 2010;**35**(5):e183–e4.
7. Matsuda M, Kato N, Hosoi M. Continuous brachial plexus block for replantation in the upper extremity. *Hand.* 1982;**14**(2):129–34. [PubMed: 7117925]
8. Fang XH. Regional anesthesia for microsurgery in China: a review. *Reg Anesth.* 1989;**14**(2):55–7. [PubMed: 2487664]
9. Gebhard RE, Visan A, Maga G, Frohock J, Missair A. Peripheral nerve blocks for surgical anesthesia in Haiti earthquale victims. *Regional Anesthesia and Pain Medicine.* 2010;**35**(5):1098–7339.
10. Tran QH, Clemente A, Doan J, Finlayson RJ. Brachial plexus blocks: a review of approaches and techniques. *Can J Anaesth.* 2007;**54**(8):662–74. [PubMed: 17666721]
11. Riazi S, Carmichael N, Awad I, Holtby RM, McCartney CJ. Effect of local anaesthetic volume (20 vs 5 ml) on the efficacy and respiratory consequences of ultrasound-guided interscalene brachial plexus block. *Br J Anaesth.* 2008;**101**(4):549–56. doi: 10.1093/bja/aen229. [PubMed: 18682410]
12. Urmey W. Pulmonary complications. In: Neal JM, Rathmell J, editors. *Complications in regional anesthesia and pain medicine*. Philadelphia: Saunders Elsevier; 2006. pp. 147–56.
13. Walid T, Mondher BA, Mohamed Anis L, Mustapha F. A Case of Horner's Syndrome following Ultrasound-Guided Infraclavicular Brachial Plexus Block. *Case Rep Anesthesiol.* 2012;**2012**:125346. doi: 10.1155/2012/125346. [PubMed: 22957277]