ABSTRACT

The vertical infraclavicular block (VIB) of the brachial plexus is commonly used to provide local anesthesia (LA) of the upper limb. The original method involves LA injection at the mid-point of an infraclavicular line between acromion and jugular fossa. However, this method is ineffective in adult patients with variant anatomy. Two modified VIB methods have been previously suggested. This prospective observational, clinical study compared both modified VIB approaches. The study showed that modified VIB is easy, efficacious, and applicable to all adult patients; including those with small stature, extreme tallness, or variant anatomy.

Key words: Brachial plexus block; clinical efficacy; variant anatomy; vertical infraclavicular block

Introduction

The vertical infraclavicular block (VIB) of the brachial plexus is commonly used to provide local anesthesia (LA) or analgesia of the upper limb; because it is relatively simple, reliable, and safe. It has clearly defined anatomic landmarks and low risk of complications. The original method involved LA injection at the mid-point of an infraclavicular line between the acromion and jugular fossa. However, this method was problematic in adult patients with small stature, extreme tallness, or variant anatomy. A modern ultrasonographic study, by Greher et al. suggested a modified method. It showed 22 cm as the optimal length from acromion to jugular fossa; that patients with shorter length <22 cm required the injection point to be moved 0.2 cm laterally for each 1 cm below 22 cm; and patients with longer length >22 cm required the injection point to be moved 0.2 cm medially for each 1 cm above 22 cm. Another modern study by Neuburger et al. suggested a modified method. It showed 20 cm as the optimal length from acromion to jugular fossa; and that patients with shorter length <20 cm required the injection point to be moved 0.3 cm laterally for each 1 cm below 20 cm. These modified methods have never been compared or evaluated further. The current study compared the efficacy and outcome of both modified VIB methods.

Case Report

This prospective, observational case series was approved and conducted at Central Manchester University Hospital, Manchester, UK; from February 2010 to January 2013. The study included 84 consenting, consecutive adult patients who underwent infraglenoid upper limb surgery, under modified VIB. Alternate patients underwent an alternate modified VIB method. VIB was performed aseptically, using 22G needle and injection of 30 ml of 0.5% bupivacaine. VIB was guided by nerve stimulation at current of 0.3–0.4 mA, and the desired...
neuromuscular response was hand contractions. Intraoperative monitoring included pulse oximetry, electrocardiography, noninvasive blood pressure, and capnography. Data collection included patient's gender, age, body mass index (BMI), surgery type, infraclavicular length from acromion to jugular fossa, the difference between infraclavicular length and optimal length, adjustment for injection point, number of VIB attempts, stimulated neuromuscular response (biceps or hand contractions), complications, and VIB efficacy.

The surgeons were blinded to the modified VIB methods used. They graded VIB efficacy as follows: 1 = effective VIB that did not require any supplement; 2 = partly effective VIB that required supplement LA infiltration or sedation; 3 = ineffective VIB that required general anesthesia. Data were analyzed with IBM® SPSS® Statistics 23 (IBM, Armonk, NY, USA); using Student’s t-test and Pearson Chi-square test. P <0.05 was considered statistically significant.

The patients in both treatment groups were evenly matched for BMI, age, and gender. Of the 84 patients, 42 (50%) underwent the Greher method, and 42 (50%) underwent the Neuburger method. They were 52.4% male and 47.6% female. Infraclavicular length in males was 16–21 cm (mean 18 ± 2 cm); and 15–20 cm (mean 17 ± 1.5 cm) in females (P = 0.03). With the Greher method, the difference in patients’ infraclavicular length from optimal length was 1–6 cm (mean 3.5 cm) for males; and 2–7 cm (mean 5 cm) for females (P = 0.01). With the Neuburger method, difference in patients’ infraclavicular length from optimal length was 1–4 cm (mean 1.7 cm) for males; and 0–5 cm (mean 3 cm) for females (P = 0.04). With the Greher method, lateral adjustment of injection point was by a mean of 0.7 cm in males; and 1 cm in females (P = 0.001). With the Neuburger method, lateral adjustment of injection point was by a mean of 0.5 cm in males; and 0.9 cm in females (P = 0.01). VIB attempts before successful neuromuscular response was 1–2 (mean 1.1) with the Greher method; and 1–3 (mean 1.6) with the Neuburger method (P = 0.001). Stimulated neuromuscular response was hand contractions in 81% of Greher approaches and 45% of Neuburger approaches (P = 0.001). With the Greher method, VIB efficacy was Grade 1 in 81% and Grade 2 in 19%; but with the Neuburger method, efficacy was Grade 1 in 59.5%, Grade 2 in 35.7%, and Grade 3 in 4.8% (P = 0.01). Surgery duration range was 50–99 min (mean 70 ± 22 min). There were no surgical, perioperative, or VIB complications.

Discussion

This study confirms that the modified Greher and Neuberger VIB methods are relatively easy and effective. The study showed that single injection of LA, using both modified VIB methods, produces efficacious nerve block. This avoids the use of multiple or dual injection infraclavicular block; a method that may be less favorable and also associated with more risks.[2,3] However, the study also shows that the Greher approach is significantly easier and more effective, compared to the Neuburger approach. The technicality of the Greher approach makes it applicable to a wider population of patients, including those with extreme tallness or extremely broad shoulders; in whom the classic or original VIB approach would have been less appropriate, ineffective or less accurate.

VIB may be occasionally complicated by pneumothorax, phrenic nerve palsy, neuropathy, systemic LA toxicity, and vascular puncture.[6,7] However, the current study found both modified VIB methods to be safe, and none of the patients had perioperative or VIB complications. This indicates that lateral adjustment of the injection point in modified VIB technique may reduce the risk of associated complications.[3,4] Ultrasound guidance may further enhance the safety and efficacy of modified VIB and should be encouraged in clinical practice.[7,8]

Conclusion

Modified VIB is an uncomplicated and efficacious brachial plexus block that is applicable to all adult patients, especially those with small stature, extreme tallness, or variant anatomy. The clinical teaching and practice of modified VIB should be encouraged. This study highlights the ease, efficacy, and applicability of modified VIB in clinical practice. Larger and randomized comparative clinical studies may be useful.

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Conflicts of interest
There are no conflicts of interest.

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