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Research Article

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Combined Suprascapular/ Supraclavicular versus Interscalene Ultrasound Guided Nerve Blocks for Shoulder Arthroscopy

Adel Mikhail Fahmy[1]* and Karim Youssef Kamal Hakim[1]

Abstract

Background: Shoulder arthroscopy has been performed as a diagnostic tool and also as a therapeutic maneuver. Interscalene approach to the brachial plexus is the most suitable block for shoulder arthroscopy. It has a lot of complications like inadvertent epidural or intrathecal injection, vertebral artery injection, recurrent laryngeal nerve block and phrenic nerve block that may need mechanical ventilation especially in patients with respiratory compromise. Ultrasound-guided supraclavicular block was reported to be safe for shoulder arthroscopy. This approach when used for shoulder surgeries by injecting the usual volumes of local anesthetic solutions; may be unsatisfactory, so this block is augmented by block of the suprascapular nerve by ultrasound guidance. The aim of this study is to compare between the combination of ultrasound-guided suprascapular and supraclavicular nerves block versus ultrasound-guided interscalene brachial plexus block for shoulder arthroscopy as regards the efficacy of the block and the incidence of complications.

Methods: 60 patients ASA physical status I–II patients were scheduled to undergo elective shoulder arthroscopic surgery. Patients were randomly assigned to one of two groups using a computer-generated table. Group **A** patients received a combination of ultrasound-guided suprascapular and supraclavicular nerves block. Group **B** patients received ultrasound-guided interscalene nerves block. In all patients, ultrasound-guided nerve blocks were performed by using a high frequency (10-15 MHz) linear probe, sterilization of the area of skin, sterile gel for the probe and a 22-gauge spinal needle for injecting the local anesthetic solution which was a 0.25% bupivacaine solution. Success of the block and additional analgesic requirements (fentanyl increments of 50μg) were recorded. If the block was failed general anesthesia was given. Any complication such as hoarseness of voice, pneumothorax, phrenic nerve affection (diagnosed by reversible shortness of breath starting within 30 minutes after injection with normal chest x-ray to exclude pneumothorax) or any other complications were recorded. Postoperative visual analogue score for pain was recorded every 4 hours for the first 24 hours. The time of first analgesic dose and total analgesics administered was recorded in the two study groups.

Results: Comparison between the two study groups as regards the success rate of the ultrasound-guided block to perform shoulder arthroscopy was statistically non-significant (90% in group A versus 93.3% in group B). The mean total intraoperative fentanyl administration was found to be non-significantly higher in group A (76.8 ± 10.7 μg) than in group B (65.9 ± 13.1 μg). There were no complications due to the block in group A patients. In group B patients, 5 out of 30 patients developed hoarseness of voice and 3 out of 30 developed unilateral phrenic nerve block; one of these patients needed support by mechanical ventilation. Statistical analysis of the visual analogue postoperative pain scoring in the first 24 hours revealed non-significant (p value>0.05) differences between the two study groups. As regards the time of first analgesic dose and the total doses given during the first 24 hours postoperative, there are no significant differences between the two groups.

Conclusion: The combination of ultrasound-guided suprascapular nerve and supraclavicular brachial plexus block gives success rate as ultrasound-guided interscalene brachial plexus block for shoulder arthroscopy with less complications especially in patients with respiratory compromise.

Keywords

Interscalene; Suprascapular; Supracavicular; Ultrasound; Bupivacine

Introduction

Shoulder arthroscopy has been performed as a diagnostic tool and also as a therapeutic maneuver e.g. stabilization of the gleno-humeral joint, rotator cuff repairs and chondroplasties. Interscalene approach to the brachial plexus is the most suitable block for shoulder arthroscopy [1]. It is the most proximal (paravertebral) approach to the brachial plexus targeting the roots and proximal trunks of the brachial plexus in the neck as they are sandwiched between the anterior and the middle scalene muscles. The anterior primary rami of the lower cervical nerves (C5, 6, 7, 8, T1) leave their intervertebral foramina and pass anterolaterally and inferiorly to lie between the anterior and middle scalene muscles (interscalene groove) and this is the site of injection of the local anesthetic solution. Complications of interscalene brachial plexus block are sometimes serious. They include: inadvertent epidural or intrathecal injection [2], vertebral artery injection that can result in convulsions and loss of consciousness, phrenic nerve block [3] that may need mechanical ventilation especially in patients with respiratory compromise and also recurrent laryngeal nerve block that may result in hoarsening of voice. The use of ultrasound in performing interscalene block improves the results through better visualization of local anesthetic spread within the fascia surrounding the trunks and therefore decreasing the amount of local anesthetic needed to provide surgical anesthesia leading to a lesser incidence of phrenic nerve palsy and subsequent hemidiaphragmatic paresis [4-6].

The supraclavicular block was traditionally performed for surgeries of the upper extremity below the shoulder [7]. Ultrasound-guided supraclavicular block was reported to be safe for shoulder arthroscopy [8]. Before the use of ultrasound, the supraclavicular approach for brachial plexus block was associated with a high incidence of pneumothorax and direct vascular puncture with subsequent local anesthetic toxicity [7]. Ultrasound has improved the

***Corresponding author:** Karim Youssef Kamal Hakim, Department of Anesthesia, Faculty of Medicine, Ain Shams University, Egypt, Tel: (02)24145837; E-mail: karimykhakim@hotmail.com

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safety of this block as the performer can visualize the subclavian artery and the dome of pleura [9,10]. This approach when used for shoulder surgeries by injecting the usual volumes of local anesthetic solutions; may be unsatisfactory as the lower roots of the cervical plexus will not be blocked and to overcome this drawback a very large volume of anesthetic solution is to be injected in the supraclavicular approach; making it indistinguishable from interscalene approach in its complications. The shoulder joint is innervated by the suprascapular, axillary and lateral pectoral nerves. The suprascapular nerve provides sensory contributions to 70% of the joint capsule [11]. The nerve can be blocked in the suprascapular fossa either with nerve stimulator or by ultrasound guidance.

The aim of this study is to compare between the combination of ultrasound-guided suprascapular and supraclavicular nerves block versus ultrasound-guided interscalene brachial plexus block for shoulder arthroscopy as regards the efficacy of the block and the incidence of complications.

Patients and Methods

After obtaining approval from the hospital ethical committee and written informed consent from patients, a sample of patients, of ASA physical status I and II, of both sexes, age ranging between 30 and 60 years, and scheduled for shoulder arthroscopic surgery under regional ultrasound-guided nerve block; in Ain Shams University hospitals in the period between March 2011 and December 2012, was prospectively enrolled in this study. Exclusion criteria include patients who refused regional anesthesia, those with coagulopathy, impaired consciousness, mental retardation, recent myocardial infarction, severe bronchopulmonary disease, neuropathy involving the brachial plexus and uncontrolled hypertension.

Preoperative investigations in the form of ECG, chest X-ray, complete blood picture and coagulation profile. Details of anesthesia technique and study protocol were explained to the patients at the preoperative visit. All patients received no premedication, an IV line was inserted in the contralateral upper limb, basic monitors were applied (ECG, pulse oximeter, noninvasive blood pressure monitoring). According to a computer-generated randomization, patients were allocated to lie in two equal groups. Group A patients received a combination of ultrasound-guided suprascapular and supraclavicular nerves block. Group B patients received ultrasound-guided interscalene nerves block. In all patients, ultrasound-guided nerve blocks were performed by using a high frequency (10-15 MHz) linear probe, sterilization of the area of skin, sterile gel for the probe and a 22-gauge spinal needle for injecting the local anesthetic solution which was a 0.25% bupivacaine solution.

Group A Patients were first placed in the sitting position for performing the suprascapular nerve block. The probe was first placed parallel to the scapular spine to visualize it then moved cephalad to identify the suprascapular fossa. The probe was then moved laterally to identify the suprascapular notch where the nerve was seen as a round hyperechoic structure at about 4 cm depth (Figure 1). The needle was then inserted along the longitudinal axis of the ultrasound beam. After visualizing the needle in proximity to the suprascapular nerve, 4 ml 0.25% bupivacaine were injected and the spread of the local anesthetic was visualized (Figure 2). Then supraclavicular nerve block was performed in the supine position with the arm placed by the side and the head turned opposite the side to be blocked. The

Figure 1: Anatomical region of the suprascapular notch. TM= trapezius muscle, SM= supraspinatus muscle, SSN= suprascapular nerve.

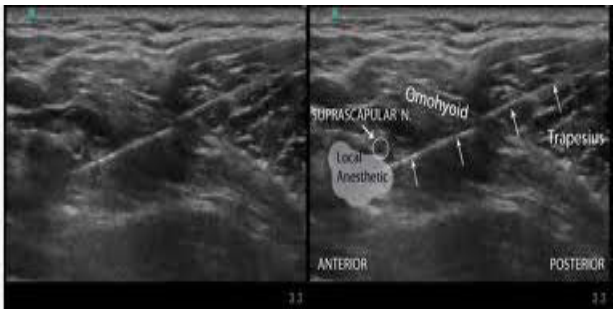

Figure 2: Spread of local anesthetic in suprascapular notch.

transducer should be placed in the supraclavicular fossa and the subclavian artery would appear as a pulsatile, hypoechoic circular structure. Once the subclavian artery had been located, the plexus would appear as several hypoechoic circles lateral and superior to the artery. Using the in-plane needle insertion technique, the needle was advanced from lateral to medial with the goal of having the tip enter the brachial plexus sheath at the most posterior imaged aspect (corner pocket), 20 ml 0.25% bupivacaine were injected and the spread of local anesthetic was visualized.

Group B patients lied supine with the neck in the neutral position and the head turned slightly to the opposite side. The ultrasound transducer was placed in the midneck at the level of the cricoid cartilage. The first two structures identified were the carotid artery and internal jugular vein. The probe was then moved in a latero-posterior direction approximately 1 to 2 cm. the brachial plexus can be seen between the anterior and middle scalene muscles as distinct hypoechoic circles with hyper echoic rings. Using the in-plane technique, the needle was inserted through the middle scalene muscle to reach the brachial plexus. Then 30 ml 0.25% bupivacaine were injected and the spread of local anesthetic was visualized.

After the blocks were given, Success of the block and additional analgesic requirements (fentanyl increments of 50 μg) were recorded. If the block was failed general anesthesia was given. Any complication such as hoarseness of voice, pneumothorax, phrenic nerve affection (diagnosed by reversible shortness of breath starting within 30 minutes after injection with normal chest x-ray to exclude pneumothorax) or any other complications were recorded.

Postoperative visual analogue score for pain was recorded every 4 hours for the first 24 hours. Patients were told to call for analgesia at

any time during the first 24 hours postoperatively whenever they were in need. They were then given increments of 2 mg morphine sulphate intravenously each time with a maximum of 10 mg. The time of first analgesic dose and total analgesics administered was recorded in the two study groups.

Statistical analysis

The sample size was estimated by using the free online Raosoft sample size calculator [12]. The acceptable margin of error is 6% with a confidence level of 95%. The population from which the random sample was taken is defined as the number patients scheduled for shoulder arthroscopic surgeries during the period between November 2011 and December 2012. The recommended minimum sample size was calculated to be 55 patients. So we enrolled 60 patients in the present study and these patients were randomly distributed to lie in either one of two equal groups each of 30 patients.

Data analysis was made by using SPSS version 14.0 for Windows. Comparison between the two study groups as regards numerical variables was made by using ANOVA test for comparing means and standard deviation. Non-numerical variables were compared by using the Chi-square test. Significant results were defined when the p value was less than 0.05.

Results

The demographic data of the two study groups were summarized in table 1. Statistical analysis revealed non-significant differences between the two study groups as regards age, sex distribution, weight, ASA physical status and the duration of surgery. The surgical arthroscopic procedures performed in patients were either: diagnostic, rotator cuff repair, stabilization or debridement. The distribution of these procedures between the two study groups was found to be non-significantly (p>0.05) different between the study groups.

The success of the ultrasound-guided block was tested by recording the number of patients who completed the surgical procedure without using general anesthesia from the start or during the procedure. It was found that only three out of thirty patients in group A could not tolerate the surgery under regional block and also after giving the supplementary fentanyl doses. Those patients needed to be shifted to general anesthesia to complete the surgery. However, in group B only two out of thirty patients needed to receive general anesthesia. One of them developed respiratory distress and needed endotracheal intubation and mechanical ventilation. This patient was fully recovered at the end of the operation. Comparison between the two study groups as regards the success rate of the ultrasound-guided block to perform shoulder arthroscopy was statistically non-significant (90% in group A versus 93.3% in group B). The mean total intraoperative fentanyl administration was found to be non-significantly higher in group A (76.8 ± 10.7 μg) than in group B (65.9 ± 13.1 μg) (Table 2). The incidence of anesthetic complications was recorded in the two study groups. This revealed no complications due to the block in group A patients. In group B patients, 5 out of 30 patients (16.6%) developed hoarseness of voice and 3 out of 30 developed symptomatic phrenic nerve block; one of these patients needed support by mechanical ventilation as mentioned before.

Statistical analysis of the visual analogue postoperative pain scoring in the first 24 hours revealed non-significant (p value>0.05) differences between the two study groups (Figure 3).

Table 1: Demographic data of the two study groups.

	Group A (n = 30)	Group B (n = 30)
Age (years)	46 ± 13.5	49 ± 11.9
Weight (kg)	83 ± 10.9	75 ± 15.8
Sex (male/female ratio)	21/9	18/12
ASA physical status (I/II ratio)	13/17	15/15
Duration of surgery (minutes)	53 ± 12.5	48.1 ± 15.7
Procedure types:		
- Diagnostic	8	10
- Rotator cuff repair	10	9
- Stabilization	9	6
- Debridement	3	5

Table 2: Success rate and fentanyl consumption.

	Group A (n=30)	Group B (n=30)
Success rate of ultrasound-guided block	90%	93.30%
The total dose of intraoperative fentanyl (μg)	78.8 ± 10.7	65.9 ± 13.1

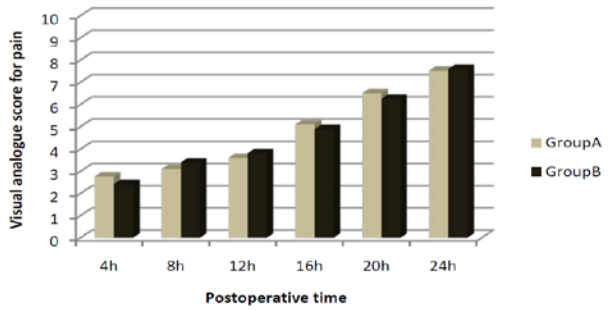

Figure 3: VAS for postoperative pain in the two study groups.

The timing of the first analgesic dose was not dependent on the visual analogue score for postoperative pain. Comparison between the two study groups revealed insignificant differences as regards the time of first analgesic dose and the total doses given during the first 24 hours postoperative as shown in table 3 (Figure 4).

Discussion

The interscalene block is the gold standard for shoulder anesthesia. It blocks the brachial plexus at the nerve roots level; usually C5-6 nerve roots or the superior trunk [13]. Although ultrasound-guided interscalene block helps in reducing the total volume of local anesthetic required to produce an effective block, yet many complications are still recorded. Common complications of the interscalene nerve blockade include phrenic nerve blockade (hemidiaphragmatic paresis), Horner's syndrome and inadvertent subarachnoid or epidural injection. Phrenic nerve block that causes ipsilateral hemidiaphragmatic paralysis is nearly always present in all cases of successful interscalene block; therefore, bilateral interscalene blocks should never be performed. It is also important to avoid

Table 3: Postoperative analgesia in the two study groups.

	Group A (n=30)	Group B (n=30)
The postoperative time of first analgesic demand (hours)	8.66 ± 3.19	7.83 ± 3.34
The total dose of IV morphine given for postoperative analgesia (mg)	5.66 ± 2.29	6.26 ± 2.08

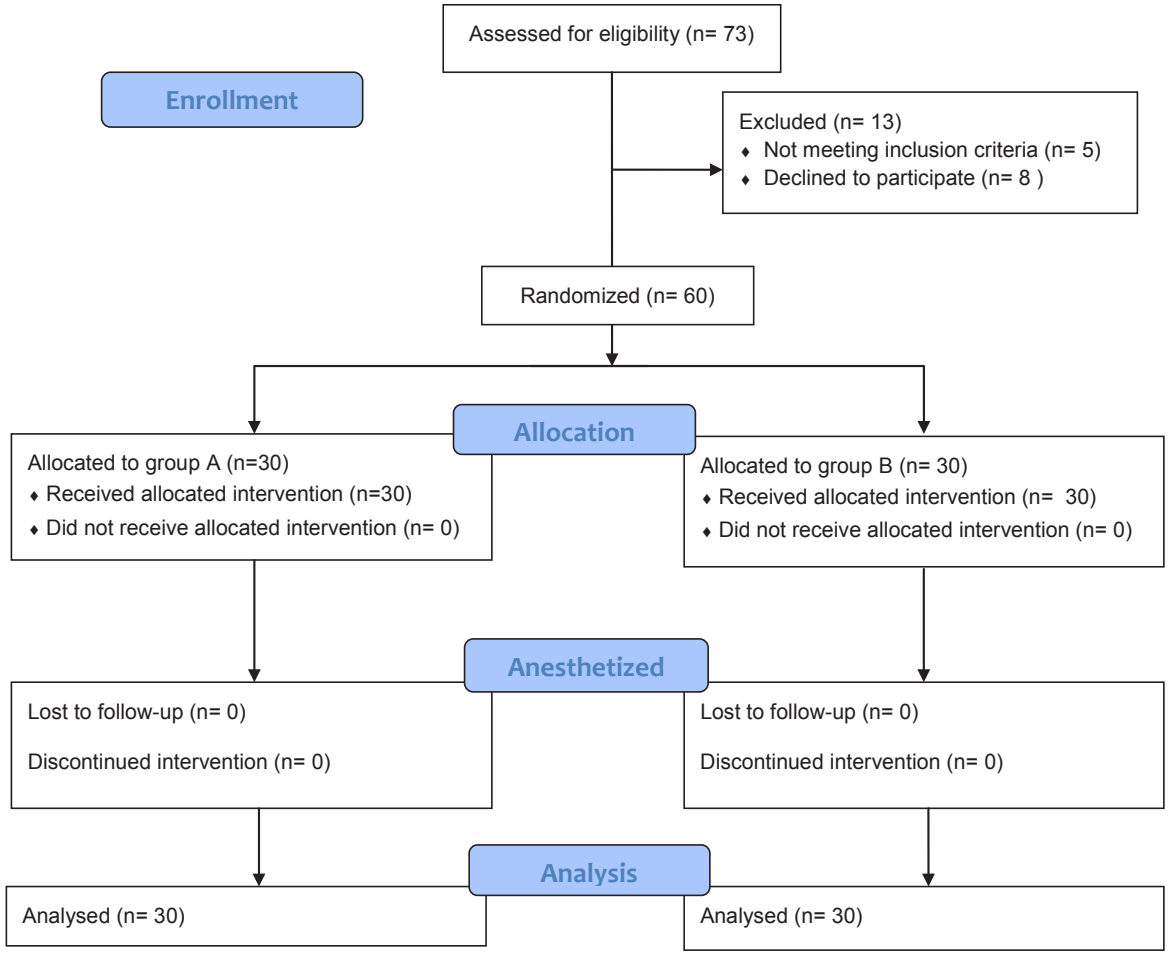

Figure 4: Patient enrolled in the study - Flow Diagram.

performing this block in patients with respiratory disease as it may lead to respiratory failure.

Supraclavicular block was traditionally performed for surgeries of the upper limb below the shoulder [7]. Liu et al. however, recently reported that ultrasound-guided supraclavicular blocks were effective and safe for shoulder arthroscopy [8]. Supraclavicular block has not been commonly used for shoulder surgery [13]; because of the concern that the block is too distal from the cervical nerve roots to provide satisfactory shoulder anesthesia. However, local anesthetic solution injected at a supraclavicular block may travel cephalad between the anterior and middle scalene muscle and can function as a caudad approach to an interscalene block [7]. Supraclavicular block has the advantage of less risk of phrenic nerve block in comparison to interscalene block and also has a lower incidence of hoarseness of voice but higher incidence of pneumothorax. The suprascapular nerve provides sensory contributions to 70% of the shoulder joint capsule [11]. So, the combination of supraclavicular with suprascapular block for shoulder arthroscopy may provide a potent anesthesia together with fewer incidences of side effects.

In this prospective study, it was reported that the success rate of ultrasound-guided supraclavicular/suprascapular block (group A) was nearly as high as (but still non-significantly lower than) that of ultrasound-guided interscalene block (group B) for shoulder arthroscopy. This excellent success rate was accompanied with no reported complications in face of a 16.6% incidence of complications in interscalene block. Postoperative analgesia was reported to be the same in the two study groups.

It was suggested from the present study that the combination of ultrasound-guided supraclavicular/suprascapular block may offer

more suitable and safe conditions for shoulder arthroscopy than that offered by ultrasound-guided interscalene block.

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References

1. Singelyn FJ, Seguy S, Gouverneur JM (1999) Interscalene brachial plexus analgesia after open shoulder surgery: continuous versus patient-controlled infusion. Anesth Analg 89: 1216-1220.
2. Passannante AN (1996) Spinal anesthesia and permanent neurologic deficit after interscalene block. Anesth Analg 82: 873-874.
3. Boezaart AP, de Beer JF, du Toit C, van Rooyen K (1999) A new technique of continuous interscalene nerve block. Can J Anaesth 46: 275-281.
4. Riazi S, Carmichael N, Awad I, Holtby RM, McCartney CJ (2008) 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 101: 549-556.
5. Renes SH, Rettig HC, Gielen MJ, Wilder-Smith OH, van Geffen GJ (2009) Ultrasound-guided low-dose interscalene brachial plexus block reduces the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med 34: 498-502.
6. Renes SH, Spoormans HH, Gielen MJ, Rettig HC, van Geffen GJ (2009) Hemidiaphragmatic paresis can be avoided in ultrasound-guided supraclavicular brachial plexus block. Reg Anesth Pain Med 34: 595-599.
7. Mirza F, Brown AR (2011) Ultrasound-guided regional anesthesia for procedures of the upper extremity. Anesthesiol Res Pract 2011: 579824.
8. Liu SS, Gordon MA, Shaw PM, Wilfred S, Shetty T, et al. (2010) A prospective clinical registry of ultrasound-guided regional anesthesia for ambulatory shoulder surgery. Anesth Analg 111: 617-623.
9. Gray AT (2006) Ultrasound-guided regional anesthesia: current state of the art. Anesthesiology 104: 368-373.
10. Soares LG, Brull R, Lai J, Chan VW (2007) Eight ball, corner pocket: the optimal needle position for ultrasound-guided supraclavicular block. Reg Anesth Pain Med 32: 94-95.
11. Fredrickson MJ, Krishnan S, Chen CY (2010) Postoperative analgesia for shoulder surgery: a critical appraisal and review of current techniques. Anaesthesia 65: 608-624.
12. www.raosoft.com
13. Sripada R, Bowens C Jr. (2012) Regional anesthesia procedures for shoulder and upper arm surgery upper extremity update--2005 to present. Int Anesthesiol Clin 50: 26-46.

Author Affiliation

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[1]Ain Shams University, Egypt