Medical Journal of the
Islamic Republic of Iran

Volume 19
Number 4
Winter 1384
February 2006

USING PHYSICAL EXAMINATION IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK WITH MODIFIED PARASCALENE APPROACH

FARAMARZ MOSAFFA, M.D., MOHAMMAD MEHDI GHIAMAT, M.D., AFSHIN FOROUTAN, M.D., AND SIROUS MOMENZADEH, M.D.

From the Departments of Anesthesiology and Intensive Care Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

ABSTRACT

Background: Because nerve stimulators are not always available for brachial plexus block, finding the right injection spot for nerve blocks is important. In this study we used physical examination to determine the appropriate spot for injection.

Methods: All patients who were candidates for upper extremity surgery and were either in class ASA I or ASA II, were selected. Paresthesia was elicited in the operation field and the three middle digits using the physical examination method. 50 cases were included totally.

Results: Paresthesia in the operation field or the three middle digits was elicited in 46 cases in which complete block was produced by local injection (success rate: 100%). Paresthesia was elicited in the shoulder region in 3 cases and in the upper arm in 1 case. In the latter case complete block was achieved by blind local injection. In the former three cases general anesthesia was necessary. No adverse effects were seen.

Conclusion: Apparently, eliciting paresthesia in the operation field and the three middle digits before injecting the anesthetic solution will increase the success rate and reduce adverse effects.

MJIRI, Vol. 19, No. 4, 313-317, 2006.

Keywords: Parascalene, Physical examination, Paresthesia.

INTRODUCTION

Brachial plexus blocks are frequently used for surgery on the upper extremities, particularly in emergency operations. Common techniques for brachial plexus block include axillary, infraclavicular, supraclavicular and interscalene approaches.[1]

The supraclavicular approach has several advantages including the fact that abduction of the arm is not required as with the axillary approach.

Corresponding author: Sirous Momenzadeh, M.D., Department of Clinical Research, National Research Center of Medical Sciences, No. 26,1 Al., Kooh-e-Noor St., Motahari Ave., Tehran, Iran, Tel: +982188501403-6 Fax: +982188730830
E-mail: Momenzadeh@NRCMS.ir and Momenzadeh_s@yahoo.com

Furthermore, it is not difficult to block C–8 or T–1, and local anesthesia solution can not spread inside the epidural or subarachnoid spaces, as it has been reported with the interscalene technique. However pneumothorax is a possible complication of the supraclavicular approach.[2,3]

The incidence of pneumothorax following supraclavicular block averages around 0.5–6%, decreasing with experience.[4]

Whatever the technique, three points continue to be a source of concern, especially for the unexperienced:

a) The subclavian arterial pulse can often be felt but the artery can not always be located accurately. b) If the first introduction of the needle does not elicit paresthesia while seeking the first rib, the needle may slip over it and pierce the pleura and lung parenchyma. c) The 22

gauge, 4 or 5 cm long needle that currently is often used is too long to be used near the pleura.[5]

To avoid these problems, an alternative to the conventional supraclavicular block of the brachial plexus can be used. We term this, the "modified parascalene approach". Before the beginning of the block procedure, the correct place for needle insertion can be found by physical examination.

MATERIAL AND METHODS

Relations of the brachial plexus

In the neck, the plexus is in the posterior triangle, covered by platysma, deep fascia and skin, through which it is palpable. It is crossed by the supraclavicular nerves, the nerve to the subclavius, the inferior belly of the omohyoid, the external jugular vein and the superficial ramus of the transverse cervical artery. It emerges between the anterior and medial scalene muscles; its proximal part is superior to the third part of the subclavian artery, the lower trunk posterior to it; the plexus passes posterior to the medial two–thirds of the clavicle, the subclavius and the supraclavicular vessels and lies on the first digitation of the serratus anterior and the subscapularis.[6] From December 2003 through March 2004, the "modified parascalene technique"* for brachial plexus block together with the "physical examination method"** was employed in 50 patients that were candidates for upper extremity operations, in Akhtar and Loghman Hospital, Tehran. The study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences. The patients were either in class I or in class II physical status of the ASA classification and none of them were addicted or morbidly obese. Indications for surgery are outlined in Table II.

Technique and anatomic landmarks

The landmarks are the midpoint of the clavicle and Chassaignac's tubercle. The latter is located by direct palpation or by using the technique described by Winnie.The point of puncture is situated at the junction of the upper two – thirds and lower one–third of the line joining the midpoint of the clavicle and Chassaignac's tubercle on approximately 1.5-2 cm above the midpoint of the clavicle in the interscalene space. The brachial plexus is located more than 1cm away from the superior border of the subclavian artery and the apex of the pleura even in neonates. On the other hand, the external jugular vein is close to the point of puncture.[7]

* This approach was designed by Dr . F. Mosaffa

** This examination was designed by Dr . A. Foroutan

Physical examination

The patient is placed supine in the dorsal recumbent position and the arm extended along the chest wall with the head turned to the opposite side.

1) The patient is instructed to raise his head to bring the lateral border of the sternocleidomastoid (SCM) muscle into view. It's location should be marked on the skin in ink.

2) The patient is then requested to relax his head and neck. The anesthesiologist then places his second and third digits lateral to the (SCM) muscle approximately 1.5-2 cm above the clavicle. The fingers should now be on the belly of the anterior scalene muscle which is moved laterally into the interscalene groove (the groove between the anterior and middle scalene muscles). An (X) is marked at a point immediately lateral to the edge of the anterior scalene muscle in the interscalene groove 1.5-2 cm above the clavicle. The (X) is above the subclavian artery and medial to the external jugular vein.

3) Then the examiner should gently push the second and third digits in the scalene groove at the parascalene region.

If the location of the groove is correct the patient feels numbness, heaviness and paresthesia of the upper limb in the specific nerve distribution that is pushed.

If paresthesia is not elicited in the operation field or the three middle digits, the examiner should move his or her finger in the interscalene groove in order to achieve the suitable numbness and heaviness. If the examiner's digits are too lateral in the interscalene groove in the parascalene region, numbness and heaviness of the shoulder is produced.

In this case, we should move our digits medially in order to achieve paresthesia. However if paresthesia is not obtained, we should move our fingers more medially and deeply.

It should be remembered that in the too medial or too deep position in the interscalene groove, the rate of success is not increased and it may also result in failure of the block. That is because in this case, the phrenic nerve is stimulated, leading to contractions of the diaphragm during needle insertion.[8]

Procedure:

1) A skin wheal is made at the x mark.

2) A scalp vein G: 25, 23 F needle, attached to a syringe filled with local anesthetic solution is inserted at a 60° angle to the skin surface. It is directed medially, dorsally and caudally at an angle of 30° to the vertical axis (similar to the interscalene approach).

3) Paresthesia is usually elicited while inserting the needle. If so, the local anesthetic solution is injected after careful aspiration.

Table I. Volume of local anesthetic solution usually administered during brachial plexus block.

Block Procedure	Weight of patient (kg)			
	40	50	60	70
Supraclavicular block	22.5mL	25mL	27.5mL	30mL

Table II. Surgical indications in 50 patients.

	Numbers
Emergency procedure	26
Colles fracture	20
Debridement and repair of lacerated wounds	6
Elective procedures	**24**
Removal of plates	3
Open reduction of forearm	9
Soft tissue and tendon surgery	8
Malformations of fingers	2
Tennis elbow	2

4) If no paresthesia is elicited, the needle is then withdrawn and redirected in an attempt to elicit paresthesia.

5) If, after several attempts, no paresthesia is obtained, the local anesthetic solution is injected along the lateral edge of the anterior scalene muscle in the interscalene groove blindly.

6) Typically, the needle should not be inserted more than 30mm.[9]

Inpatients were premedicated with morphine and diazepam, while patients having emergency operations received fentanyl and midazolam, five minutes before the beginning of the procedure in the operating room.

An intravenous needle and a blood pressure cuff were placed in the opposite arm before the procedure was started.

The local anesthetic solution consisted of 1.5% lidocaine with 1: 200000 epinephrine plus (7.5%) sodium bicarbonate (1/10 total volume).Usual dose of lidocaine with epinephrine was 5mg/kg. (Table I)

The expected duration of operation was maximally 2 hours.

Onset of anesthesia was observed within 5-10 minutes. If, after 15 minutes, a satisfactory block, i.e. numbness of all fingers, wrist drop and inability to lift the arm, had not been obtained, we waited an additional 10-15 minutes.[8]

General anesthesia was administered to patients with inadequate or unsuccessful blocks.

The onset and duration of anesthesia and the operative time were recorded

Postoperatively, inpatients remained in the recovery room until the block was off, then they were sent to the ward.

In the recovery room patients were closely observed for chest pain, difficulty in breathing, hoarseness, signs and symptoms of pneumothorax and phrenic or recurrent laryngeal nerve paralyses.

RESULTS

There were 43 male and 7 females. Their ages ranged between 19 and 48 years (mean: 24±8.7). The elective operations were 24 cases and the emergency operations were 26 cases (Table II).

Of the 50 patients, in 46 patients (92%) paresthesia was elicited completely.

It was achieved in one attempt in 44 and in two attempts in 2 cases (Table III).

In all the 46 cases complete block was achieved by locally injecting an anesthetic (success rate was 100% after elicting paresthesia). Paresthesia was not elicited in the operation field or the three middle digits in four cases by using the physical examination method. It was elicited in the shoulder region in 3 cases and in the up-

Table III. Rate of complete block by local injection of anesthetic based on eliciting paresthesia.

	Paresthesia in the operation field and the three middle digits in one attempt N=44	**Paresthesia in the operation field and the three middle digits in two attempts N=44**	**Paresthesia in upper arm N=1**	**Paresthesia in shoulder N=3**
Total block	44 (100%)	2 (100%)	1(100%)	0
Relative block	0	0	0	3 (100%)

per arm in 1 case. Therefore, we injected the anesthetic blindly in the interscalene groove. In the former three cases it resulted in relative anesthesia and general anesthesia was necessary. In the latter case complete block was achieved by blind local injection. We didn't observe tourniquet pain, pneumothorax or neurologic adverse effects in any of the patients.

DISCUSSION

According to our result, success in elicting paresthesia in the operation field or the three middle digits by using the physical examination method will result in accurate injection of the anesthetic and complete block will be achieved in 100% of the cases.[10]

The finding is especially significant because physical examination was used instead of nerve stimulators and the right spot for injection was determined without any adverse effects. By taking the four failure cases into account the success rate of this method decreases. After blind injection complete block was only achieved in the patient who had developed paresthesia in the upper arm. General anesthesia seems rational in patients who develop paresthesia in the shoulder by using this method. More studies are necessary to confirm this.

This method has another advantage. Because anterior scalene is adhered to the first rib, using a short needle on the lateral section of this muscle at a 60° angle to the skin surface (as performed in this method) prevents pneumothorax which is a common side effect of supraclavicular block .

The 100% success rate in cases of elicited paresthesia is especially worth consideration since Yasuda et al. achieved a success rate of 98% when they could stimulate the three middle digits by a nerve stimulator.[10]

In 1961, Brand et al reported the success rate of brachial plexus complete block in the supraclavicular region after eliciting paresthesia to be 84%. This is lower than our results.[11]

Many techniques for blocking the brachial plexus have been described with the common goal of avoiding pneumothorax while providing reliable, predictable anesthesia.The subclavian perivascular technique introduced by Winnie and Collins[8] emphasizes the use of a short needle and a single injection while the needle lies parallel to the anterior scalene muscle and tangential to the subclavian artery to minimize the possibility of pneumothorax. Several modifications of this technique have been described using the same anatomic landmarks and a similar needle direction.

Moore[12] and Eriksson[13] recommended that the puncture site be the intersection of the upper border of the clavicle with the lateral border of the clavicular head of the anterior scalene muscle. However, the potential risks of this technique are higher. Also, Dupre[7] et al recommended using other anatomic landmarks.

The interscalene technique introduced by Winnie in 1970, consists of insertion of the needle at the level of the sixth vertebra in the interscalene groove so that pneumothorax can be completely avoided. Unfortunately other complications such as subarachnoid and epidural injections are possible with this approach, and these have been reported. In addition, anesthesia may not be complete and may require separate nerve blocks at the elbow.

Raj et al[14,19] in 1973 and Sims[15,17] in 1977 reported an infraclavicular approach in which the tip of the needle is directed away from the lungs so as to avoid pneumothorax. However, their technique requires a nerve stimulator to assure proper placement of the needle.

Vongvises and Panijayamond[9] in 1979 have recommended the parascalene block, in which the needle should be introduced strictly in the anteroposterior plane without extending beyond the plane of the first rib. The risks of pneumothorax and vascular injury are fewer.

Also, Bernard Dalens and Vanneuville[16,18] described the parascalene block in children, that the needle be introduced strictly in the anteroposterior plane.

With our approach at a level lower than that of the interscalene technique, good ulnar nerve anesthesia is achieved. Another advantage of this method is the lack of need for a nerve stimulator which was recommended for the modified parascalene approach by Raj et al. and

Sims et al. In conclusion, the physical examination method and this approach appears simple, safe and reliable.

REFERENCES

1. Brown DL: Atlas of Regional Anesthesia, Second edition, pp. 34–57, 1999.
2. Kumar L, Battit GE, Froese AB, Lang MC: Bilateral Cervical & Thoracic epidural blockade complicating interscalene brachial plexus block; report of two cases. Anesthesiology 35: 651–2, 1971.
3. Ross S, and et al: Total spinal anesthesia following brahical plexus block. Anesthesiology 39: 458, 1973.
4. Moore DC: Atlas of Regional block Anesthesia Procedure: New York, Parthenon Publishing, 4th edition, pp. 221-42, 1975.
5. Ferner H, Staubesand J: Sobotta Atlas of Human Anatomy: Baltimore-Munich, Urban & Schwarzenberg, 10th English edition, 263-271, 1983.
6. Dupre LJ, Danel V, Legrand J and et al: Surface landmarks for supraclavicular block of brachial plexus. Anesthesiology 61: 28-31, 1982.
7. Winnie AP, Collins NJ: The subclavian technique of brachial plexus anesthesia. Anesthesiology 25: 353-63, 1964.
8. Vongvises P and et al: A parascalene techniqe of brachial plexus anesthesia. Anesthesiology 25: 353-63, 1964.
9. Yasuda I and et al: Supraclavicular brachial plexus block using a new stimulation and insulated needle. BJA 52: 409, 1980.
10. Branrd L, Papper EM: A comparison of supraclavicular and axillary technique for brachial plexus block. Anesthesiology 22: 226-9, 1961.
11. Eriksson E: Brachial plexus block supraclavicular approach. Wily, Copenhagen, 75-77, 1969.
12. Raj PP, Montgomery SJ, Nettles D and et al: Intraclavicular brachial plexus block. Anesthesia & Analgesia 52: 897-904, 1973.
13. Sims JK: A modification of landmarks for intraclavicular approach to brachial plexus block. Anesthesia & Analgesia 56: 554-555, 1977.
14. Brnard D and et al: A new parascalene approach to the brachial plexus in children. Anesthesia & Analgesia 66: 264-71, 1987.
15. Raj PP, et al: Suclavian perivascular brachial plexus blocks. Reg Anesth Pain Med 25(1): 41-2000.
16. Jutzi H and et al: Interscalene block with a nerve stimulator. Reg Anesth Pain Med 25(4): 356-9, 2000.
17. Weber SC and et al: Buprenorphine added to the local anesthetic for brachial plexus block to provide postoperative analgesia in out patients. Reg Anesth Pain Med 26(4): 352-6, 2001.
18. Weber SC, Parise CA, Jain R: Interscalene block superior to general anesthesia: A discussion of the conclusions regarding these two anesthesia techniques, Anesthesiology 104(1): 208-9, 2006.
19. Blumenthal S, Jutzi H, Borgeat A: Is the interscalene brachial plexus block the best approach? Anesth Analg 102(2): 652-3, 2006.