Anatomical and clinical study of the subscapular nerves

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Abstract

Introduction: Painful shoulder on hemiplegic patients has been associated to subscapular muscle spasticity. An alternative for treatment is based on subscapular nerve block using phenol. However, there is lack of information on anatomical references for subscapular nerves blockage technique. The aim of this study was to determine mean values and confidence intervals for maximum penetration points in order to facilitate blockage during anesthetic procedure of subscapular nerves. Material and methods: Using 30 dissected adult cadaver limbs, the medial edge of scapula and a horizontal plan to the lower edge of the bone spine were identified. The maximal and minimal angles of the penetration points of the subscapular nerve both above and below the horizontal plan were measured, as well as the minimal and maximal distances from the medial edge of scapula. Superior and inferior bisector angles and the mean horizontal distance (in mm) were calculated for descriptive analysis. Kolmogorov-Smirnov normality test indicated the normal distribution of the data ($p > 0.05$). Results: Mean superior angle was 6.63° (confidence interval 4.52-8.75), mean inferior angle was 11.30° (confidence interval 8.73-13.86) and mean horizontal distance was 72.53 mm (confidence interval 69.25-75.80). Conclusions: According to this data, for maximum points blocking after solution injection, the needle should be introduced horizontally at the scapula spine level under its medial edge to a mean depth of 72.53 mm. Then, the needle must be driven upwards in a 6.63° angle and later, driven downwards to form a 11.30° angle with the horizontal plan. Those mean values represent 95% of the distribution.

Keywords: subscapular nerves, anesthetic procedure, phenol, painful shoulder and spasticity.

1 Introduction

Current literature addressing spastic hemiplegia often reports painful symptoms due to the the involvement of the shoulder in a forced adduction position and internal rotation. Spasticity and contracture of subscapular muscle, the major internal rotator and adductor of the shoulder, play a key role on the flexor synergy pattern, usually present in spastic hemiplegia resulting in a longterm painful shoulder (CAILLIET, 1981; CHIRONNA and HECHT, 1990; HECHT, 1992).

In order to treat the spastic subscapular muscle, Chironna and Hecht (1990) and Hecht (1992) recommend the chemical block of subscapular nerves using phenol. This technique is still recently recommended by various authors (YELNICK, COLLE and BONAN, 2003; YELNICK, COLLE, BONAN et al., 2007). In this procedure a needle connected to an electrical stimulator is inserted just under the medial edge of scapula at the level of the spine, and is advanced in the same direction or slightly under it. Considering subscapular muscle is supplied by two separate branches from the brachial plexus, the upper and lower subscapular nerves, the operator explores the muscle area with the needle attempting to find the two points of highest electrical stimulation, where phenol solution should be injected.

However, exploring the area with the needle may cause severe pain and discomfort to the patient. Anatomical information on the penetration points of the subscapular nerve should help operators in the straight forward needle injection at the two main subscapular branches reducing patient anxiety and stress during the nerve blockage procedure.

Therefore, this study aims to determine mean values and confidence intervals for maximum points for blockage during anesthetic procedure of subscapular nerve.

2 Material and methods

Anatomic pieces were obtained at Anatomy Laboratory of Federal Universities of São Paulo and Maranhão. A dissection of 30 (thirty) upper limbs of adult cadavers upper limbs stored at 10% formol was carried out. Samples were chosen at random with no regard to race or sex. Exclusion criteria included any type of deformity on the shoulder joint or muscle-related atrophy.

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Then, the subscapular zone was dissected, including the posterior cord of the brachial plexus and its branches: upper and lower subscapular nerves, thoracodorsal, axillary and radial. Further, the upper limbs were disjointed and the penetration points of branches of the lower, medium, and upper subscapular nerves were identified at the lateral and anterior surface of subscapular muscle. The medium subscapular nerve corresponded to the branches found between upper and lower subscapular nerves, which emerged directly from the brachial plexus posterior cord.

The medial scapular edge and the spine were exposed to serve as bony landmarks. The intersection between those bony landmarks was used as the bone reference (BR) for biometric data measurement. This is also the anatomical reference point used during anesthetic clinical procedures (Figure 1a).

The penetration points identified at the anterior surface of the subscapular muscle and the BR were drawn on superimposed transparence sheets. The images were digitalized and biometric measures were performed on each sample, using CorelDraw software.

Then a horizontal line (HL) was drawn from the BR toward lateral direction. The purpose of this HL determination was to allow for angle calculations formed by the highest and lowest subscapular penetration points both above and below the HL. The bisector angles formed between those angles

were determined at both levels (Figure 1a). The maximal and minimal distances displayed by the penetration points in relation to BR were also calculated.

The mean distance formed between those distance was identified (Figure 1b). Superior and inferior bisector angles and mean distance (in mm) were used for descriptive analysis. Kolmogorov-Smirnov normality test indicated the normal distribution of the data ($p > 0.05$). The mean and 95% confidence intervals were determined to serve as anatomical guidelines for neurolitic procedures.

3 Results

A normal distribution of the data was identified (Kolmogorov-Smirnov test, $p > 0.05$), indicating the mean and confidence intervals can be considered as reliable.

Mean and standard deviation of superior angle was 6,63° (±5.66) (confidence interval 4.52-8.75), whereas inferior angle was 11.30° (±6.88) (confidence interval 8.73-13.86) and horizontal distance was 72.53 mm (±8.78) (confidence interval 69.25-75.80).

4 Conclusion

This descriptive anatomical study involving the subscapular nerves identified the penetration points of these nerves on the muscle with the purpose of calculating the mean and confidence intervals to guide phenol injection for nerve blockage in painful shoulder treatment on hemiplegic patients. It was observed that most of the penetration points are located next to scapula spine, as indicated by Chironna and Hecht (1990) and Hecht (1992).

In this study the bone landmarks used to guide the identification of nerve penetration points, the medial edge and spine of the scapula, are easily find by any operator during the anesthetic procedure. By using a simple method of calculation, an upper and lower bisector angles were calculated in relation to a horizontal plan passing adjacent to the scapula spine. The mean distance to medial edge of the scapula was also determined. This way, the central area of distribution of the subscapular nerve at both superior and inferior areas could be plotted for statistical analysis to verify whether those areas were normally distributed and represents the 95% confidence interval of the population. According to this observation, it is possible to suggest that the needle should be inserted horizontally at the scapula spine level just under the medial edge, to a mean depth of 72.53 mm towards lateral.

Then, the needle should be conducted upwards until an angle of 6.63° is formed with the horizontal plan (to cover the highest number of motor points at the upper region). Later, the needle should be directed downwards, until a 11.30° angle is formed with the horizontal plan (to cover the highest number of motor points at the lower region). According to the data collected those mean values represents 95% confidence interval of the population.

The technique described above is in line with Chironna and Hecht (1990) and Hecht (1992) recommendations that describe a minimum of two regions for chemical blockage of subscapular nerves, and could be used in association with the electrical stimulation technique in order to accelerate the identification of areas with higher number of motor points. It is expected that the identification of bone landmarks and
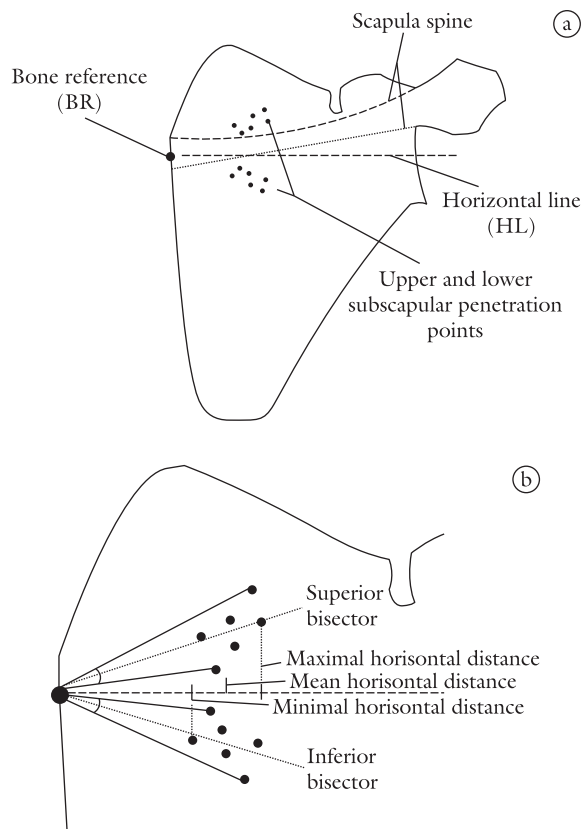

Figure 1. Schematic illustration of the anterior face of the subscapular muscle over the scapula bone. a) anatomical references used for the penetration points location; b) close of the mesial edge to demonstrate angles and distances measurements for calculation of the maximal point blocking during anesthesia.

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the mean values for needle penetration during anesthetic procedure in the subscapular area would help operators to reduce stress during the treatment of shoulder pain in hemiplegic patients.

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