# Evaluation of acromion as a landmark for suprascapular nerve block

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## ABSTRACT

**Objectives:** Shoulder pain is an important and frequently encountered clinical condition. One of the important causes of the shoulder pain is related with the rotator cuff muscles. Thus, the suprascapular nerve block is used as a treatment option for chronic shoulder pain. In this study, we aimed to evaluate acromion as a landmark for suprascapular nerve blocks.

**Methods:** Distance of acromion to suprascapular notch and spinoglenoid notch was measured in dry bones. According to the obtained mean distances, nerve block was applied with colored dye to the shoulder region of a 72-years old male cadaver. After dissection of the shoulder region, distribution of the dye was evaluated in terms of nerve block.

**Results:** Injection point for suprascapular notch was found to be 4.37 cm anterior and 5.3 cm medial to lateral tip of the acromion. Injection point for spinoglenoid notch was found to be 4.45 cm inferior and 4.42 cm medial to lateral tip of the acromion. Cadaveric dissection revealed that nerve block was successful.

**Conclusions:** Acromion was found to be as an alternative landmark in terms of suprascapular nerve block and isolated infraspinatus muscle block.

## Introduction

Shoulder joint is one of the most active joints in the human body. Since it is a spheroid type synovial joint, it has a wide range of motion. This mobility allows the joint to perform all basic movements (1). In addition, this mobility makes it vulnerability to various injuries. Shoulder pain is one of the most encountered clinical conditions in the musculoskeletal disorders and it has many reasons. Bones, muscles, tendons and ligaments are the major causes of shoulder pain such as impingement, tendinitis or instability etc. In addition, rare causes such as entrapment neuropathies or referring pain of gallbladder are seen (1).

The suprascapular nerve derivates from the superior trunk of the brachial plexus and it is one the peripheral nerves innervating the shoulder region (1). Thus, the suprascapular nerve block is one of the treatment options of shoulder pain, especially chronic shoulder pain. It can be performed with guidance of USG or via blind injection. The nerve block can be nonselective or selective depending on the etiological cause and different approaches has been described (2).

In this study, we evaluated the acromion as a landmark for the suprascapular nerve blocks and to describe an alternative injection technique. Dorsal surface of the scapula is divided into two fossa by the spine of the scapula. Two of the rotator cuff muscles are located on these fossa – supraspinatus and infraspinatus muscles. Acromion is the flat expansion of the spine, at the lateral edge. While the medial border of the acromion is articulating with the clavicle, lateral border is located subcutaneously and can be palpated easily through the skin. The suprascapular nerve which is innervating the supraspinatus and infraspinatus muscles reaches to the supraspinous fossa via the suprascapular notch. After innervating the supraspinatus muscle located in the supraspinous fossa, the suprascapular nerve travels to infraspinous fossa by passing through the spinoglenoid notch (1). Since the acromion is a palpable surface landmark, it is easy to locate the suprascapular notch and the spinoglenoid notch by measuring the distance between acromion and these anatomical structures. Thus, the mean distance between the suprascapular notch, the spinoglenoid notch and the acromion can be used for the suprascapular nerve blocks.

## Methods

A total of 32 (16 right and 16 left sides) dry scapulae were included into the study. The bones were obtained from the Department of Anatomy. The bones were belonged to adult Caucasian subjects. The age and the gender of the bones were unknown. One of the scapulae (left side) was excluded from the study due to fracture.

The lateral border of the acromion was selected as a reference point since it is a palpable bony landmark. In the nonselective suprascapular nerve blocks, while anesthetic agent is applied to the brachial plexus (interscalen block), the suprascapular notch is being targeted as the injection site in selective nerve blocks (2). On the other hand, the anesthetic agent should be applied to the spinoglenoid notch or distal to the spinoglenoid notch in order to block nerve branches regarding infraspinatus muscle and infraspinous fossa. Thus, in order to define injection point according to the acromion, distance of the acromion to the suprascapular and the spinoglenoid notches were measured with a digital caliper. Injection points for suprascapular notch and spinoglenoid notches are shown in Figure 1. The mean distance was calculated after the measurements. According to the mean distance between the acromion and the mentioned notches, injection site was marked on the shoulders of a 72 years old male cadaver which has been obtained from the Department of Anatomy. Colored dye injection was performed for suprascapular nerve block according to current described technique. Fist injection was for suprascapular notch where the trunk of the nerve enters the supraspinous fossa, before giving off any branches. Second injection was for spinoglenoid notch where fibers of the suprascapular nerve reaches the infraspinatus muscle. After the injections, dissection of the shoulder region was performed and the effectiveness of the nerve block was investigated by distribution of the colored dye in the both injection points. The shape of the acromion and suprascapular notch, width and depth of the suprascapular notch were also noted.

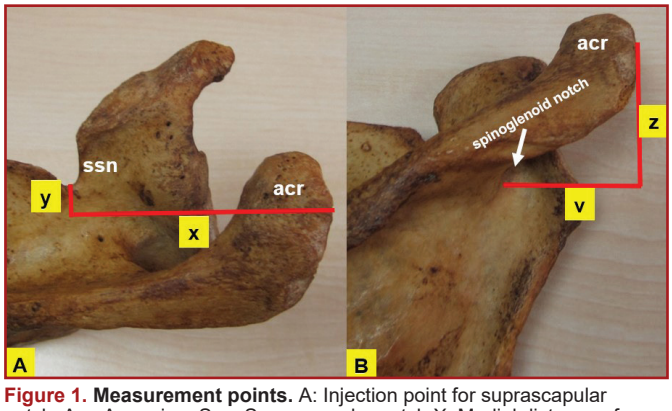


**Figure 1. Measurement points.** A: Injection point for suprascapular notch. Acr: Acromion, Ssn: Suprascapular notch X: Medial distance of ssn to acromion, Y: anterior distance os ssn to acromion. B: Injection point for spinoglenoid notch. Z: Inferior distance of spinoglenoid notch to acromion, V: medial distance of spinoglenoid notch to acromion

Statistical results represented as mean ± standard deviation. Student's t-test was performed to compare the measurements of left and right sides. SPSS soft-ware (version 16) were used in analyses of the data, at a statistical significance set at $p<0.05$.

This study was conducted under ethical approval of local ethical committee (Approval number of the institutional review board of the Ethics Committee 2016-14).

## Results

The suprascapular notch was located anterior and medial to the acromion. The spinoglenoid notch was located inferior and medial to acromion. Injection point for the suprascapular notch was found to be 4.37 cm anterior and 5.3 cm medial to lateral tip of the acromion. Injection point for the spinoglenoid notch was found to be 4.45 cm inferior and 4.42 cm medial to lateral tip of the acromion.

Dissection of the right shoulder region revealed that colored dye in first injection was reached to the suprascapular notch in the supraspinous fossa. On the other hand, dissection of the spinoglenoid notch revealed that branches of the suprascapular nerve passing through the spinoglenoid notch and coursing to infraspinous fossa were also stained in the second injection (Figure 2). Dissection of the cadaver showed that both selective and infraspinous fossa blocks were found to be successful according to current described injection points.

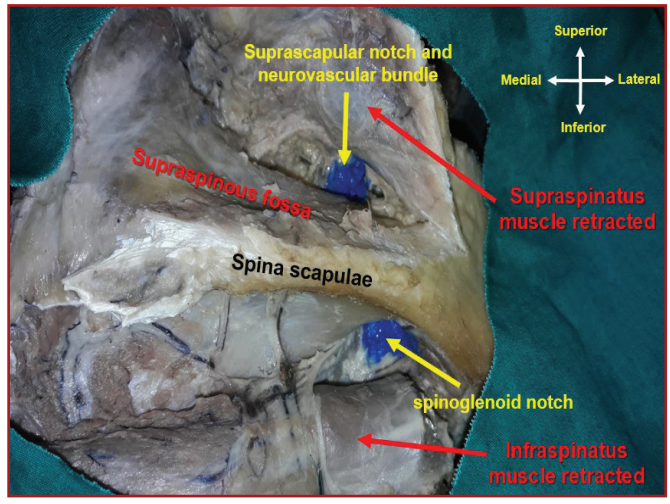


**Figure 2. Distribution of the injected dye to neurovascular structures**
Injected blue dye has reached to suprascapular and spinoglenoid notches

The Bigliani classification was used to classify the shapes of acromion (3). Curved shape of acromion (Type 2) was the most common observed acromion type (n: 18) – 58%. Flat shaped acromion (Type 1) is the second most common observed type (n: 11) – 35.4%. Hooked shaped acromion (Type 3) was the least observed type (n: 1) – 3.3%. In one of the samples an atypical shape of acromion was observed – 3.3%. In general, tip of the acromion curves ventrally, then it flattens and extends to the superior of the head of humerus. In this atypical form of acromion, flat and expand part of acromion is not seen (Figure 3). Besides, no convex shaped acromion (type 4) was observed in the present study.

In literature, various shapes of the suprascapular notch has been described. In the present study, laterally deviated U shaped suprascapular notch was the most common observed shape. The mean width and the depth of the suprascapular notch were 8.3 mm and 5.8 mm, respectively. Morphometric features are shown in Figure 3.

In statistical analysis, measurement data was compared with Student's t test in order to compare the data belonged to right and left sides. No statistically significant difference was found between the measurements of right and left sides, $p>0.05$.

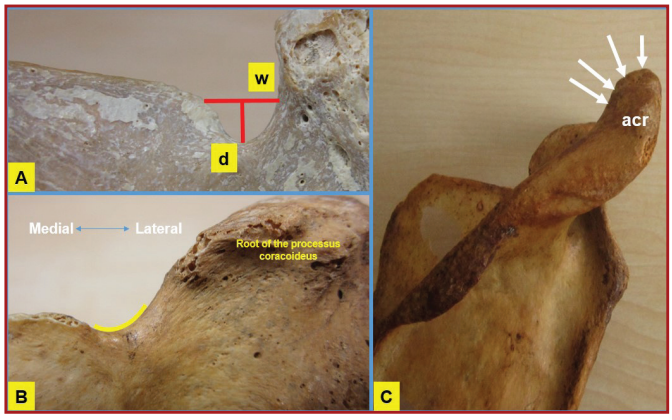


**Figure 3. Morphometric features of acromion and suprascapular notch.** A: Width and depth of the notch, B: Suprascapular notch – Shallow, C: Atypical shape of acromion

## Discussion

The most common used classification for acromial shape is Bigliani classification and it depends on the shape of the inferior surface of the acromion. Curved shaped acromion (Type 2) was reported to be the most common type according to literature. The reported incidence shows a wide range (3-5). With a 58% percentage, our results obtained in the present study are consistent with the literature data. While Type 1 – The flat shaped acromion was reported to be the second most common acromial shape in some of the previous studies (4, 6), some authors had reported that Type 3 – The hooked shaped acromion as the second most common acromial shape (3, 5). In the current study flat shaped acromion was found to be the second most common type, Type 3 was observed in only one of the samples. In a recent study, convex type of acromion was also described and reported to be the least observed type of the acromion (6). However we did not observed convex typed acromion in our study. We think that the reason of differences in the incidence of acromion types is related to the comparatively low sample size and sample types. While the majority of the previous studies had used radiological samples, dry bone samples were used in the present study.

The appearance of the suprascapular notch was described differently in previous studies (7, 8). The most common reported shape was U shaped notch which our results seems to be similar with the literature data.

The shoulder joint is one of the most used synovial joints. Due to the complex nature of the shoulder joint, shoulder pain is frequently encountered as an important clinical condition. As a branch of brachial plexus, suprascapular nerve innervates two of four rotator cuff muscles involved in the stability of the shoulder joint (1). The suprascapular nerve which is the nerve of the most injured muscle among the rotator cuff muscles -supraspinatus muscle, can be blocked for therapeutic purposes in chronic shoulder pain (9). In different studies different landmarks have been used to describe the injection site for the nerve block due to complex anatomy of the shoulder joint. The main target region is the suprascapular notch where the nerve passes through. Thus, the all fibers innervating the both muscles on the dorsal side of the scapula will be blocked. Processus coracoideus, spina scapula, acromial tip of clavicula are the most common used landmarks (2, 10, 11). It is not always possible to block the nerve successfully due to difficulties of palpating (proc. coracoideus) or degeneration (extremitas acromialis). Thus, success of the nerve block varies according to the method which had been used. While a recovery rate about 50% was reported by Shanahan, Pitombo reported an improvement about 91% (2,11).

According to the anatomical position, the most lateral point of the acromion is an easily palpable surface landmark under the skin and the degenerative changes are hardly observed. The observations and the measurements we have made revealed that the location of the suprascapular notch can be determined with the acromion and successful nerve block was demonstrated with the cadaveric injection. The current method seems to be as an alternative method for suprascapular nerve blocks.

In addition, there may be isolated infraspinatus muscle involvement in the athletes who are dealing with overhead sports branches such as swimming or volleyball (12-14). Overhead movements of the brachium causes extra load on the shoulder complex. This repetitive stress may cause injuries to the tendons of rotator cuff muscles as well as the labral tissue or the joint cartilage. Such injuries, which have a negative effect on the joint stability, causes difficulties for both the athletes and the physicians in terms of performance and treatment (12, 13). The strong external rotation of the brachium when the scapula is abducted can adversely affect the muscles located on the dorsal side of the scapula (14). In such situations, tear or avulsion of the supraspinatus muscle tendon can be seen and as a cause of chronic shoulder pain, the suprascapular nerve block is widely used for the treatment of these injuries (2, 5, 11, 14). On the other hand, in some clinical cases involvement of the infraspinatus muscle may accompany to the supraspinatus muscle injuries or isolated injuries of this muscle can also be seen (14). In such clinical conditions, proximal nerve block of the suprascapular nerve will be unnecessary. Since fibers of the suprascapular nerve which are innervating the infraspinatus muscle passes through the spinoglenoid notch, this notch should be the nerve block site for isolated infraspinatus injuries.

The spinoglenoid notch is located on the dorsal side of the scapula. Thus, the nerve block injections in guidance of processus coracoideus or extremitas acromialis of clavicle may not result successful nerve block due to ventral anatomic localization of the landmarks. Besides, as far as we know, there is no such definition for infraspinatus muscle block. Cadaveric dissection showed that acromion also appears to be useful for isolated nerve block which is regarding the nerve fibers of the infraspinatus muscle.

The most important limitation of our work is the comparatively low sample size. We are convinced that more detailed results will be obtained by further studies with larger sample size.

In conclusion, in this study, the acromion was evaluated in terms of the suprascapular nerve block and it was evaluated that it could be an alternative landmark. We think that we contribute literature especially in terms of injection site for the isolated infraspinatus muscle block.

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**Conflict of Interest**

The author declared he does not have anything to disclose regarding conflict of interest with respect to this manuscript.

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