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The suprascapular notch: its morphology and distance from the glenoid cavity in a Kenyan population

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The morphology of the suprascapular notch has been associated with suprascapular entrapment neuropathy, as well as injury to the suprascapular nerve in arthroscopic shoulder procedures. This study aimed to describe the morphology and morphometry of the suprascapular notch. The suprascapular notch in 138 scapulae was classified into six types based on the description by Rengachary. The suprascapular notch was present in 135 (97.8%) scapulae. Type III notch, a symmetrical U shaped notch with nearly parallel lateral margins, was the most prevalent type, appearing in 40 (29%) scapulae. The mean distance from the notch to the supraglenoid tubercle was 28.7 ± 3.8 mm. This varied with the type of notch, being longest in type IV (30.1 ± 1.8 mm) and shortest in type III (27.3 ± 2.3 mm). The mean distance between the posterior rim of the glenoid cavity and the medial wall of the spinoglenoid notch at the base of the scapular spine was found to be 15.8 ± 2.2 mm. Type III notch was the most prevalent, as found in other populations. In a significant number of cases the defined safe zone may not be adequate to eliminate the risk of nerve injury during arthroscopic shoulder procedures, even more so with type I and II notches. (Folia Morphol 2010; 69, 4: 241–245)

Key words: suprascapular notch, glenoid cavity, suprascapular nerve entrapment

INTRODUCTION

The suprascapular notch (SSN) is bridged by the superior transverse scapular ligament (STSL), which is sometimes ossified and the foramen and, thus completed, transmits the suprascapular nerve (SN) to the supraspinatus fossa [15]. Accordingly, this notch is an important landmark of the SN during arthroscopic shoulder operations [3, 14]. Furthermore, variation in the morphology of SSN has been identified as one of the causes of SN entrapment [4, 12]. Rengachary et al. [12] classified this notch into six types based on its shape.

Data on the morphology of the SSN and its distance from the supraglenoid tubercle are important in explaining the prevalence of SSN entrapment and minimising its injury. While notch morphology has been described in other populations, data among Africans is scarce, and no such association between the notch types and these safe zone distances has been made. This study, therefore, determined the prevalence of the various types of SSN and related them to distances from selected margins of the glenoid cavity.

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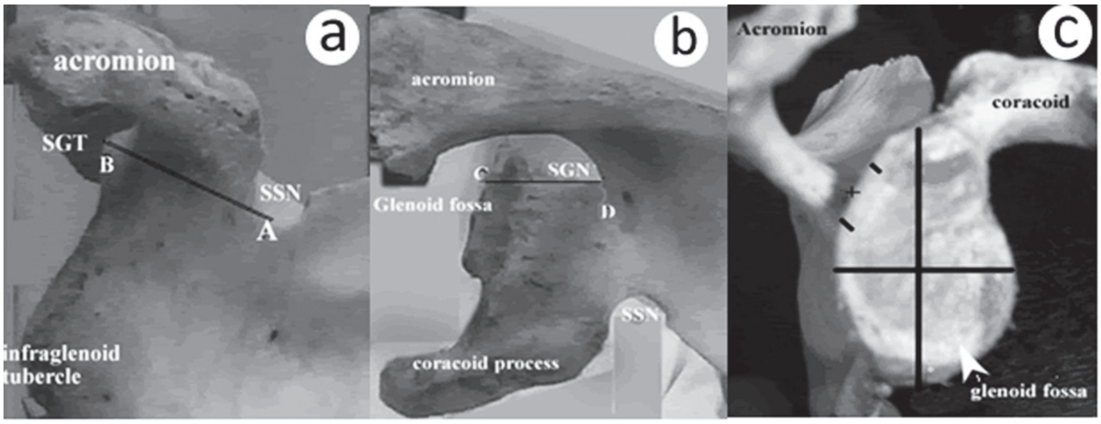

Figure 1. Lateral aspect of scapula; SGN — spinoglenoid notch; SSN — suprascapular notch; SGT — supraglenoid tubercle; **a.** The anterior view of the lateral aspect of the scapula. Note that distance AB was measured between the deepest point of the SSN (A) and the SGT (B); **b.** The superior view of the lateral aspect of the scapula; distance CD was measured between the medial wall of the SGN at the base of the scapular spine (D) and point C on the posterior rim of the glenoid cavity; **c.** Lateral view of the right scapula showing the glenoid cavity. Note point C (illustrated by a star) at the 10:30 position.

MATERIAL AND METHODS

A total of 138 human scapulae obtained from the Department of Human Anatomy of the University of Nairobi were analysed. Broken scapulae were excluded. Notch classification (type I–VI) was based on the description by Rengachary et al. [12]. The type of SSN was noted and recorded. Representative photographs of the various notch types were taken using a digital camera (Olympus 6.0 Megapixels). The distance between the deepest point of the SSN (A) and the supraglenoid tubercle (B) (Fig. 1A) and the distance between the medial wall of the spinoglenoid notch at the base of the scapula spine (D) and a point at the 10:30/1:30 clock position (right/left scapula) position on the posterior rim of the glenoid cavity (C) (Fig. 1B, C) were determined. Measurements were taken using a sliding vernier calliper SOMET™ CN-25 1234 (accurate to 0.1 mm) and recorded in millimetres. Data was analysed using SPSS version 13.0 for Windows and presented in tables and bar graphs. Student *t* test was used to compare distances in different types of notches ($p = 0.05$).

RESULTS

Morphology of the suprascapular notch

One hundred and thirty-eight (71 right, 67 left) scapulae were analysed. SSN was present in 135 (97.8%) scapulae (Fig. 2). The distribution of the various types of suprascapular notches is illustrated in Table 1. Type III was the most common type with 40 (29%) scapulae, whereas type VI was the least observed type with just four (2.9%) scapulae. In one scapula, a type V notch was present together with a complete foramen.

Distance between suprascapular notch and the supraglenoid tubercle

The mean distance between the SSN and the supraglenoid tubercle was 28.74 ± 3.8 mm (16–36 mm) (Fig. 3). The distance varied with the type of notch, with type V notch displaying the greatest distance and type III the least (Table 2). The difference was, however, not statistically significant ($p = 0.133$).

The distance between the posterior rim of the glenoid cavity and the medial wall of the spino-glenoid notch at the base of the scapula spine

The distance between the posterior rim of the glenoid cavity and the medial wall of the spinoglenoid notch at the base of the scapula spine was found to be 15.86 ± 2.2 mm (range: 14–20 mm). Grouped according to type of notch, the distances were distributed as shown in Table 3.

DISCUSSION

SSN was absent in three of the 138 (2.12%) scapulae studied. A complete absence of SSN has been reported in one case report [11] and has been suggested to be one of the predisposing factors for suprascapular entrapment neuropathy [8]. In tandem with other studies, SSN type III was the most prevalent while type VI was the least prevalent [9, 12]. However, our study reported the highest incidence of type I SSN. Usually type III SSN has a small sized

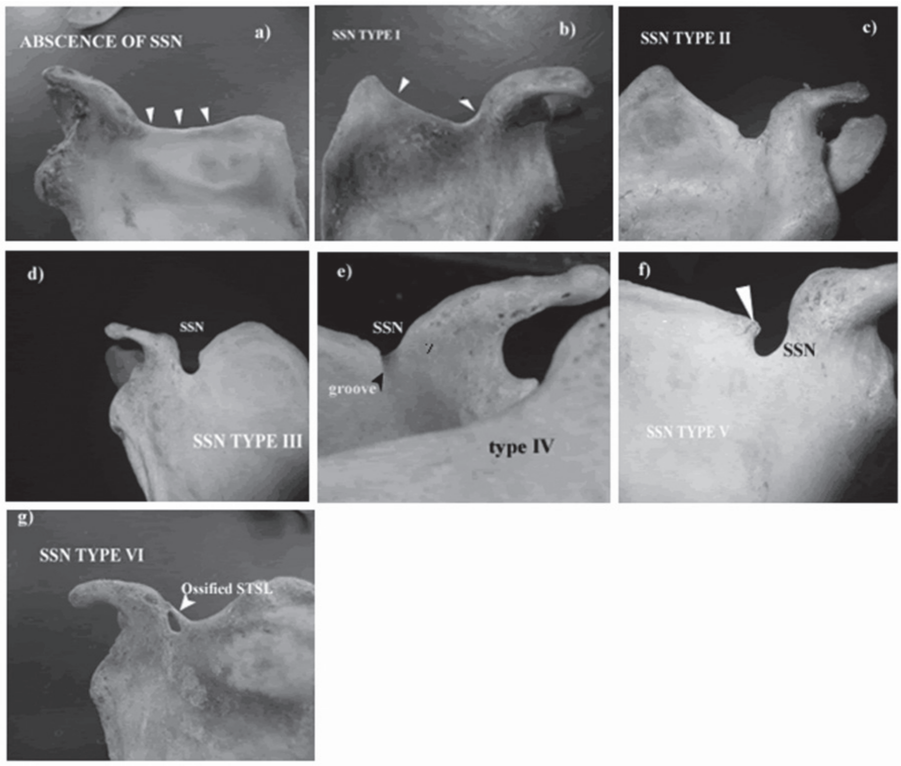

Figure 2. Anterior view of the scapula showing different types of suprascapular notch (SSN); **a.** Note the absence of a SSN along its superior border of the scapula (arrowheads); **b.** Type I: note a wide depression from the medial superior angle to the base of the spine; **c.** Type II: a wide blunted V shaped notch along the superior border at the scapula; **d.** Type III: a symmetrical U shape; **e.** Type IV: A small V shaped notch with a shallow groove adjacent to it as indicated by the arrowhead; **f.** Type V: Note the partial ossification of the superior transverse scapular ligament (STSL) (arrowhead); **g.** Type VI: Note the complete ossification of the STSL converting the notch into a complete bony foramen.

Table 1. Frequency of each type of suprascapular notch

Suprascapular notch	Left	Right	Total
Type I	16	14	30
Type II	14	15	29
Type III	24	16	40
Type IV	2	5	7
Type V	12	13	25
Type VI	1	3	4
Total	69	66	135

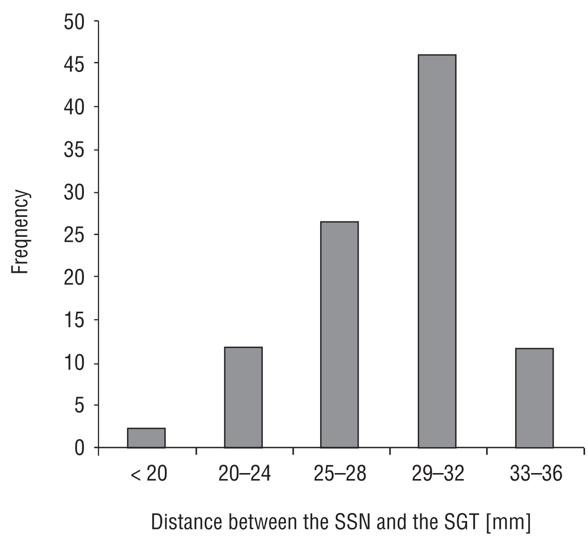

Figure 3. The distance between the suprascapular notch (SSN) and the superior aspect of the supraglenoid tubercle (SGT).

foramen, thus having a higher predisposition to SN entrapment neuropathy [13], especially if other contributing factors such as an anomalous STSL are present [1, 2, 5, 16]. It would be useful to find out the type of SSN in patients presenting with SN entrapment neuropathy locally to help explain the possible association between the two.

In one of the 135 (0.72%) scapulae a type V notch was observed together with foramen. This is higher than that reported in North Americans [16] and Greeks [9] but lower than that reported in French subjects [17] (Table 4).These findings suggest high inter-

Table 2. Distance between suprascapular notch and supraglenoid tubercle

Suprascapular notch	Frequency	Mean length AB [mm]	Range [mm]
Type I	30	29.15	16–36
Type II	29	29.03	20–35
Type III	40	27.35	22–34
Type IV	7	29.14	26–32
Type V	25	30.16	25–36
Type VI	4	27.38	25–30

Table 3. Distances between the posterior rim of glenoid cavity and the base of scapula spine

Suprascapular notch	Frequency	Range [mm]
Type I	30	8–19
Type II	29	14–20
Type III	40	12–19
Type IV	7	12–20
Type V	25	12–20
Type VI	4	14 – 20

Table 4. Coexistence of suprascapular notch (SSN) and foramina in different populations

Author	Population (N)	SSN + foramina
Kajava, 1925 [7]	Finnish (200)	1.5%
Vallois, 1926 [17]	French (200)	6.5%
Ticker et al., 1998 [16]	North American (79)	1.27%
Natsis et al., 2007 [9]	Greek (400)	0.75%
Present study, 2010	Kenyan (138)	2.9%

population variability in the coexistence of foramina with the notch. The coexistence of a notch with the foramen can theoretically lead to a decrease in the size of the foramen formed, thereby increasing the probability of nerve entrapment in the foramen.

One interesting finding is the relatively high prevalence of SSN type I (22%) compared to previous studies (Table 5). This probably reflects population differences. It is plausible to say that the ossification of the coracoid process and epiphysis influences the shape of the SSN. Odita et al. [10] reported that these appeared earlier in Nigerian infants than in Caucasians. Whether this will influence the type of notch formed is not clear, but could in part explain the population differences reported.

The distance between the SSN and the margin of the glenoid cavity is critical during open surgical procedures requiring dissection of the posterior shoulder joint [6, 18]. An effort to avoid injury to the SN during these procedures has lead to the description of a 'safe zone' based on a critical distance within which these procedures can be done safely [3, 14]. This has been reported to be 2.3 cm from the glenoid rim at the level of the superior rim of the glenoid and 1.4 cm from the posterior rim of the glenoid at the level of the base of the scapular spine [14]. The corresponding distances in the present study were less than 23 mm in 5.9% of scapulae and less than 1.4 cm in 12%, respectively. This calls for extra caution during arthroscopic procedures to the shoulder joint.

Nevertheless, 8 (5.9%) and 12 (12%) scapulae had dimensions falling short of those defined above (23 mm and 14 mm, respectively). This implies that the defined safe zone is inadequate for avoiding the SN in a significant number of patients. Moreover, regarding notch type and SN safe zone dimensions, types I and II had more cases within the defined safe zone. It is plausible, therefore, to suggest that when dealing with SSN types I and II, one has to be cautious of the possibility of SN injury during shoulder procedures.

CONCLUSIONS

Previous descriptions of 'safe zones' for arthroscopic shoulder procedures may not be reliably applied to all scapulae, especially those with type I and II notches. Our findings call for extra caution for surgeons operating on the shoulder joint.

Table 5. Frequency of various types of suprascapular notch (SSN) in different populations

Author	Population (N)	SSN I	SSN II	SSN III	SSN IV	SSN V	SSN VI
Natsis et al., 2007 [9]	Greek (423)	6%%	24%	40%	13%	11%	6%
Rengachary et al., 1979 [12, 13]	American (211)	8%	31%	48%	3%	6%	4%
Present study, 2010	Kenyan (138)	22%	21%	29%	5%	18%	4%

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