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Original Research Article

ANATOMICAL STUDY AND MORPHOMETRIC PREDICTIVE FACTORS OF THE SUPRATROCHLEAR FORAMEN OF THE HUMERUS IN A WEST AFRICAN SAMPLE

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ABSTRACT

Background: The supratrochlear foramen (STF) is the most important anatomical variation of the humerus with great significance. However, in our environment, studies are rare and the FST remains almost unknown. This research aimed to study the prevalence of STF in a West African sample, its morphological characteristics and predictive factors of its presence.

Material and methods: We investigated the presence, shape, side, situation and dimensions of the STF in 142 human adult humeri from West African cadavers. The morphometric measurements of the humeri were taken and we analyzed the predictive factors of the presence of the STF by binary logistic regression.

Results: The prevalence of the STF was 36.6%. In the depth of the olecranon fossa, the STF was closer to the medial epicondyle (24.9 ± 2.9 mm) than to the lateral epicondyle (26, 1 ± 2.8mm). The STF occurred in oval (50%), round (25%) triangular (23.1%) and irregular (1.9%) shapes. The mean transverse diameter of the STF was 6.5 ± 2.7 mm and 4.5 ± 1.5 mm for the vertical diameter. Humeri with STF had a significantly lower inter-epicondylar width; higher olecranon fossa width and height; and were significantly predominant on the left. The inter-epicondylar width *(OR=1.10, $P<0.001$)* and the width of the olecranon fossa *(OR=0.81 $P<0.001$)* were associated with the absence of STF.

Conclusion: A third of humeri in our population have STF. This implies that anatomists, anthropologists, orthopedists and radiologists should be aware of this frequent anatomical variation with great implications.

KEY WORDS: Supratrochlear foramen, West-Africans, Predictive factors.

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INTRODUCTION

The supra-trochlear foramen or septal aperture is the most important anatomical variation of the humerus [1]. It is an aperture formed when the bone septum separating the olecranon and coronoid fossae is perforated, making these two fossae communicate with each other on dry humerus [2-5]. The shape and size of the STF are variable, but three forms predominate: oval, triangular and round [6, 7].

Although the STF has always aroused a great deal of interest for anthropologists since its first description in 1825 [8], it has not constituted a focus of research for anatomists until recent past. However, in recent years, there has been a great deal of interest in the STF because of the numerous clinical applications and implications of its presence. For instance, humeri bearing a STF are more vulnerable to supracondylar fractures; their medullary canals are shorter and narrower, which may complicate the intramedullary fixation of their fractures [7, 9, 10]. Moreover, on a radiograph of the elbow, the STF may be misinterpreted as an osteolytic bone lesion [6, 11, 12]. Functionally, people with STF can perform hyperextension of the elbow [11, 13].

For anthropologists, the STF remains an enigma of evolution. The understanding of its origin seems crucial for the correct interpretation of several biological phenomena. Two major theories have been advanced concerning its origin: the mechanical theory and the genetic theory [14]. The mechanical theory states that the STF is formed by perforation of the inter-olecrano-coronoid septum by mechanical solicitation (flexion and hyperextention) of the elbow [7, 15]. In contrast, the genetic theory suggests that the STF is a genetically determined trait [1].

The prevalence of STF varies considerably based on ethnicity and region of the world, with ranges from 0.3 to 58% depending on studies [6, 16]. More curiously, in the same ethnic group, the prevalence of the STF seems to vary from one region of the world to another. Very few studies on the STF have been carried out in the different regions of Africa and the STF remain unknown. The aim of this study was to determine the prevalence of STF in a West African sample, to describe its anatomical characteristics and to determine the humeral morphological characteristics associated with its presence. The results would be useful to anthropologists, anatomists, orthopedists and radiologists.

MATERIALS AND METHODS

Study material: This study focused on dry adult human humeral bones, previously collected from Blacks cadavers of West African origin, at the Laboratory of Anatomy and Organogenesis of the Cheikh Anta Diop University of Dakar. All the adult humeri with physical integrity, free of antemortal or post-mortal trauma were included. A total of 142 adult humeri, of unknown age and sex, were analyzed.

Procedure: For each humerus, the presence of the STF was sought and established after visual observation, bearing in mind to discriminate between a true STF and a lesion of the bone specimen. The shape of the STF and its position with respect to the trochlear groove were registered. The following measurements were made as indicated in figure 1: the maximum transverse diameter (TD) and the maximum vertical diameter (VD) of the STF; the distance from lateral edge of the STF to the lateral epicondyle (LD); the distance from medial edge of the STF to the medial epicondyle (MD); and the maximum distance from the medial epicondyle to the lateral epicondyle (IEB).

We performed the following morphometric measurements for all the humeri included in the study: the maximum length of the bone; the inter-epicondylar breadth (IEB); the vertical (height) and transverse diameters (breadth) of the olecranon and coronoid fossae. The measurements were made using a digital caliper and a measuring tape and expressed in millimeters. Photographs of each specimen of bone were made.

Fig. 1: Landmarks of measurements on the distal epiphysis of the humerus. **1**: Vertical Distance; **2**: Transverse Distance; **3**: Lateral Distance; **4**: Medial Distance; **5**: Inter Epicondylar Breadth

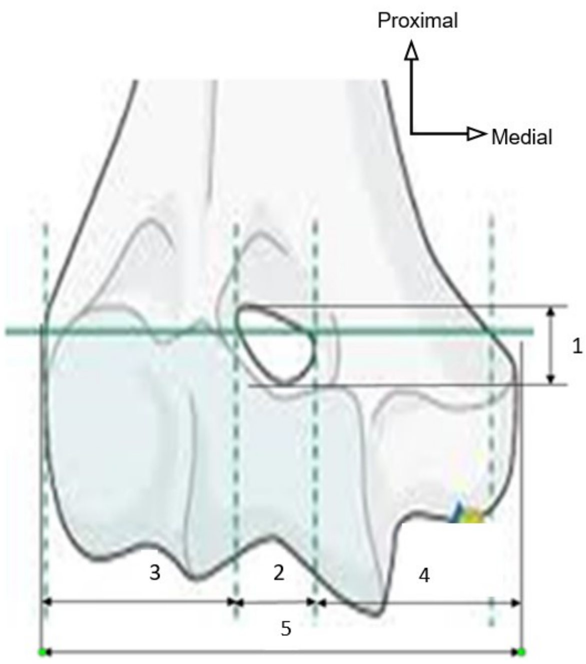
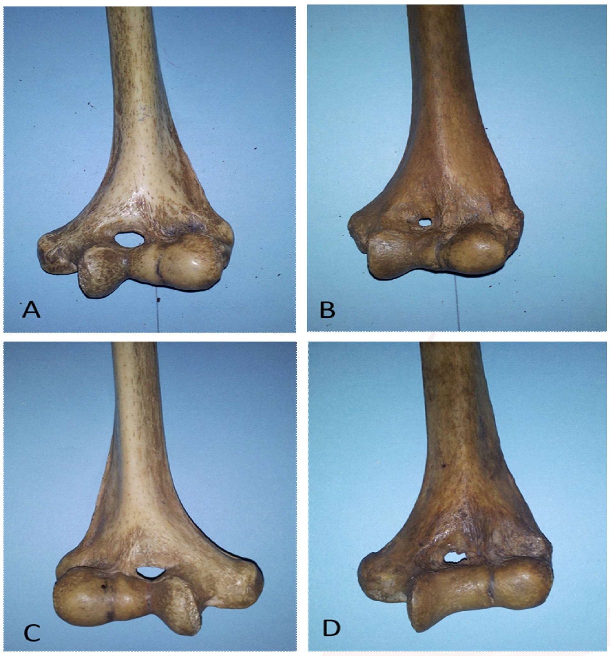


Fig. 2: Various shapes of the STF. **A**: Oval. **B**: Round. **C**: Triangular. **D**: irregular.



Statistics: The data collected was coded, entered and analyzed using *SPSS version 20.0 software (SPSS, Chicago, Illinois, USA)*. Continuous variables were described by average with standard deviation and categorical data in numbers and proportions (n, %). The Student's T test was applied to compare the continuous variables whereas the Chi-squared test or its equivalents were used to compare the categorical data. Multivariable logistic regression was used to determine predictive factors for the presence of the STF. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The general morphometry of the humeri is presented in Table 1. We examined a sample of 142 adult humeral bones, 66 (45.5%) of the right side and 76 (53.5%) of the left side.

Prevalence of the STF: The supra-trochlear foramen was observed in 52 bones of the 142, corresponding to a prevalence of 36.6%.

Situation of the STF: In the depth of the olecranon fossa above the trochlea, the STF had a central position in relation to the trochlear groove in 69.2% of specimen, lateral in 19.2 % and medial in 11.6% (See Table 2). It was proximal to the trochlea (inferior half of the olecranon fossa) in almost all cases (98.1%). Theaverage LD was 26.1 ± 2.8 mm whereas thea verage MD was 24.9 ± 2.9 mm.

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Shape of the STF: The oval shape was the most frequent with 26 (50%) cases; followed by the triangular (25%); round (23.1%) and irregular (1.9%) shapes (see table 2)

Dimensions of the STF: The average TD was 6.5 ± 2.7 mm while the average VD was 4.5 ± 1.5 mm.

Differences between humerus bearing STF and humerus without STF (Table 3): When we compared morphometric data of humeri presenting the STF with humeri without STF, the inter-epicondylar breadth (IEB) was significantly lower when the STF was present (56.5 ± 4.4 mm vs 57.6 ± 5.7mm, *P=0.007*). The height (24.0 ± 2.5 mm vs 23.6 ± 2.6 mm, *P=0.015*) and breadth (28.1 ± 2.4 mm vs 27.6 ± 2.4 mm, *P= 0.002*) of the olecranon fossa were significantly higher in STF bearing humeri. We also had a statistically significant difference for the sidedness (40.9% vs 31.8%, *P=0.008*), the STF been predominant on the left side.

Humeral morphological Predictors of STF (Table 4): In multivariate binary logistic regression analysis, the humeral morphological variables that influenced the variation of the presence of the STF were the inter-epicondylar breadth (IEB) and the transverse diameter of the olecranon fossa. The increase of each millimeter in IEB increased the odds of absence of the STF by 1.1 times, whereas the increase of each millimeter in the transverse diameter of theolecranon fossa decreased the Odds of absence by 0.8 times.

Table 1: General Morphometry of humeri.

Categorical variable	n (%)
Sidedness	
- Right	66 (46,5)
- Left	76 (53,5)
Continuous variables, in mm	**Mean (DS)**
Average length of the humerus	321,0 (21,9)
Mean inter-epicondylar breadth	57,2 (5,3)
Mean diameters of the olecranon fossa	
- Vertical	23,7 (2,6)
- Transversal	27,8 (2,4)
Mean Diameters of the Coronoid fossa	
- Vertical	15,7 (2,9)
- Transversal	17,4 (2,5)

Table 2: morphological features of the STF.

Categorical variables	n (%)
Form	
- Oval	26 (50,0)
- Triangular	13 (25,0)
- Round	12 (23,1)
- Irregular	1 (1,9)
Situation in relation to the trochlea groove	
- Central	36 (69,2)
- Lateral	10 (19,2)
- Medial	6 (11,5)
Continuous variables	**Mean (DS) in mm**
Distance from inferior border of STF to the trochlea	
- Anterior	5,4 (1,6)
- Posterior	9,3 (2,1)
Distance from inferior border of STF to the elbow line space	14,7 (1,9)
Diameters of the STF	
- Transverse distance (breadth)	6,5 (2,7)
- Vertical distance (height)	4,5 (1,5)
Maximum distance from STF to epicondyles	
- Medial epicondyle to medial border of STF	24,9 (2,9)
- Lateral epicondyle to lateral border of STF	26,1 (2,8)

Table 3: Comparison between humeri bearing STF and humeri without STF.

Variables	Humeri with STF (n = 52)	Humeri without STF (n = 90)	p
Sidedness: n (%)			
Right (n = 66)	21 (31.8%)	45 (50.0%)	0.008
Left (n = 76)	31 (40.9%)	45 (50.0%)	
Continuous variables, in mm : Mean (DS)			
Average humeral length	321,2 (19,8)	320,9 (23,0)	0,714
Mean inter- epicondylar breadth	56,5 (4,4)	57,6 (5,7)	0,007
Mean diameter of olecranon fossa			
Vertical	24,0 (2,5)	23,6 (2,6)	0,015
Transversal	28,1 (2,4)	27,6 (2,4)	0,002
Mean diameter of coronoid fossa			
Vertical	15,7 (2,5)	15,7 (3,2)	0,944
Transversal	17,6 (2,3)	17,3 (2,6)	0,174

Table 4: Morphological predictors of the absence of the STF.

Variables	Odds ratio (IC 95%)	*p*
Dominant right side	1,30 (0,96 – 1,77)	0,088
Length of the humerus	1,00 (0,99 – 1,01)	0,536
Inter-epicondylar breadth	**1,10 (1,06 – 1,14)**	**< 0,001**
Vertical diameter of the olecranon fossa	0,96 (0,90 – 1,03)	0,235
Transverse diameter of the olecranon fossa	**0,81 (0,74 – 0,88)**	**< 0,001**
Vertical diameter of the coronoid fossa	1,03 (0,96 – 1,09)	0,430
Transverse diameter of the coronoid fossa	0,97 (0,90 – 1,05)	0,420

Table 5: prevalence of the FST among different populations in increasing order.

Author, year	Study Population	Prevalence (%)
Papaloucas et al, 2011	Greeks	0,3
H. Varam, 2005	Romanians	1,8
Hirsh 1927 (reported by Morton and Crysler)	White American	4,2
Glandville, 1967	Netherlands	6,1
Orztuk et al., 2000	Egyptian	7,9
Li et al, 2015	Chinese	10,3
Erdogmus et al, 2014	Turkish	10,8
Trotter	Black Americans	12,6
Akabori, 1934	Japanese	18,1
Chagas et al, 2016	Brazilians	22,5
Shivaleela et al, 2016	South Indians	26,7
Chatterjee, 1968	East Indians	27,7
Sunday et al, 2014	Nigerians	27,7
Singh et Singh, 1972	North Indians	27,5
Singhal et Rao, 2007	South Indians	28
Kate et Dubey, 1970	Center Indians	32
Ndou et al, 2013	South Africans	32,5
Nayak et al, 2009	Indians	34,4
Our study	**Senegalese**	**36,6**
Krishnamurthy et al, 2011	Australians	46,5
Glanvile, 1967	Africans	47
Hirsh, 1927 (reported par Morton and Crysler)	Arkansas Indians	58

DISCUSSION

The STF of the humerus has been a neglected entity in standard anatomy and orthopedic books [6], yet its prevalence can reach up to 58 % in some studies and it is an important anatomical variation of great clinical and anthropological interest. To our knowledge, very few studies have been done on the subject in Black Africa, and this is the very first study on the STF in Senegal. In this sense, this work is a pilot study that provides valuable local data on the STF and can generate more interest in our environment.

Prevalence of the STF: This study performed on 142 unpaired humeri found a STF prevalence of 36.6%. Studies in Africa are rare in literature: Glanville [14] found 47%; Ndou [5] who studied a cosmopolitan population in South Africa found 32.5%; Sunday [17] in Nigeria found a prevalence of 28.7%. Global statistics reveal a prevalence of STF ranging from 0.3% to 58% (Table 5) depending on the region around the world and the population studied. The prevalence in Indian populations with the largest number of studies on STF is close to ours, ranging from 25 to 34.4% [6, 7, 18-21]; with the exception of Hirsh [3] who found 58% of STF among Arkansas Indians.

In general, the prevalence of the STF is low in American and European white populations and high in Black African and Indian populations. Curiously, while the prevalence of STF in the white populations mentioned above is very low (See Table 5. Greeks: 0.3%, Romanian: 1.8%, white American 4.2%, Netherlands: 6.1%); it is 16% in white South African populations and 48% in Australian populations. This makes it possible to hypothesize that these whites would have developed evolutionary adaptations to the environment when they migrated to these regions of the world. It is equally the same for these huge differences between the black populations of Africa (about 1/3 of the humeri) and black Americans (about 1 / 10) [22].

This wide disparity in the prevalence of the STF, which varies widely across ethnic group, but also across regions of the world, is in favor of genetic and evolutionary theory. Indeed, several studies have suggested that the STF would be a hereditary phylogenetic trait associated with evolution-related component [1, 7]. The STF is normally found in several species, such as dogs, hyenas, cats, primates. Darwin considers that the presence of the STF in humans is a factor in favor of the evolutionary theory of the origin of men who come from primates [2, 23]. Lamb observed that the STF was more present in ancient populations (prehistoric and Neolithic) and that this character tends to disappear with evolution [4, 24, 25].

Situation, shape and dimensions of the STF: Relative to the trochlear groove, the STF was centrally located in the olecranon fossa in 69.2% and proximal in almost all cases. Some authors suggested that the location of the STF would correspond to the maximum pressure point of the olecranon process on the inter-olecrano-coronoid septum, and could be an argument in favor of mechanical theory [5, 7]. According to Lamb, the STF is thought to be due to the impact pressure of the olecranon process of the ulna on the contact zone at the level of the septum in situations of hyperextention of the elbow, leading to the resorption of the septum at this level [15]. Kubicka et al. had shown that olecranon processes that respond to humeri with STF are more prominent than those corresponding to humeri without STF [26]. All this would explain why the STF is more common in dogs, hyenas and other primates because of the postures they adopt to tear their food [7, 27]. However, the presence of such a foramen in humans, who do not adopt such postures, is controversial. In addition, had it been that mechanical stress is the cause, then the STF should be more present on the right side and in male subjects. On the contrary, it is more frequently found on the left side and among women, suggesting that the STF is a predominant characteristic of "weak limbs" [28]. Better still, the same mechanical constraints should produce the same effects on the different populations, and therefore the same incidence of the STF, which does not seem to be the case because the distribution of the STF reveals an ethnic character.

The oval shape was the most found in our series in 50% of cases, in agreement with most of the studies. However, the factors that influence the shape of the STF remain unknown. Would it be related to the shape of the corresponding olecranon? This needs to be elucidated. The transverse diameter of the STF was 6.5 ± 2.7 mm against 4.5 ± 1.5 mm for the vertical diameter. These figures are close to those found by the majority of authors [5-7, 20, 25].

Anatomical factors associated with the presence of the STF: Humeri with STF had a significantly lower inter-epicondylar breadth than humerus without STF. However, it is clearly established that the IEB is a major discriminating factor that makes it possible to determine the membership sex of the humerus, the feminine being narrower [29]. The prevalence of the STF was significantly (P: 0.008) higher on the left humeri (40.9%) than on the right humeri (31.8%), which is in line with the majority of studies [5, 10, 18, 19, 27, 30]. We can therefore rightly infer that humeri with STF are less robust, reinforcing previous suggestions that slender limbs (such as in women and on the left side) are more prone to STF formation [5, 6, 28, 31]. Some authors have hypothesized that female and slender limbs, would have more laxity, allowing hyperextension causing excessive conflict between the olecranon process and the inter- olecrano - coronoid septum that would lead to its erosion and resorption [24]. In favor of that mechanical theory, studies have shown that the humerus is not perforated during the embryonic period. A thin bone plate always separates the coronoid and olecranon fossae until the age of 7, after which this bone septum can be resorbed to form the STF [3].

The mean height and breadth of the olecranon fossa were significantly higher in humeri with STF than in humeri without STF. The predictive factors significantly influencing the presence of the STF were the inter-epicondylar breadth (the larger the IEB, the lower the risk to present STF) and the breadth of the olecranon fossa (the larger the olecranon fossa, the higher the risk to present STF). Kubicka [26] found that the width and depth of the olecranon fossa and the prominence of the olecranon process positively influenced the presence of STF. In a recent study, Ndou et al [31] also found that the predictive factors were the length of the olecranon process and the depth of the olecranon fossa that positively influenced the presence of the STF. However, he did not measure the breadth of the olecranon fossa, just as we could not study the length of the olecranon process and the depth of the corresponding olecranon fossa. Nevertheless, all these convergent results allow us to suggest as Mays [15] that a longer olecranon process is much more likely to be in conflict with the inter-olecrano-coronoid septum, causing resorption of the latter, which leads to the formation of the STF. The mechanical theory is thus reinforced by these findings.

This study has some limitations. The availability of the ulna corresponding to each humerus, the pairing of the humeri, informations about age and sex of the individuals, would have allowed for better analysis. However, the rigor and reliability of the observations and measurements, as well as the relevance of the statistical analysis constituted the strength of this study.

CONCLUSION

This study revealed, for the first time, that the prevalence of STF in a sample from our population was high, found to be 36.6% of humeri. Of the three main shapes observed, the oval represents half. Its average diameter was 6.5 mm transversely and 4.5 mm vertically. Humeri with a STF were narrower and had a larger and higher olecranon fossa. The predictive factors for the presence of the STF were the inter-epicondylar breadth (negatively) and the breadth of the olecranon fossa (positively).

This high prevalence of STF in our population makes it mandatory to be known by orthopedists and radiologists in our milieu. They must always keep it in mind when analyzing a radiography of the elbow or performing surgery on the humerus. However, the etiology of that foramen remains an enigma to elucidate. At the end of this study, we suggest that the two theories are not mutually exclusive; the STF would be linked to the mechanical constraints occurring on a background with phylogenetic and racial predispositions.

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Conflicts of Interests: None

REFERENCES

[1]. Varlam H, Antohe D, Chistol RO. Supracondylar process and supratrochlearforamen of the humerus: a case report and a review of the literature. Morphologie 2005;89(286):121-125.

[2]. Chagas CA, Gutfiten-Schlesinger G, Leite TF, Pires LA, Silva JG Anatomical and Radiological Aspects of the Supratrochlear Foramen in Brazilians. J Clin Diagn Res 2016;10(9):10-13.

[3]. Hirsch IS. On a foramen in the lower extremity of the humerus. Radiology 1928;10:199-208.

[4]. Lamb D. The olecranon perforation. Am Anthropol 1890;3:159-165.

[5]. Ndou R, Smith P, Gemell R, Mohatla O. The supratrochlear foramen of the humerus in a South African dry bone sample. Clin Anat 2013;26(7):870-4.

[6]. Nayak SR, Das S, Krishnamurthy A, Prabhu LV, Potu BK. Supratrochlear foramen of the humerus: an anatomico-radiological study with clinical implications. Ups J Med Sci 2009;114(2):90-94.

[7]. Singhal S, Rao V. Supratrochlear foramen of the humerus. Anat Sci Int 2007;82(2):105-7.

[8]. Meckel JH (1825) cited in Kate BR, Dubey PN. A note on the septal apertures in the humerus of Central Indians. . Eastern Anthropologist 1970;33:270-84.

[9]. Akpinar F, Aydinlioglu A, Tosun N, Dogan A, Tuncay I, Unal O. A morphometric study on the humerus for intramedullary fixation. Tohoku J Exp Med 2003;199(1):35-42.

[10]. Paraskevas GK, Papaziogas B, Tzaveas A, Giaglis G, Kitsoulis P, Natsis K. The supratrochlear foramen of the humerus and its relation to the medullary canal: a potential surgical application. Med Sci Monit 2010;16(4):119-123.

[11]. De Wilde V, De Maeseneer M, Lenchik L, Van Roy P, Beeckman P, Osteaux M. Normal osseous variants

presenting as cystic or lucent areas on radiography and CT imaging: a pictorial overview. Eur J Radiol 2004;51(1)77-84.

[12]. Veerappan V, Ananthi S, Kannan N, Karthikeyan P. Anatomical and radiological study of Supratrochlear foramen of humerus. World journal of pharmacy and pharmaceutical sciences 2013;2(1):313 - 320.

[13]. Bhanu S, Sankar D. Anatomical note of supratrochlear foramen of humerus in south costal population of Andhra Pradesh. Narayana Medical Journal 2012;1(2).

[14]. Glanville EV. Perforation of the coronoid-olecranon septum. Humero-ulnar relationships in Netherlands and African populations. Am J Phys Anthropol 1967;26(1):85-92.

[15]. Mays S. Septal aperture of the humerus in a mediaeval human skeletal population. Am J Phys Anthropol 2008;136(4):432-40.

[16]. Christos P, Marios P, Apostolos P. Rare cases of humerus septal apertures in Greeks. Trends Med Res 2011;6:178–183.

[17]. Sunday O, Olusegun O, Oluwabunmi B. The Supratrochlear Foramen of the Humerus: Implications for Intramedullary nailing in distal Humerus. Journal of Biology, Agriculture and Healthcare 2014;4(7):136-139.

[18]. Chatterjee K. The incidence of perforation of olecranon fossa in the humerus among Indians. Eastern. Anthropologist 1968;21:270-84.

[19]. Kate B, Dubey P. A note on the septal apertures in the humerus of Central Indians. Eastern Anthropologist 1970;33:105-10.

[20]. Singh S, Singh S. A study of the supratrochlear foramen in the humerus of North Indians. J Anat Soc India 1972;21:52-6.

[21]. Rao EVK, Shiny VBH. A study on the incidence and size of the supratrochlear foramen of the humerus in south indian dry adult humeri with its clinical importance. Int J Anat Res 2018; 6(3):5647-5651.

[22]. Trotter M. Septal apertures in the humerus of American Whites and Negroes. Am J Phys Anthropol 1934;19:213-228.

[23]. Mathew AJ, Gopidas GS, Sukumaran. A Study of the Supratrochlear Foramen of the Humerus: Anatomical and Clinical Perspective. J Clin Diagn Res 2016;10(2):05-8.

[24]. C S, Afroze KH, S L. An osteological study of supratrochlear foramen of humerus of south Indian population with reference to anatomical and clinical implications. Anat Cell Biol, 2016;49(4):249-253.

[25]. Erdogmus S, Guler M, Eroglu S, Duran N. The importance of the supratrochlear foramen of the humerus in humans: an anatomical study. Med Sci Monit 2014;20:2643-50.

[26].Kubicka AM, Myszka A, Piontek J. Geometric morphometrics: does the appearance of the septal aperture depend on the shape of ulnar processes? Anat Rec. 2015;298(12):2030-8.

[27]. Akabori E. Septal aperture in the humerus in Japanese, Ain and Koreans. Am J Phys Anthrop 1934;18:395–401.

[28]. Benfer RA, McKern TW. The correlation of bone robusticity with the perforation of the coronoid-olecranon septum in the humerus of man. Am J Phys Anthropol 1966. 24(2):247-52.

[29]. Steyn M, Iscan MY. Osteometric variation in the humerus: sexual dimorphism in South Africans. Forensic Sci Int 1999;106(2):77-85.

[30].Krishnamurthy A, Yelicharla A, Takkalapalli A, Munishamappa V, Bovinndala B, Chandramohan M. Supratrochlear foramen of humerus—A morphometric study. Int J Biol Med Res 2011;2:829-831.

[31]. Ndou R, Schepartz LA. Morphometric Characteristics of the Humerus and Ulna in Limbs Bearing the Supratrochlear Aperture (STA). Anat Rec, 2016;299(2):220-33.

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