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MORPHOLOGIC AND MORPHOMETRIC STUDY OF SUPRA TROCHLEAR FORAMEN OF DRIED HUMAN HUMERI OF TELANGANA REGION

Udaya Kumar P., Sukumar C. D., Sirisha V., Rajesh V., Murali Krishna S., Kalpana T.

Department of Anatomy, Mamata Medical College, Khammam, Telangana, India.

ABSTRACT

Introduction: Olecranon fossa and coronoid fossa of lower end of humerus are separated by a thin plate of bone called supratrochlear septum. In some cases this septum is perforated, named as supratrochlear foramen.

Materials & Methods: The present study is carried out with 270 (119 left sided + 151 right sided) dried humeri of unknown sex and age. Bones were examined for the presence of supratrochlear foramen, their shape and measured vertical and horizontal diameters. Translucency of septum was identified by keeping the bone against a light source.

Results: Observation of 270 humeri showed the presence of Supra trochlear foramen in 57(26%) bones. 26% left sided bones and 17.21% of right sided bones were found to have STF. Oval shaped foramen dominated the other shapes. The mean transverse diameter of foramen was observed to be 6.36 ± 2.88 mm on left side and 5.76 ± 2.22 mm on right side, where as the vertical diameter was found to be 4.76 ± 2.64 mm mm on left side and 4.64 ± 2.45 mm on right side. Out of 213 bones, transluscency of septum was observed in 130 (61.03%) humeri.

Conclusion: The present study suggests left preponderance with majority of oval shape of supra trochlear foramen in similarity with most other studies done in India. The knowledge of STF is important to Orthopedicians, radiologists and Anthropologists

Key Words: Supra trochlear septum, Supra trochlear foramen, Humerus, Translucency of septum

INTRODUCTION

Olecranon fossa and coronoid fossa of lower end of humerus are separated by a thin plate of bone called supratrochlear septum. It is lined by synovial membrane in life[1]. In some cases this septum is perforated, called supratrochlear foramen. Supra trochlear foramen was also called as epitrochlear foramen, intercondylar foramen or septal aperture in various anthropometric studies. It was first described by Merckel in 1825[2]. Supratrochlear foramen has been described in dogs, rats and cattle by various animal studies[3, 4]. Paraskevas *et al.*[5] reported that the medullary canal is shorter in bones with supratrochlear foramen. With the increase in intramedullary nailing as a means of supracondylar fracture repair of humerus, it is of clinical significance to orthopedicians, as is also of great interest to anthropologists in establishing evolutionary relationship between lower animals and humans.

MATERIALS & METHODS

Aim of the study is to analyze the morphology and morphometry of supratrochlear foramen and to calculate its incidence in Telangana region of South India.

The present study is carried out in with 270 (119+151) dried humeri of unknown sex and age. Bones were obtained from the department of Anatomy, Mamata Medical College. One hundred and nineteen left sided and One hundred and fifty one right sided bones, free from pathological changes, were examined for the presence of supratrochlear foramen and their shape. Vertical and horizontal diameters were measured using vernier caliper. Translucency of septum was identified by light source from behind.

Corresponding Author:
Udaya Kumar P., Department of Anatomy, Mamata Medical College, Khammam, Telangana, India
E-mail: udaygmc@yahoo.co.in

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RESULTS

Two hundred and seventy dry humeri were observed for the presence of supra trochlear foramen. Out of 119 left sided bones, 31 bones (26%) and out of 151 bones, 26 (17.21%) bones were found to have supra trochlear foramen. Twenty six (21.9 %) left sided bones and nineteen (12.6%) bones on the right showed oval shaped foramen. rounded foramen was observed in five bones both on right side (3.3%) as well as on the left side (4.2%). A Triangular shaped foramen and a semi lunar foramen were observed in two individual right sided bones (Figure No.1). The mean transverse diameter of foramen was observed to be 6.36 mm on left side and 5.76 mm on right side with a standard deviation of 2.88 mm and 2.22 mm respectively, where as the vertical diameter was found to be 4.76 mm on left side and 4.64 mm on right side with a standard deviation of 2.64 mm and 2.45 mm respectively. Out of 213 bones, transluscency of septum was observed in 130 (61.03%) humeri with 63.07% (82) on left side and 36.92% (48) on right side. Comparative data on incidence of various shapes, mean and standard deviation of vertical & horizontal diameters of supra trochlear foramina are shown in tabular form (Table No: I & II).

DISCUSSSION

Various mechanisms have been postulated, explaining the reasons for existence of supratrochlear foramen. Tyllianakis, *et al.*[6] considered this foramen as atavistic, in contradiction to the popular theory of mechanical pressure causing this foramen in the distal end of humerus during hyper extension or due to larger olecranon process. Brauer, *et al.*[7] suggested that the Joint hyper mobility on left side and in females is the reason for high prevalence of the same. Hirsh *et al.*[8] proposed that the pressure of olecrenon process reduces the blood flow to the septum, leading to the formation of foramen. Benfer[9] and Sahajpal *et al.*[10] attributed this formation of foramen to disturbance of calcium metabolism and excessive bone resorption during child growth respectively. According to Blakely *et al.*[11], supra trochlear foramen is a phylogenetic character found in primates, which is expressed in weaker limbs and suppressed in the stronger limbs.

Statistics show that the incidence of STF in Indian population ranges from 19.17% (Veerappan *et al.*[12]) to 40.78% (Jadhav Maryuri *et al.*[13]). Incidence of STF in various studies in India are tabulated (Table no. III). 26% of bones showed the presence of supra trochlear foramen in the present study.

The frequency of supra trochlear foramen is higher on left side than on the right, in almost all the studies as was observed in the present study also. In contrast Nayak *et al.*[14] and Kumarasamy S A[15], observed the frequency of supra trochlear foramen to be higher on right (44.5% and 36.6% respectively) side than on left (26.8% and 22.8% respectively) side. Singhal S.[16] found that the frequency was similar on both sides.

In seperate studies by Bhanu PS *et al.*[17] and Krishna Murthy *et al.*[18], anupama *et al.*[19] and Manjappa[20], translucency of septum was found in 82.14% and 66.6%, 62% and 48.4% of humeri respectively. vasantha bhai[21] and veerappan[12] reported an incidence of 66.6%, 545.8% respectively, chiefly on right side in contrast to the above said studies. In the present study the translucency was found to be in 61.03% with 63.07% (82) on left side and 36.92% (48) on right side. As De Wilde V *et al.*[22] pointed out, Radiological misinterpretation of STF can avoided with the knowledge of STF, as it may be mistaken with osteolytic or cystic lesion of distal end of humerus.

In the present study the average transverse diameter was found to be 6.36 ± 2.88 mm on left side and 5.76 ± 2.22mm on right side, and vertical diameter was found to be 4.76±2.64 on left side and 4.64 ± 2.45 on right side, which was observed to be in close proximity to all the other studies.

The knowledge of STF is a necessity to orthopedicians as the presence of STF poses difficulty in fixation of supra condylar fracture by intra medullary nailing. Akpinar *et al*[23], observed that the humeri with septal aperture have very narrow medullary canal. Paraskevas[5] advised that the antegrade route is better for intramedullary nailing, than retrograde method, in people with STF.

CONCLUSION

The present study suggests left preponderance with majority of oval shape of supra trochlear foramen in similarity with most other studies done in India. But in view of smaller sample size in many studies, the statistics need to be carefully considered before radiological diagnosis or undertaking surgical interventions.

ETHICAL COMMITTEE CLEARANCE: As the study included only dry human bones from the bone bank of department of Anatomy, ethical committee clearance was not taken into consideration. Authors will take the responsibility of any further allegations regarding ethical clearance that arise from the study.

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Table 1: Showing the incidence of shape of STF on left and right sides.

Shape of STF*	LEFT (Percentage) n = 119	RIGHT(Percentage) n = 151
Oval	26 (21.9%)	19 (12.6%)
Rounded	5 (4.2%)	5 (3.3%)
Triangular	Nil	1 (0.7%)
Semilunar	Nil	1 (0.7%)

*STF = Supra trochlear foramen. n = no.of humeri studies

Table 2: Showing the mean and standard deviation of transverse and vertical diameters of STF

Side	Transverse diameter		Vertical diameter	
	Mean	SD*	Mean	SD*
Left	6.36	2.88	4.76	2.64
Right	5.76	2.22	4.64	2.45

*STF = Supra trochlear foramen.SD = Strandard Deviation

Table 3: Showing the percentage of incidence of STF in various studies in India.

Author (Region/state in India)	Percentage of Incidence of STF
Veerappan V[12] (Tamilnadu) - 2013	19.1% (14 out of 74 bones)
Hima Bindu A et al[24] (Andhra Pradesh) - 2013	20% (10 out of 50 bones)
Krishnamurthy A et al[18] (Andhra Pradesh) - 2011	23% (42 out of 180 bones)
Sejal V Patel et al[25] (Gujarat) - 2013	23.5% (133 out of 565 bones)
Rakeshkumar Diwan[26](Utter Pradesh, North India) - 2013	24.1% (428 out of 1176 bones)
Varalaxmi K L et al[27] (Karnataka) - 2014	25.8% (22 out of 85 bones)
Chatterjee et al[32] (Eastern India) - 1968	27.4%
Jaswinder Kaur et al[28] (Punjab) - 2013	27.5% (22 out of 80 bones)
Berjina Farooq Naqshi et al[29] (Jammu) - 2015	27.5% (22 out of 80 bones)
Singh S et al[31] (North India) - 1972	27.5%
Raghavendra et al[30] (Karnataka, South India) - 2014	28% (28 out of 100 bones)
Suruchi Singhal et al[16] (Banglore, South India) - 2007	28% (42 out of 150 bones)
P Sharmila Bhanu et al[17] (Costal Andhra Pradesh) - 2012	30.58% (37 out of 121 bones)
T Manjappa et al[20] (Karnataka) - 2014	31% (155 out of 500 bones)
Suba Ananthi Kumarasamy et al[15] (Tamilnadu) - 2011	31.3% (67 out of 214 bones)
Kate BR et al[1] (Central Indians) - 1970	32%
Soubhagya R Nayak et al[14] (Karnataka) - 2009	34.3% (132 out of 384 bones)
Jadhav Mayuri et al[13] (Maharashtra) - 2013	40.78% (31 out of 76 bones)
Present study (Telangana, South India) – 2015	26% (57 out of 270 bones)

*STF = Supra trochlear foramen.

Figure 1: Showing various shapes of supra trochlear foramen. 1. Oval shape, 2. Round shape, 3. Triangular shape, 4. Semilunar shape.