IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 6 Ser.8 (June. 2023), PP 39-42
www.iosrjournals.org

Osteological Study Of Supratrochlear Foramen Of Humerus And Its Clinical Implications

Dr. Abhishek Kavlekar[1], Dr. Fatima De Souza[2]
[1] *(Tutor/Demonstrator, Department of Anatomy, Goa Medical College, Bambolim Goa, 403202)*
[2] *(Associate Professor and Officiating Head, Department of Anatomy, Goa Medical College, Bambolim Goa, 403202)*

Abstract
Background: *The radial fossa and the coronoid fossa are two fossae located anteriorly at the lower end of humerus. Posteriorly the lower end presents the olecranon fossa. Separating the olecranon fossa and coronoid fossa is a plate of bone which is thin. This thin plate presents a foramen called supratrochlear foramen in some humerii. The supratrochlear foramen is a common anatomical variation at the distal end of the humerus.*
Materials and Methods: *Supratrochlear foramen was studied in 75 humerii [35 right and 40 left] in the Department of Anatomy, Goa Medical College. The prevalence and the diameters of the supratrochlear foramen were measured as well as the distances of the foramen from the medial and lateral epicondyle and the mid-point of trochlea. All the measurements were performed using digital Vernier caliper with a least count of 0.01 mm.*
Results: *The data collected was analysed using SPSS software version 20 and was tabulated using Microsoft office Excel. Out of the 75 humerii studied, supratrochlear foramen was seen to be present in 18 humerii showing an incidence of 24 %. Supratrochlear foramen was present in 5 out of 35 right humerii (14.28%) and 13 out of 40 left humerii (32.50%).*
Conclusion: *The high incidence of the supratrochlear foramen deserves attention by the orthopaedic surgeons, surgeons and radiologist since it has not been mentioned in most of the standard textbooks. Our study has highlighted the high incidence of the foramen in Goan as well as in the Indian population and its importance in day to day practice of orthopaedic surgeons and radiologists.*
Keywords: *Radial fossa, coronoid fossa, olecranon fossa, supratrochlear foramen, anthropology, supracondylar fracture, epicondyle*

Date of Submission: 05-06-2023 Date of Acceptance: 15-06-2023

I. INTRODUCTION

The radial fossa and the coronoid fossa are two fossae located anteriorly at the lower end of humerus. Posteriorly the lower end presents the olecranon fossa. Separating the olecranon fossa and coronoid fossa is a plate of bone which is thin. This thin plate presents a foramen called supratrochlear foramen in some humerii. Meckel first described the supratrochlear foramen in 1825 [1].

Hrdlicka observed that the incidence of supratrochlear foramen is more in higher primates compared to lower animals.[2] This foramen was considered by Darwin, as one of the features which demonstrates the evolution of humans from primates.[3] Therefore it is of importance in anthropology to establish a relationship between man and lower animals. The presence of supratrochlear foramen could help in a greater degree of extension movement at the elbow joint since it may allow the olecranon process of ulna to pass into the foramen in full extension.

The presence or absence of supratrochlear foramen is of importance not only for anatomists and anthropologists, but also for orthopaedic surgeons and radiologists for their routine clinical practice with regard to fractures of lower end of humerus. Hence in cases of supracondylar fractures of humerus, pre-operative planning would be required with regard to the presence of supratrochlear foramen if present. Also, this foramen can be mistaken for a lesion such as a cyst in an x-ray.

Supratrochlear foramen [STF] in the distal end of the humerus is always associated with a narrow intramedullary canal in its lower end. Since narrowing of canal is more pronounced in the distal end of humerus above the STF, there are difficulties faced during intramedullary nailing procedures in cases of supracondylar fractures.[4]

Hence the aim of this study is to determine the incidence, size and distance of the supratrochlear foramen from the humeral condyles in humerii of Goan population.

II. MATERIALS AND METHODS

Supratrochlear foramen was studied in 75 humerii [35 right and 40 left] in the Department of Anatomy, Goa Medical College. Ethical clearance was obtained from the institutional ethics committee before starting the research. Humerii with loss of bony features were excluded from this study. The prevalence of supratrochlear foramen was noted and the distance of the foramen from the medial and lateral epicondyles and also its distance from the mid-point of trochlea was measured. The vertical and transverse diameters of the foramen were also measured. All the measurements were performed using digital Vernier caliper with a least count of 0.01 mm. The measurements were tabulated and analysed using Microsoft office Excel.

III. RESULTS

Out of the 75 humerii studied, supratrochlear foramen was seen to be present in 18 humerii showing an incidence of 24 %. Supratrochlear foramen was present in 5 out of 35 right humerii (14.28%) and 13 out of 40 left humerii (32.50 %).

The incidence of supratrochlear foramen was higher in the left humerii as compared to the right humerii. The mean vertical diameter of the supratrochlear foramen was 3.43 ± 1.59 mm on right side and 3.68 ± 1.80 mm on the left side. While the mean transverse diameter on right side was 6.12 ± 2.56 mm and 6.09 ± 2.33 mm on the left side. The mean distance of the supratrochlear foramen from the medial epicondyle was 26.08 ± 1.40 mm on right and 26.65 ± 2.66 mm on left side. Distance from the lateral epicondyle was 26.18 ± 1.76 mm on right and 26.49 ± 1.92 mm on the left side. And distance from the mid-point of the trochlea was 13.07 ± 1.04 mm on right and 14.27 ± 1.32 mm on the left side.

Table 1: Incidence of supratrochlear foramen in humerii irrespective of age and sex.

Side of humerii	No.of humerii with supratrochlear foramen	Total no. of humerii	Percentage
Right	5	35	14.28 %
Left	13	40	32.5 %
Total	18	75	24 %

Table 2: Distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea.

Distance	Right [mm]	Left [mm]
Distance of foramen from medial epicondyle	26.08 ± 1.40	26.65 ± 2.66
Distance of foramen from lateral epicondyle	26.18 ± 1.76	26.49 ± 1.92
Distance of foramen from mid-point of trochlea	13.07 ± 1.04	14.27 ± 1.32

Table 3: Diameters of supratrochlear foramen.

Diameters	Right [mm]	Left [mm]
Vertical	3.43 ± 1.59	3.68 ± 1.80
Horizontal	6.12 ± 2.56	6.09 ± 2.33

IV. DISCUSSION

The Supratrochlear foramen has not been described in standard Anatomy and Orthopaedic text books. It is commonly found in primates and hence it is considered to be an atavistic feature.[2] In animals such as primates this foramen could have been formed in order to increase the range of extension at the elbow joint. The exact cause of supratrochlear foramen is not been mentioned in standard anatomy textbooks, However, one hypothesis suggests that mechanical factors such as an overgrown olecranon or coronoid process could lead to erosion of the thin plate of bone between the coronoid and olecranon fossa thus forming an aperture.[5]

The foramen may be occurring as a result of atrophy of bone after ossification which in turn is a result of impact pressure during hyper- flexion or hyper-extension at the elbow joint which causes resorption of the coronoid-olecranon septum at a point where the coronoid process or olecranon process of the ulna would potentially make contact.[6]

In Indian population, the incidence is different in different regions. In Eastern Indians it is 27.4% [7] ,in Central Indians 32% [1] ,in South Indians 28% [3], while in North Indians it is 27.56% [8]. In Americans it is 6.9 % [9], in Egyptians 7.9% [10] and in Japanese the incidence is 18.1% [11].

In the present study done in Goan population the incidence has been found to be 24 %, which suggests the incidence is slightly on the lower side as compared to other regions of India.

The incidence of supratrochlear foramen has been found to be more common on the left humerii as compared to the right humerii in past studies as well as our study. This could be due to the fact that the right hand

is the dominant hand and as a result the bones of the right upper limb are more robust and resistant to formation of apertures.

The mean vertical diameter of the supratrochlear foramen in our study was 3.43 ± 1.59 mm on right side and 3.68 ± 1.80 mm on the left side. While the mean transverse diameter on right side was 6.12 ± 2.56 mm and 6.09 ± 2.33 mm on the left side. These finding were similar to those found in other studies.

Table 4: Comparative data showing incidence of supratrochlear foramen in various populations

Population	Prevalence [%]	Author
Chinese	17.5	Ming-tzu[15]
Japanese	18.1	Akabori[11]
Koreans	11	Akabori[11]
Turks	12	Cimen et al. [16]
Africans	47	Glanville[17]
Libyans	57	Macalister[18]
Egyptians	7.9	Ozturk et al[10]
Greeks	0.304	Papaloucas et al.[19]
Europeans	6	Glanville[17]
Italians	9.4	Hrdlička[2]
Germans	8.8	Hrdlička[2]
Australians	46.5	Hrdlička[2]
Native Americans [Arkansas]	58	Hirsh[20]
African Americans	21.7	Hirsh[20]
White Americans	4.2	Hirsh[20]
Mexicans	38.7	Krishnamurthy et al.[14]
American	6.9	Benfer and Mckern[21]
Indians	34.4	Nayak et al. [13]
North Indians	27.5	Singh and Singh [9]
Eastern Indians	27.4	Chatterjee [12]
Central Indians	32	Kate and Dubey [1]
South Indians	28	Singhal and Rao [3]
Indians [Telangana region]	23	Krishnamurthy et al. [14]
Goans	24	Present study

Table 5. Incidence of supratrochlear foramen on right and left sides in various studies.

Population studied	Right [%]	Left [%]
Japanese [11]	25	27
North Indians [9]	24	31
Eastern Indians [12]	22	35
Central Indians [1]	28	35
South Indians [4]	22	20
Present study	14.28	32.50

Table 6: Comparative data showing diameters of supratrochlear foramen observed in previous studies
(VD = Vertical Diameter, TD = Transverse diameter)

Author	Diameter	Right (mm)	Left (mm)
Nayak et al. [2009] [13]	TD	5.99 ± 1.47	6.55 ± 2.47
	VD	3.81 ±0.97	4.85 ± 1.64
Krishnamurthy et al.[14]	TD	5.22.47	6.50 ± 2.59
	VD	4.0 ±1.52	4.70 ± 1.69
Veerappan et al. [2013] [22]	TD	8.30 ± 1.07	7.53 1.28
	VD	4.09 ± 1.13	5.35 ±1.60
Mathew et al. [2016] [23]	TD	5.24 ± 1.76	4.88 ± 1.63
	VD	3.82 ± 1.07	3.37 ± 1.25
Present study	TD	6.12 ± 2.56	6.09 ± 2.33
	VD	3.43 ± 1.59	3.68 ± 1.80

Intramedullary nailing is a common procedure done in cases of traumatic injuries and pathological fractures. The high incidence of supratrochlear foramen in Goan population makes the preoperative evaluation of the foramen necessary for intramedullary nailing procedures of lower end of humerus.

In supracondylar fracture of humerii having a pre-existing supratrochlear foramen, instead of performing a retrograde medullary nailing it would be advisable to perform antegrade nailing. This is due to the fact that in humerii with a supratrochlear foramen there is a higher chance of secondary fracture since it such humerii have a narrow medullary canal in the distal part. [24]

In radiographs of the elbow joint, the foramen can be mistaken for a cystic or an osteolytic lesion.

Hence we can conclude that the high incidence of the supratrochlear foramen deserves attention by the orthopaedic surgeons, surgeons and radiologist since it has not been mentioned in most of the standard textbooks. Preoperative evaluation has to be done to look for supratrochlear foramen before proceeding for intramedullary nailing in cases of supracondylar fracture of humerus. Prior anatomical knowledge of the foramen may also keep a check on the errors in interpretation of x-rays by radiologists.

V. CONCLUSION

Our study has highlighted the high incidence of the foramen in Goan as well as in the Indian population and its importance in day to day practice of orthopaedic surgeons and radiologists.

REFERENCES

[1]. Kate BR., Dubey PN., A note on the septal apertures in the humerus of central Indians, Eastern anthropologist.,1970, 33, 105-110.
[2]. Hrdlicka A., The humerus septal apertures, Anthroplogie,1932, 10, 34-96.
[3]. Singhal S., Rao V., Supratrochlear foramen of the humerus, Anat Sci Int,2007, 82, 105-107.
[4]. Shivaleela C., Khizer Hussain Afroze, An osteological study of supratrochlear foramen of humerus of south Indian population with reference to anatomical and clinical implications, Anat Cell Biol, 2016, 49, 249-253
[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, 870-4.
[6]. Lamb D.S., The olecranon perforation , Am Anthropol,1890, 3, 159-74.
[7]. Mall [1905] cited by Chatterjee KP., The incidence of perforation of olecranon fossa in the humerus among Indians. Eastern Anthropologist, 1968, 21, 270-284.
[8]. Singh, Singh SP., A study of the supratrochlear foramen in the humerus of North Indians. J Anat Soc India, 1972, 21, 52-56.
[9]. Benfer, McKern T., The correlation of bone robusticity with the perforation of the coronoid-olecranon septum of humerus of man. Am J Phys Anthropol, 1966, 24, 247-252.
[10]. Ozturk A, Kutlu C, Bayraktar B, Zafer ARI, Sahinoglu K., The supratrochlear foramen in the humerus [Anatomical study]. st Tp Fak. Mecmuas, 2000, 63, 72-76.
[11]. Akabori E., Septal apertures in the humerus in Japanese,Ainu and Koreans. Am J Phys Anthropol, 1934, 18, 395-400.
[12]. [Chatterjee KP., The incidence of perforation of olecranon fossa in the humerus among Indians. Eastern Anthropol, 1968, 21, 279-84.
[13]. 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, 90-4.
[14]. Krishnamurthy A, Yelicharla AR, Takkalapalli A, Munishamappa V, Bovinndala B, Chandramohan M., Supratrochlear foramen of humerus: a morphometric study. Int J Biol Med Res, 2011, 2, 829- 31.
[15]. Ming-Tzu P., Septal apertures in the humerus in the Chinese. Am J Phys Anthropol, 1935, 20, 165-70.
[16]. Cimen M, Koşar Y, Sonmez M., Humerus' ta apertura septalis ile ilgili bir araştırma. Antropoloji, 2003, 14, 20-3.
[17]. Glanville EV. Perforation of the coronoid-olecranon septum., Humero-ulnar relationships in Netherlands and African populations., Am J Phys Anthropol, 1967, 26, 85-92.
[18]. Macalister A., Anatomical notes and quaries. Series II., Perforate humeri in ancient Egyptian skeletons., J Anat Phys, 1990, 35, 121-2.
[19]. Papaloucas C, Papaloucas M, Stergioulas A., Rare cases of humerus septal apertures in Greeks. Trends Med Res, 2011, 6, 178-83.
[20]. Hirsh IS.,The supratrochlear foramen: clinical and anthropological considerations. Am J Surg, 1927, 2, 500-5.
[21]. 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, 247-52.
[22]. Veerappan V, Ananthi S, Kannan NG, Prabhu K., Anatomical and radiological study of supratrochlear foramen of humerus. World J Pharm Pharm Sci, 2013, 2, 313-20.
[23]. Mathew AJ, Gopidas GS, Sukumaran TT., A study of the supratrochlear foramen of the humerus: anatomical and clinical perspective. J Clin Diagn Res, 2016, 10:AC05-08.
[24]. 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, 119-123.