Supra-trochlear foramen and its clinical significance

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ABSTRACT :

Background: Supra-trochlear foramen is not described in textbooks of anatomy and orthopedicsbut clinically and radiologically its presence in adult human humerus is very important for intramedullary nailing for treatment of supracondylar fractures and to prevent misinterpretation of radiographs respectively.

Methods: The study was carried on 222 dry adult human humeri (113 right sided and 109 left sided), of unknown sex, for the presence of supra-trochlear foramen. When foramen was present then its shape was observed and remaining bones were observed for translucency and perforation ofcoronoid-olecranon septum.

Results: Supra-trochlear foramen was present in 77 (34.68%) humeri. It was present on right side in 39 (34.51 %) bones out of 113 and on left side in 38(34.86 %) bones out of 109. We observed translucency of the coronoid-olecranon septum in 105 bones and it was perforated in 15 bones. We observed three different types of shape of supra-trochlear foramen.

Conclusion: The results of our study showed that the incidence of supra-trochlear foramen was almost same on right and left side. Its high incidence in Indian population requires special attention during surgery especially intramedullary humeral nailing of humerusand interpretation of X-rays by radiologists.

Keywords: Supra-trochlear foramen, Humerus, supracondylar fractures, Intramedullary nailing

INTRODUCTION:

A thin plate of bone which separates the coronoid fossa in front and the olecranon fossa behind of humerus is known as the coronoid-olecranon septum (COS). This septum is lined in fresh state by the synovial membrane of elbow joint and its thickness varies from 0.5mm to 1cm. Sometimes, this thin bony plate becomes transparent or may contain several perforationsor in some humeri it may become perforated to form a foramenwhich is known as supra-trochlear foramen (STF) or septal aperture. In 1825, Meckel described this foramen. [1] This thin plate is always present until the age of seven years. STF occurs due to intralamellar space enlargement and gradual absorption ofcoronoid-olecranon septum.STF is more frequent in higher primates other than man. [2]Many researchers studied the incidence of STF in human population and higher primates. It was described in dogs, hyenas, cattle, and other primates. [3, 4]Incidence of STF in adults varies from 6.9% to 60% in different races [3, 4, 5] and it is more frequent in females.[6]This foramen is one of the points in establishing relationship between man and lower animals therefore it is of great interest to anthropologists.The presence of STF is significant not only for anatomist and anthropologist but for radiologist and orthopedic surgeons in cases of humeral fractures and their management as concerns the STF. [7, 8]The objective of present study was to describes the incidence of supra-trochlear foramen in the humeri of Indian population.

MATERIAL AND METHODS:

Supra-trochlear foramenwas studied in 222 humeri (113 right sided and 109 left sided humeri) of unknown sex and age. These bones were obtained from our department and students from 1st M B B S and BPTh. The bones were free of any pathological changes were used. The bones where the foramen was present, we observed the shapes. The incidence of STF was noted side wise. We tested the remaining humeri against the light for translucency and perforations

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in the coronoid-olecranon septum.

RESULTS:

Supra-trochlear foramenwas present in 77 (34.68%) humeri out of 222. It was present on right side in 39 (34.51 %) bones out of 113 and on left side in 38(34.86 %) bones out of 109.In remaining bones, we observed translucency of the coronoid-olecranon septum in 105 (right-51; left-54)bones (Fig. 1a, 1b) and it was perforated in 15(right-9; left 6)bones (Fig. 2a, 2b). We observed three different types of shape of supra-trochlear foramen (Fig. 3).

Shape	Right (n= 39)	Left(n= 38)
Oval	27	25
Round	06	07
Irregular	06	06

Table 1 showing the incidence of different shapes of supra-trochlear foramen

DISCUSSION:

The supra-trochlear foramen is commonly found in primates. Therefore, it is considered to be an atavistic character.[8] Ample of studies has been carried out on STF of humerus. Incidence of presence or absence of STF in human populations varies significantly between ethnic groups as well as individuals of the same ethnic groups with similar habits and occupation. [2, 9] Various populations showed different percentage of STF as shown in Table 2.

Populations	Incidence
Americans	6.9%
White Americans	4.2%
Japanese	18.1%
South Africans	32.5%
Turkish populations	8.6%
Egyptians	7.9%
Indians	34.4%
Present study	34.68%

Table 2 showing the incidence of STF in various populations

Incidence of STF in Indian populations is different in different regions. It is present in Eastern Indians -27.4% [10], central Indians- 32% [1], North Indians-27.5% [11], and South Indians - 28%. [12]Present study observed the incidence of STF 34.68% which suggest that the occurrence is slightly on higher side as compared to other Indians. The results of the study showed that the occurrence of STF is almost same on right and left side; with the oval shape was the commonest. But most of the researchers observed its incidence more common on left side, with the oval shape. Present study observed that, the majority of bones that had no foramen showed translucency and perforation of the coronoid-olecranon septum (Fig 1a, 1b and 2a, 2b) which is also variable when we compared with other researchers. [12, 13]

Exact reason for occurrence of the STF is not known. Various hypotheses have been put forward. According to Lamb [14]the occurrence of it may be due to atrophy of the bone after ossification due impact pressure in cases of hyper-flexion or hyper-extension at elbow joint which leads to resorption of the COS at a point where the coronoid process or olecranon process of the ulna would potentially make contact and it explains why the foramen is common in primates because of the postures used by animals while tearing morsels of food but the presence of foramen in humans who do not assume such posture is debatable. According to Benfer andMcKern [15] it is a phylogenetic characteristic feature frequently found in primates and is suppressed by the stronger limb and exhibited in the weaker limb.

Figure 1a and 1b- Showing translucency of the coronoid-olecranon septum of humerus against light.

Figure 2a and 2b- Black arrow showing perforations of the coronoid-olecranon septum of humerus

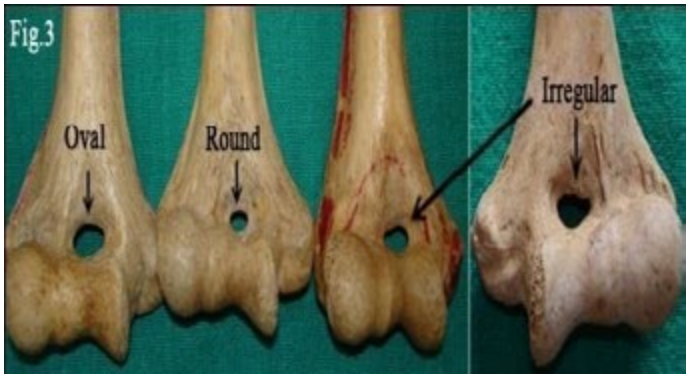

Figure 3-Black arrow showing different shapes of supra-trochlear foramen of humerus

The presence of the STF in the lower end of the humerus makes it more difficult to plan out intramedullary nailing because it is always associated with a narrow medullary canal in the humerus. Also, the STF is seen as a type of 'pseudolesion' in any X-ray of the lower end of humerus, which can be mistaken for an osteolytic or cystic lesion. Therefore, the knowledge of the presence of STF is important for preoperative planning for treatment of supracondylar fractures and interpretation of radiographs. [13]

CONCLUSION:

Supra-trochlear foramen is not described in textbooks of anatomy and orthopedics. However, its high incidence in Indian population requires special attention during surgery especially intramedullary humeral nailing of humerusand interpretation of X-rays by radiologists. This data will be helpful for orthopedic surgeons, radiologist and anatomist. Also, erroneous study should be done in different ethnic groups as well as individuals of the same ethnic groups with similar habits and occupation with the help of dry bones, cadaveric study and new imaging techniques which will provide us detail knowledge.

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