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Research Article

MORPHOMETRIC ANALYSIS OF SEPTAL APERTURE OF HUMERUS

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ABSTRACT

Introduction: Lower end of humerus shows olecranon and coronoid fossae separated by a thin bony septum, sometimes it may deficient and shows foramen which communicates both the fossae called Septal aperture, which is commonly referred as supratrochlear foramen (STF). **Materials & Methods:** We have studied 260 humeri (126 right side and 134 left side), measurements were taken by using vernier caliper, translucency septum was observed by keeping the lower end of humerus against the x-ray lobby. **Results:** A clear cut STF was observed in 19.2% bones, translucency septum was observed in 99 (91.6%) humeri on the right side and 95 (93.1%) humeri on the left sides respectively (Table – 1). **Clinical significance:** The presence of STF is always associated with the narrow medullary canal at the lower end of humerus, Supracondylar fracture of humerus is most common in paediatric age group, medullary nailing is done to treat the fractures in those cases the knowledge about the STF is very important for treating the fractures. It has been observed in x-ray of lower end of the humerus the STF is comparatively radiolucent, it is commonly seen as a type of 'pseudolesions' in an x-ray of the lower end of humerus and it may mistake for an osteolytic or cystic lesions. **Conclusion:** The present study can add data into anthropology and anatomy text books regarding STF and it gives knowledge of understanding anatomical variation of distal end of the humerus, which is significant for anthropologists, orthopaedic surgeons and radiologists in habitual clinical practice.

Keywords: Humerus, Sepatal aperture, Supratrochlear foramen, Medullary canal, anthropology

INTRODUCTION

A thin plate of bony septum (0.5 to 1 mm thickness) is present between olecranon and coronoid fossae at the distal end of the humerus. In some bones this bony septum may shows several perforations and in some bones it shows clear foramen named as Septal aperture, which is commonly referred as Supratrochlear foramen (STF), if this anatomic variation is wider one can overextend the elbow joint.[1] It has been termed the septal aperture by Hrdlicka.[2] It also has been designated by a variety of names, among the more well-known being Supratrochlear foramen (STF), Septal aperture, Intercondylar foramen, Olecranon foramen.[3] Patience and detailed look at the literature show that the STF was first described by Meckel (1825)[4], since then it has been described in various animals like cattle, dogs, hyenas and other primates.[5]

STF is always associated with narrow medullary canal, in that case it is not easy to perform intramedullary fixation of the humerus in traumatic injuries and pathologic fractures is very difficult. According to Hirsh etal.,[6] and Morton the thin bony

plate observed between the olecranon and coronoid fossa is always present until the age of seven years, after which the bony septum becomes absorbed to form the STF.[6]

Various authors have been reported about STF and it is evaluated radiologically for pathologic lesions and abnormal cyst. Even though there are many studies the occurrence of STF is variant based on races and region. The present study focused to highlight the percentage of incidence of STF, morphological features and its clinical importance, which may be useful for anthropologist, orthopaedic surgeons and radiologist in day to day clinical practice.

The knowledge about the structure of humerus may play vital role in the intramedullary fixation. The medullary canal width at the entry point of a retrograde intramedullary nail was statistically smaller in humeri with foramen than in humeri without it.[7] Furthermore, the medullary canal of the humeri with foramen ends more proximally than the canal of non-foramen humeri.

MATERIALS AND METHODS

The STF was studied in 260 (126 right side and 134 left side) macerated adult humeri of unknown sex and age mostly of south Indians of Tamilnadu region. These bones were collected from the bone bank of Anatomy and Forensic Medicine departments of Karpagam Medical College, Coimbatore, Tamilnadu. Damaged and Pathologically defected bones were excluded from the study, all these bones were carefully screened to observe the presence of STF and the shape of STF (Oval or Round) is also noted. The Transverse and Vertical diameter of STF was measured by using vernier caliper (Fig-1). The STF varied in different shape such as round and oval (Fig 2). In some bones we observed translucency of septum which was noted by placing lower end of humerus against X-ray lobby (Fig -3).

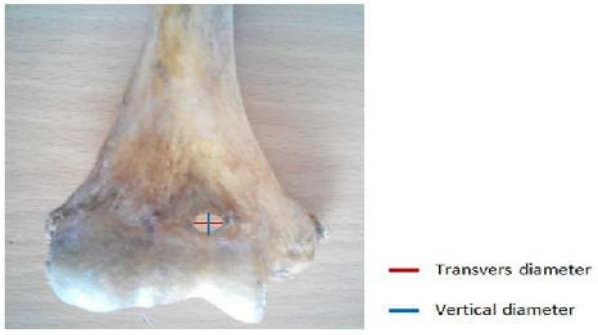

Fig 1: Photograph: Showing measurements of STF

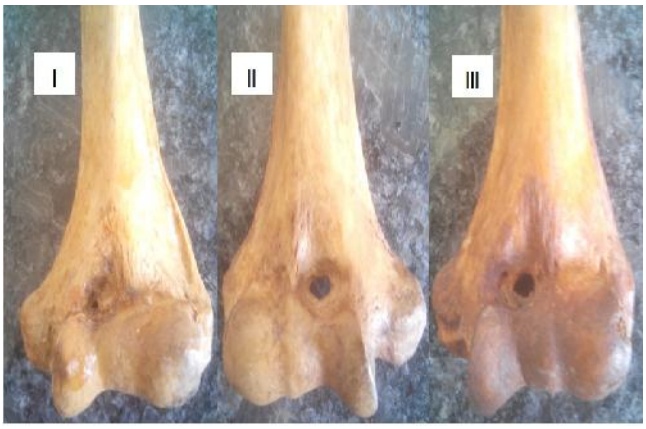

Fig 2: Photograph showing various shapes of STF I). Round II). Oval III). Triangular

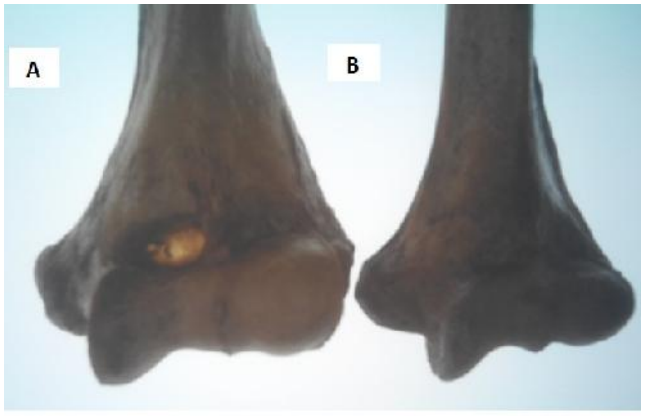

Fig 3: Shwoing distal end of humerus against x-ray lobby (A: Translucency septum, B: Opaque septum)

RESULTS

A Clear cut supratrochlear foramen was found in 19.2% of humeri (Figure No–1 & 2). Septal apertures are more common on the left humeri than the right ones. Out of 260 humeri (126 right side and 134 left side) 19.2% (50humeri) of bones showed septal aperture, oval shaped (70%) foramens were more common than vertical shaped (30%) ones. The maximum transverse diameter of STF is 9.5 mm, 11 mm on the right and left sides, respectively. The maximum vertical diameter of STF on the right is 6 mm and left side is 10 mm. The mean length of the transverse diameter for supratrochlear foramen was 6.5 and 5.1 on the right and left sides, respectively (Table – 2). The mean length of the vertical diameter for STF was 4.7 and 3.9 on the right and left sides, respectively (Table - 2). STF was abscent in 210 (80.7%) humeri: in 108 (85.7%) humeri of the right

side and in 102 (76.1%) humeri on the left side. In that most of the bones without foramen showed a translucency septum and in some bones showed opaque septum (Table – 1). Translucent septum was observed in 99 (91.6%) humeri on the right side and 95 (93.1%) humeri on the left sides respectively.

Table 1: Showing Frequency of STF and Translucent septum

Side	Number of bones	Presence of STF	Translucent septum	Opaque septum
Right	126	18(14.2%)	72 (66.6%)	36(33.3%)
Left	134	32(23.8%)	76 (74.5%)	26(25.4%)

Table 2: Showing Different Measurements of STF

Side	Transverse diameter (mm)	Vertical diameter (mm)
	Mean±SD	**Mean±SD**
Right	5.1± 2.4	3.9±1.4
Left	6.5±2.5	4.7±1.6

DISCUSSION

The STF is a foramen of the bony septum, which separates the olecranon and coronoid fossae at the distal end of the humerus. Its occurrence in adults varies from 6-47% in population of india. The STF, since it was first described by Meckel in 1825[4], has been identified in many groups, present study is mainly focusing on presence of STF and its morphological and morphometric analysis in south Indians of tamilnadu region. There are previous studies in the Indian population which reported the incidence to be 32%, 28%, 27.5%, and 27.4% in central Indians, south Indians, North Indians, and Eastern Indians, respectively[4 8 9 10] . Our study on south Indians of tamilnadu population showed an incidence of 19.2%, which is slightly lower prevalence than earlier studies.

The incidences of STF are 14.2% and 23.8% on the right side and left side, respectively, which is similar to earlier studies. STF was absent in 80.7% of humeri, in that 57% is showing translucent septum which is similar to the studies by Anupamamahajan (2011)[8] and Sejal V. Patel et al (2013).

The STF of the humerus has been a neglected topic in anthropology, standard anatomy and orthopedics text books. The incidences of STF were not described clearly, it may due to atrophy of septum or may be mechanical. According to the opinion of previous authors the occurrence of STF is due to atrophy of the bony septum after ossification; atrophy of the bony septum is due to the impact pressure in cases of the extension of the arm in straight line direction[11 12]. The incidences of STF are most common in cattle, dogs, hyena and other primates because of the posture used by animals while tearing morsels of food. In cats septal aperture is absent because supracondylar aperture is most common in cats[13]. If the mechanical stress is the causative agent, then it should be more on right side. In contrast, it is more common on left side according to the present and previous studies[14]. It can be explained that it is a phylogenetic characteristic feature frequently found in primates.

Racial incidence of the STF as shown in (Table-3) represents evolutionary aspects of the foramen in addition to its clinical significance and its anthropological importance[15]. STF is found only in mammals and is inconstant in various species. Darwin mentions this foramen in humans as one of the characteristic that show man's close relationship to lower forms. Anthropologists say that STF is more in ancient primitive people than recent civilization[2 9 16 17].

Table 3: Comparative data (in %) of septal aperture in humerus, race-wise

Race	Percentage
Australians	46.5
Egyptians	43.9
Mexicans	38.7
Central Indians	32
American Indians	29.6
Eastern Indians	27.4
Eskimos	19.8
American negroes	18.4
Japanese	18.1
Koreans	11
Italians	9.4
Germans	8.8
American whites	6.9
Present study	19.2

Clinical significance: Supracondylar fractures most common injuries in the paediatricage group[16]. Intramedullary humeral nailing is done to treat supracondylar fractures which become more difficult in presence of STF leading to secondary fractures. The distal portion of the medullary canal in humeri with the STF was narrower and shorter than in

humeri without foramen. Therefore, the knowledge of presence of STF may be important for preoperative planning for treatment of supracondylar fractures and perform antegrademedullary nailing rather than retrograde medullary nailing.

X-ray is performed at the lower end of humerus to detect bone cysts, tumors and other lytic lesions in day to day clinical practice. It has been observed in x-ray of lower end of humerus the STF is comparatively radiolucent, it is commonly seen as a type of 'pseudolesions' in an x-ray of the lower end of humerus and it may mistake for an osteolytic or cystic lesions[7]. So that, anatomical knowledge about the STF may minimizes the wrong interpretation of x-rays by radiolucent.

CONCLUSION

The presence of STF is an important variation in the distal end of humerus, our study highlighted the percentage of incidence of STF and its morphological and morphometric analysis. The incidence is 19.2% and it is more common on left humeri than right humeri which agrees with previous others. The present study can add data in to anthropology and anatomy text books regarding STF and it gives knowledge of understanding anatomical variation of distal end of humerus, which is significant for anthropologists, orthopaedic surgeons and radiologists in habitual clinical practice.

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