

## The Supratrochlear Foramen of the Humerus: Implications for Intramedullary nailing in distal Humerus

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### Abstract

Supratrochlear foramen (STF) is an important anatomical variation resulting from perforation of Olecrano-Coronoid septum. In spite of high incidence of STF in Nigerians, there is paucity of literature on STF morphometry and clinical implications. 65 dried humeri of unknown sex and age were collected from bone bank of Department of Anatomy, University of Ibadan. The dimensions of STF were taken using the digital vernier calliper. The STF was seen in 27.7% of total humeri occurring more frequently on the left side. The commonest shape is oval while the least is triangular. The radiolucency of bones without STF was determined using X-ray. The STF is an important single factor which determines the route and mode of insertion of intramedullary nail during the management of supracondylar fractures.

**Keywords:** Humerus, supratrochlear foramen, intramedullary nailing.

### Introduction

The olecranon and coronoid fossa at the distal humerus are usually separated by a thin bony septum lined by a synovial membrane in life. In some individuals, the bony septum may become perforated to form an opening above the epiphysial line called the Supratrochlear Foramen. Following the first description of STF by Merckel in 1825, studies have shown STF to be more frequent in females and more characteristic on the left side (Warren, 1897 and Hirsh, 1927). The STF is formed after the age of 6 years following incomplete ossification, intralamellar space enlargement or gradual septum absorption (Hirsh, 1927; Ming Tzu, 1935). Individuals with STF may be able to hyperextend the elbow joint (De Wild et al., 2004). Despite its non inclusion in Terminologia Anatomica name, the recent increased practice of intramedullary nailing has made STF more relevant than before. Studies have shown medullary canal to be shorter in bones with STF compared to bones without STF (Paraskevas et al., 2010).

### Materials and Methods

The supratrochlear foramen was studied in 65 adult dried humeri (29 right side and 36 left side) of unknown sex. The pathology free bones were obtained from the bone bank of Department of Anatomy, University of Ibadan. The presence of STF was observed and classified into four types (Round, Oval, Triangular, and Kidney shaped) [Fig 1]. The transverse diameter, vertical diameter, distance of STF from the tip of medial condyle and septum thickness were measured in millimeters using the digital vernier caliper (6 inches 150mm Dhgac digital vernier caliper). The X-ray of the lower end of the humerus (Postero-anterior view) was taken using Dean Mobile II X-ray machine in ultrad radiology unit of University of Ibadan health center and the translucency of the septum was noted by placing the film against the X-ray lobby [Fig 2].

### Results

Out of 65 humeri studied, clear cut supratrochlear foramen (STF) was found in 18 humeri (27.7%). The STF was round, oval, triangular and kidney shaped in 4, 10, 1 and 2 cases respectively. The mean dimension of transverse diameter for STF on the left ( $6.82 \pm 2.92\text{mm}$ ) was significantly greater than that on the right ( $4.95 \pm 1.02\text{mm}$ )  $P = 0.02$  (Table 1). The mean dimension of vertical diameter for STF on the left ( $5.00 \pm 2.40\text{mm}$ ) was not significantly higher than that on the right ( $3.33 \pm 1.04\text{mm}$ )  $P = 0.10$ –Table1. The incidence of STF was greater on the left side (77.8%) as compared to the right (22.2%). The STF was absent in 47 humeri (72.3%). The mean septum thickness on the left side ( $2.40 \pm 0.22\text{mm}$ ) was statistically greater than the mean septum thickness on the right side ( $1.89 \pm 0.99\text{mm}$ )  $P = 0.05$ . The bones that had no STF showed a translucency of septum in 18 cases (54.5%) on the right side and 15 cases (45.5%) on the left side. The mean of distance of STF from the tip of medial condyle was ( $26.30 \pm 2.07\text{mm}$ ) on the right and ( $25.82 \pm 2.75\text{mm}$ ) on the left. The difference was not statistically significant.

## Discussion

Detailed look at the literature revealed that there is a paucity of studies on STF in Nigerian population. The global statistics show an incidence of 4.2%, 18.4%, 8.8%, 18.1%, 21.7%, 43.9% and 9.4% in White Americans, American Negroes, Germans, Japanese, African Negroes, Egyptians and Italian populations respectively. The incidence of STF in this study (27.7%) doubles that of Northern Indians.

The aetiology of STF has been an issue of controversy over the years. Some authors claimed that STF occurs as a result of incomplete ossification while others attributed the cause to the mechanical pressure from a large olecranon process during hyperextension of elbow. Recent studies counteract the mechanical pressure hypothesis claiming that since large olecranon process are features of males, STF would have been commoner in males.

Racial variations in occurrence of STF support the evolutionary theory. STF has been reported in animals like dogs, horse, and hyena with a similar pattern to that of man. Charles Darwin mentioned STF in humans as one of the characteristics linking origin of man's evolution to lower animals. The STF is commoner in ancient primitive people than modern man, hence the presence of STF can be an invaluable tool to the anthropologists for dating specimens.

The STF appears radiolucent on X-ray and can be confused for an osteolytic or cystic lesion (De Wilde V et al). Knowledge of STF may check misinterpretation of X-ray by radiologists.

Supracondylar fracture is the commonest fracture after femoral shaft fracture amongs paediatrics in Nigerians (Nwadinigwe CU et al.,2005). Intramedullary nailing has been a procedure of choice for managing supracondyloid fracture. Due to the narrowing of distal medullary canal in bones with STF, an antegrade route has been advocated rather than a retrograde nailing route (Paraskevas et al., 2010).

In antegrade intramedullary nailing of the humerus, the nail length and diameter should take into account the distal narrowing of the humerus. The nail should end approximately 1 to 2cm proximal to the olecranon fossa.

In retrograde nailing the insertion hole in the distal humerus is made 2.5cm from the tip of the olecranon fossa.

The medullary canal of the humerus is wider in the proximal third and circular in shape while it is narrower in the distal third with the shape been oval. Intramedullary nailing has however become popular with the advent of locked nails.

In adults with complex supracondylar fracture of the humerus, stable fixation is often achieved with the placement of two plates on the posterior aspect of humeral pillars. In humerus with a wide supratrochlear foramen, there will be difficulty in placing the plates to achieve stable reduction (Bryan R S and Brakel W H, 1971).

## Conclusion

The STF is a neglected but important anatomical entity. The high incidence of STF (27%) in Nigerians calls for caution in choosing the route of intramedullary nail insertion. An antegrade route is favored to retrograde route due to narrowed distal medullary canal encountered in bones with STF. The knowledge of STF may also be beneficial to radiologists and anthropologists.

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Fig 1: Photograph showing the various shapes of Supratrochlear foramen.

A-Triangular STF

B- Kidney shaped STF

C- Circular STF

D- Oval STF





Fig 2: Radiograph showing radiolucency of Olecrano-coronoid septum.  
 (Arrows shows the radioluscent septum)

Table 1: Different measurements of STF dimensions and septum dimensions on both sides of humerus.

STF dimensions	Right side	Left side	P-value
Transverse diameter of STF in mm( mean± SD)	4.95 ±1.02	6.82±2.92	0.02
Vertical diameter Of STF in mm (Mean±SD)	3.33±1.04	5.00±2.92	0.10
Distance of STF in mm (Mean±SD)	26.30±2.07	25.82±2.75	0.53
Septum thickness in mm (Mean±SD)	1.89±0.99	2.40±0.22	0.05