

Anatomical Variations of the Distal Humeral Septum: A Cross-Sectional Study on the Presence of the Supratrochlear Foramen

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Abstract

A cross-sectional, descriptive study was conducted in the Department of Anatomy, Mymensingh Medical College, Mymensingh, Bangladesh, between July 2021 and June 2022, to assess the prevalence and morphological dimensions of the supratrochlear foramen of the humerus in a Bangladeshi population. A total of 100 dried humeri (43 right-sided and 57 left-sided) of unknown sex and age were included, selected through purposive sampling. Damaged, unossified, or fractured humeri were excluded to ensure the accuracy of this study. In this study, among 43 right humeri, the supratrochlear foramen was observed in 10(23.25%) cases, while it was absent in 33(76.75%) cases. Among 57 left humeri, 17(29.82%) had the supratrochlear foramen, and it was absent in 40(70.18%) cases. The anatomical knowledge of the supratrochlear foramen is essential for professionals such as anthropologists, orthopedic surgeons, and radiologists. Understanding its presence and variations is particularly important in the context of supracondylar fractures of the humerus, as it can aid in accurate diagnosis, treatment planning, and the avoidance of potential complications during surgical procedures or imaging.

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Introduction

The supratrochlear foramen (STF) is an important and relatively common anatomical variation located at the distal end of the human humerus (Fig. 1). Despite its clinical and anthropological relevance, the STF has often been overlooked in standard anatomical and orthopedic textbooks. However, recent studies highlight the importance of recognizing this structure due to its implications for anatomists, anthropologists, orthopedic surgeons, and radiologists.¹ A thin, transparent bony plate known as the supratrochlear

septum, typically varying in thickness from 0.5 mm to 1 cm, separates the olecranon fossa and coronoid fossa of the humerus. In the fresh state, this septum is lined by the synovial membrane of the elbow joint. It may contain multiple small perforations and, in some individuals, becomes fully perforated to form an aperture called the supratrochlear aperture or supratrochlear foramen (STF).² Developmentally, the septum is consistently present until the age of seven years, after which it may be partially or completely

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absorbed, resulting in the formation of the STF.³ This change tends to occur during adolescence or adulthood, often due to incomplete ossification in the distal humerus.⁴ Interestingly, the STF is not exclusive to humans; it is also found in various other mammals such as apes, dogs, hyenas, and other primates. In these species and in humans, the STF is associated with hyperextension of the elbow joint, which plays a role in certain habitual or functional activities.⁵⁻⁶ Its presence has anthropological significance, serving as a point of comparison in the evolutionary relationship between humans and lower animals. Clinically, this variation holds importance, particularly for orthopedic surgeons performing procedures like intramedullary fixation of the humerus. The presence of STF can affect the structure and strength of the distal humerus, underscoring the necessity for thorough anatomical knowledge and preoperative planning, especially in trauma or fracture management.⁷

The present study aimed to examine the morphology of the supratrochlear foramen of the human humerus, with a detailed comparison to the available literature.



Fig.1: Supratrochlear foramen of the human humerus bone⁸

Methods

This cross-sectional, descriptive study was conducted in the Department of Anatomy, Mymensingh Medical College, Mymensingh, Bangladesh, between July 2021 and June 2022.

A total of 100 fully ossified dry human humeri were collected for this study. We adopted a non-random purposive sampling technique for sample selection. Bones that were unossified, developmentally abnormal, or broken were excluded from the study. The focus was on the lower end of the humerus, where the presence of the supratrochlear foramen was observed and recorded (Fig. 2 & 3).

Data was collected and recorded in the data sheet. Then data was scrutinized, compiled, coded and analyzed using MS-Excel sheet. Descriptive statistics were presented as frequency and percentage. Data was presented in tabulated form.

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of Mymensingh Medical College, Mymensingh, Bangladesh.



Fig. 2: Photograph showing the supratrochlear foramen of the right humerus



Fig. 3: Photograph showing the supratrochlear foramen of the left humeri.

Results

In the present study, out of 43 right humeri, the supratrochlear foramen was present in 10(23.25%) cases and absent in 33(76.75%) cases. Out of 57 left humeri, the supratrochlear foramen was present in 17(29.82%) cases and absent in 40(70.18%) cases (Table-I).

Table-I: Incidence of the supratrochlear foramen in right and left humeri (N=100)

Supratrochlear foramen	Right (n=43)		Left (n=57)	
	Frequency	Percentage	Frequency	Percentage
Present	10	23.25	17	29.82
Absent	33	76.75	40	70.18

Discussion

In the present study, out of 43 right humeri, the supratrochlear foramen was present in 23.25% cases. Similar observation was reported by Shivaleela, Afroze & Lakshmiprabha (22.22%) and Bhanu & Sanka (26.53%)^{9,10}. However, our result is

higher than that of Jadhav *et al.* (15.78%)¹¹, Abo Sablan & Calmon (6.32%)¹², Erdogmus *et al.* (4.8%)¹, Mahitha *et al.* (13.60%)⁷, Bahsi (19.94%)¹³, Arunkumar *et al.* (19.6%)¹⁴, and Kumar *et al.* (17.21%)¹⁵. In contrast, our result is lower than that of Lalita *et al.* (46.37%)¹⁶, Silva *et al.* (39.32%)¹⁷, Nayak *et al.* (44.5%)¹⁸, and Mathew, Gopidas & Sukumaran (31.67%)¹⁹.

Out of 57 left humeri, the supratrochlear foramen was present in 29.82% cases in our study. Our result is nearly similar to the findings of Arunkumar *et al.* (23.3%)¹⁴, Nayak *et al.* (26.8%)¹⁸, Jadhav *et al.* (25%)¹¹, Mahitha *et al.* (23.6%)⁷, Kumar *et al.* (26%)¹⁵, and Shivaleela, Afroze & Lakshmiprabha (31.43%)⁹. However, our result is higher than that of Erdogmus *et al.* (16.9%)¹, and Bahsi (21.15%)¹³, but lower than that of Lalita *et al.* (53.62%)¹⁶, Mathew, Gopidas & Sukumaran (61.33%)¹⁹, Abo Sablan & Calmon (49.36%)¹², Bhanu & Sanka (33.33%)¹⁰, and Silva *et al.* (39.28%)¹⁷.

Overall, the incidence of STF was observed 27% in our study, which is nearly similar to the finding of Krishnamurthy *et al.* (23%)²⁰, but higher than that of Kabakci *et al.* (15%)²¹. Regarding clinical significance, for the orthopaedic surgeons, the presence of the STF plays a crucial role in

preoperative planning for cases involving supracondylar fractures of the humerus. Accurate knowledge of STF anatomy helps in selecting the most appropriate intramedullary nail, optimizing surgical outcomes, and minimizing potential complications. For radiologists, recognizing the STF is key when interpreting radiographs and CT scans of the lower humerus. The STF can be mistaken for osteolytic or cystic lesions; hence, understanding its normal anatomical variation is essential for distinguishing between benign anatomical features and pathological findings.^{9,14,16,18,19}

Conclusion

The present study offers new data on the supratrochlear foramen (STF), contributing to the existing body of research by enhancing our understanding of its population frequency and distribution. These findings are placed in context by comparing them to previously reported frequencies, enriching the knowledge base in this area.

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