

**Original Article****Anatomical Study of Supratrochlear Foramen of Dry Human Humerus**

\* Haque SMA<sup>1</sup>, Kabir A<sup>2</sup>, Chowdhury IJ<sup>3</sup>, Mehataz T<sup>4</sup>, Afros F<sup>5</sup>, Islam S<sup>6</sup>

1. \*Dr. Shah Md. Atiqul Haque, Assistant Professor, Department of Anatomy, Mymensingh Medical College, Mymensingh.
2. Dr. Anamul Kabir, Associate Professor, Department of Anatomy, Jahurul Islam Medical College, Bhagalpur, Bajitpur, Kishoregonj.
3. Dr. Israt Jahan Chowdhury, Assistant Professor, Department of Physiology, Shahabuddin Medical College, Dhaka.
4. Dr. Tasnova Mehataz, Indoor Medical Officer, Department of Anaesthesiology, Community Based Medical College Hospital Bangladesh, Mymensingh.
5. Dr. Farzana Afros, Assistant Health Officer, Dhaka North City Corporation, Dhaka.
6. Dr. Shamima Islam, Lecturer, Department of Anatomy, Mymensingh Medical College, Mymensingh.

\*For correspondence

**Abstract**

**Objective:** The aim of the present study was to establish the prevalence and morphometry of supratrochlear foramen of the humerus in the Bangladeshi population and to correlate with the previous studies.

**Methods:** Samples were selected through purposive sampling for this cross-sectional descriptive study which was carried out in the Department of Anatomy, Mymensingh Medical College During the period of July 2021 to June 2022. Any damaged, unossified and fractured humerus were excluded to contrive a standard measurement. Data were tabulated and statistically analyzed using Microsoft Excel and SPSS. The present prospective study was carried out with 100 (43 right-sided + 57 left-sided) dried humeri of unknown sex and age.

**Results:** In the present study, out of 43 right humeri, supratrochlear foramen was present 08(18.60%) and 35(81.40%) were absent and out of 57 left humeri, supratrochlear foramen were present 15(26.31%) and 42(73.69%) were absent. The mean vertical diameters of the supratrochlear foramen on the right side were 3.271 ( $\pm$  1.017) mm and the left humeri was 4.643 ( $\pm$  3.422) mm. The mean transverse diameters of the supratrochlear foramen on the right side were 4.496 ( $\pm$  2.224) mm and the left humeri was 5.981 ( $\pm$  3.375) mm.

**Conclusion:** The anatomical knowledge of supratrochlear foramen is beneficial for anthropologists, orthopedic surgeons & radiologists in cases of supracondylar fractures of the humerus.

**Key words:** Anatomy, Human, Supratrochlear Foramen, Humerus

## Introduction

The supratrochlear foramen (STF) is an important and relatively common anatomic variation in the lower end of the humerus in humans. The supratrochlear foramen (STF) of the humerus has been neglected in standard anatomy and orthopedics books. In recent years it has become clear that STF should be emphasized because anatomical knowledge of STF is useful for anatomists, anthropologists, orthopedic surgeons, and radiologists<sup>1</sup>. A thin, transparent plate of bone known as supratrochlear septum varying in thickness from 0.5mm to 1cm in thickness, which is lined in the fresh state by the synovial membrane of the elbow joint separates the olecranon and coronoid fossae. This septum may contain several perforations and, in some cases, may become perforated to form an aperture known as 'supratrochlear aperture' or 'supratrochlear foramen' (STF)<sup>2</sup>. The septum is always present until seven years of age after which it is occasionally absorbed to form STF<sup>3</sup>. Its development occurs more frequently during adolescence or in adulthood, due to the incomplete ossification of that region<sup>4</sup>. The presence of STF is not only observed in humans but also in lower animals such as apes, dogs, hyenas, and other primates. The presence of STF in individuals and primates results in hyperextension of the elbow joint during various activities in day-to-day life<sup>5,6</sup>. This foramen is of great interest to anthropologists who claim it as one of the points in establishing the relationship between man and lower animals. This study contributes to increasing anatomical data and consistency in anthropology and also for clinicians. The anatomical structure of the humerus may play an important role in the intramedullary fixation thereby stressing the need for prior anatomical knowledge & and preoperative planning in the presence of variations like STF in the distal end of the humerus<sup>7</sup>.

The aim of the present study was to describe the morphology and morphometry of the supratrochlear foramen of the human humerus and to compare it with the other studies in details.



**Figure 1: Photograph Showing Supratrochlear Foramen of the Humerus**

## Materials and methods

The study was conducted from July 2021 to June 2022 at the Department of Anatomy, Mymensingh Medical College, Mymensingh, Bangladesh. Samples were collected from the Department of Anatomy, Mymensingh Medical College, Mymensingh, Bangladesh. One hundred (100) fully ossified dry human humerus were collected for the study. The study was a cross-sectional descriptive type. A non-random purposive sampling technique was used for sample selection. The sample was excluded if the bones were unossified, developmentally abnormal and broken bones. The presence of supratrochlear foramen was observed in the lower end of the humerus. The transverse and vertical diameters of supratrochlear foramen were measured using a digital Vernier caliper. All observations were recorded in a tabular form. The vertical diameter of the supratrochlear foramen was measured by digital slide calipers in the vertical plane.

The one jaw of the caliper was placed on the mid-point of the upper margin and the sliding jaw was placed on the mid-point of the lower margin of the supratrochlear foramen of the humerus. The distance between them was measured and expressed in mm. The transverse diameter of supratrochlear foramen was measured by

digital slide calipers horizontally. The one jaw of calipers was placed on the medial most point of the foramen of the humerus. The distance between them was measured and expressed in mm. Supratrochlear foramen and the sliding jaw was placed on the lateral most point of the supratrochlear



**Figure 2: Photograph Showing Procedure of Measurement of Vertical Diameter of Supratrochlear Foramen**



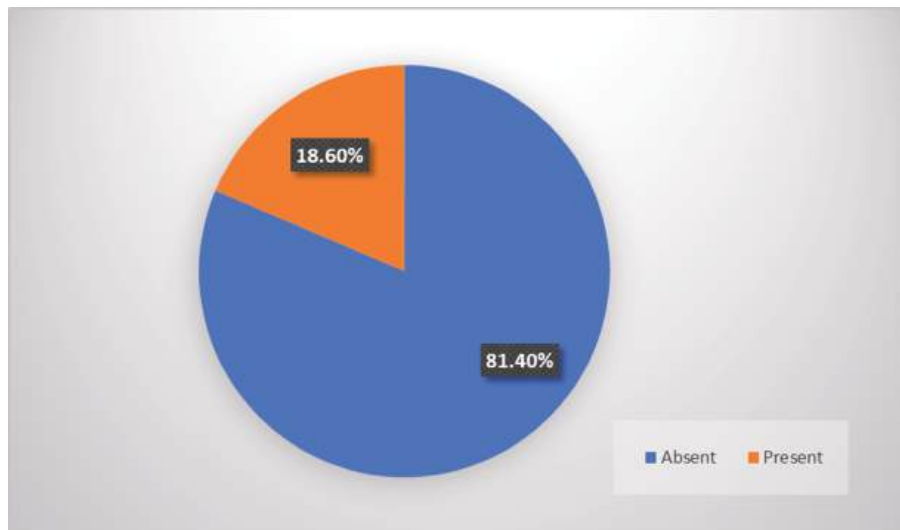
**Figure 3: Photograph Showing Procedure of Measurement of Transverse Diameter of Supratrochlear Foramen**

### Results

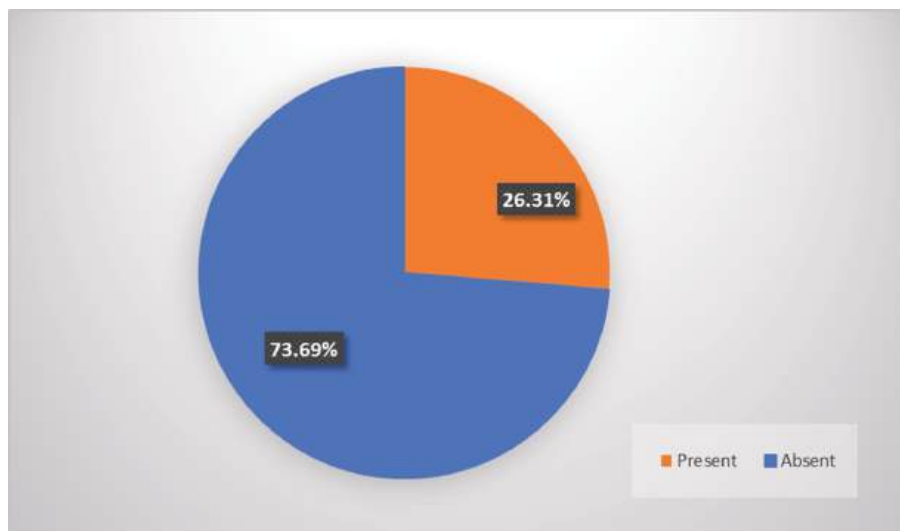
In this study, the presence of supratrochlear foramen was observed. Out of 43 right humeri, supratrochlear foramen was present 08(18.60%) and 35(81.40%) were absent. Out of 57 left humeri, supratrochlear foramen was present 15(26.31%) and 42(73.69%) were absent.

**Table I: Incidence of Supratrochlear Foramen**

Supratrochlear foramen	Right		Left	
	Frequency	Percent (%)	Frequency	Percent (%)
Present	08	18.60	15	26.31
Absent	35	81.40	42	73.69
Total	43	100	57	100



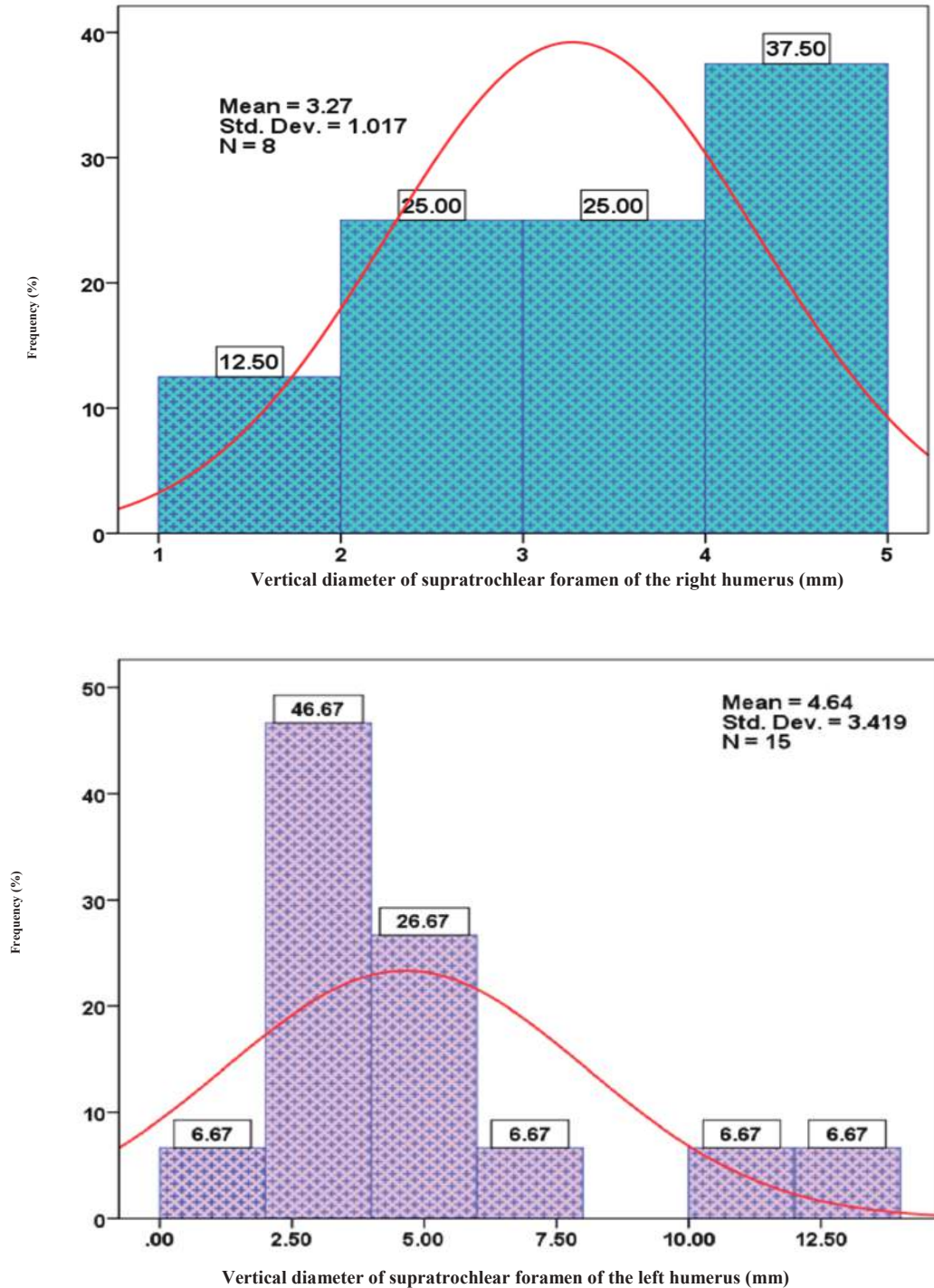
(a)



(b)

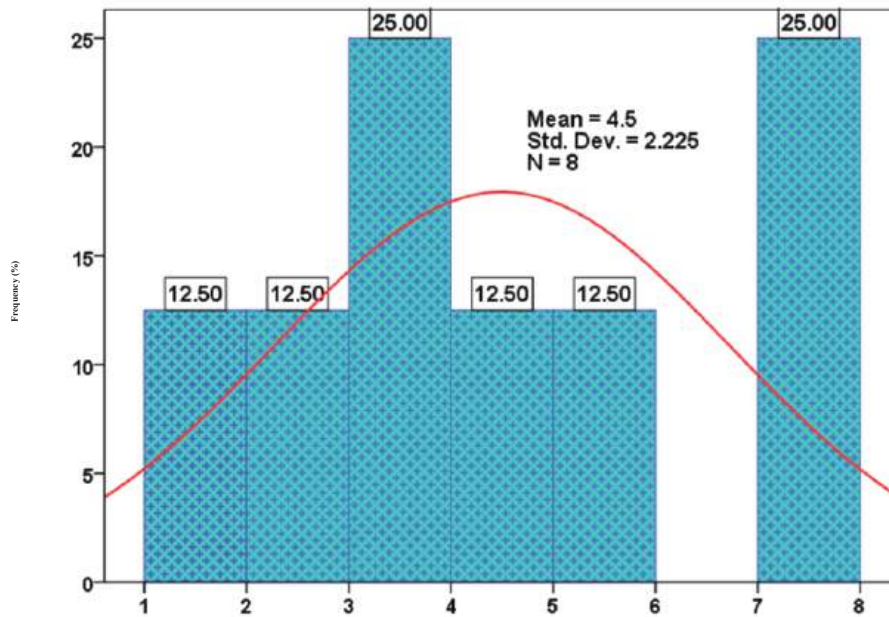
**Figure 4: Pie Diagram Showing Incidence of Supratrochlear Foramen of (a) Right Humerus (b) Left Humerus**

The vertical diameter of the supratrochlear foramen of 43 right humeri ranged from 1.82 mm to 4.89 mm. More than 87.5% of samples were measured within the range of 2.00 mm to 5.00 mm. The vertical diameter of the supratrochlear foramen of 57 left humeri ranged from 1.25 mm to 13.36 mm. More than 80% of samples were measured within the range of 1.00 mm to 6.00 mm.

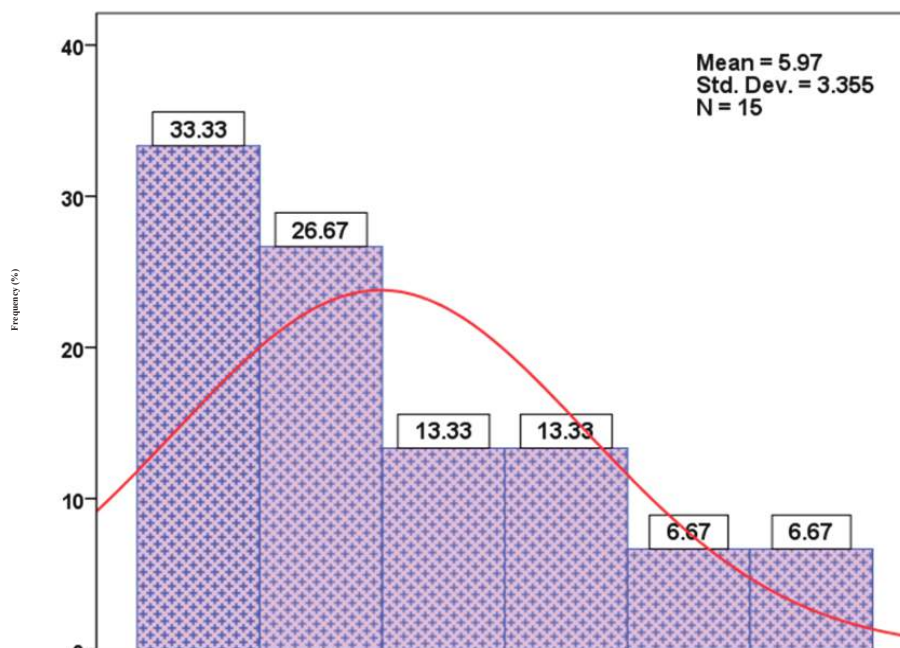


**Figure 5: Histogram Showing the Frequency Distribution of Vertical Diameter of Supratrochlear Foramen on Both Sided Humerus**

The transverse diameter of the supratrochlear foramen of 43 right humeri ranged from 1.11 mm to 7.90 mm. More than 75% of samples were measured within the range of 1.00 mm to 6.00 mm. The transverse diameter of the supratrochlear foramen of 57 left humeri ranged from 2.33 mm to 13.36 mm. More than 73% of samples were measured within the range of 2.00 mm to 8.00 mm.



Transverse diameter of supratrochlear foramen of the right humerus (mm)



Transverse diameter of supratrochlear foramen of the left humerus (mm)

**Figure 6: Histogram Showing the Frequency Distribution of Transverse Diameter of Supratrochlear Foramen on Both Sided Humerus**

## Discussion

In this present study, supratrochlear foramen was present in 08 out of 43 right humeri. The incidence was 18.60%. Supratrochlear foramen was present in 15 out of 57 left humeri. The incidence was 26.31%. In this present study, supratrochlear foramen was present in 23 (08 on the right side and 15 on the left side) out of 100 humeri. The incidence was 23%.

The incidence of the present study regarding the presence of supratrochlear foramen on the right side was nearly similar to Kumar et al.<sup>8</sup>, Bahsi<sup>9</sup> and Arunkumar et al.<sup>10</sup> as 17.21%, 19.94% and 19.6% respectively. But higher than Jadhav et al.<sup>11</sup>, Sablan & Calmon<sup>12</sup>, Erdogmus et al.<sup>1</sup> and Mahitha et al.<sup>7</sup> as 15.78%, 6.32%, 4.8% and 13.60% respectively. And the incidence was lower than Lalita et al.<sup>13</sup>, Silva et al.<sup>14</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup>, Bhanu & Sanka<sup>16</sup>, Nayak et al.<sup>17</sup>, Mathew, Gopidas & Sukumaran<sup>18</sup> as 46.37%, 39.32%, 22.22%, 26.53%, 44.5% and 31.67% respectively. The incidence of the present study regarding the presence of supratrochlear foramen on the left side was nearly similar to Arunkumar et al.<sup>10</sup>, Nayak et al.<sup>17</sup>, Jadhav et al.<sup>11</sup>, Mahitha et al.<sup>7</sup> and Kumar et al.<sup>8</sup> as 23.3%, 26.8%, 25%, 23.60% and 26% respectively but higher than Erdogmus et al.<sup>1</sup> and Bahsi<sup>9</sup> as 16.9% and 21.15% respectively. And the incidence was lower than Lalita et al.<sup>13</sup>, Mathew, Gopidas & Sukumaran<sup>18</sup>, Sablan & Calmon<sup>12</sup>, Bhanu, Sanka<sup>16</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup> and Silva et al.<sup>14</sup> as 53.62%, 61.33%, 49.36%, 33.33%, 31.43% and 39.28% respectively. The incidence of the present study regarding the presence of supratrochlear foramen was similar to Krishnamurthy et al. 23%<sup>19</sup> but higher than Kabakci et al. 15%<sup>20</sup>.

According to the present study, the mean ( $\pm$  SD) vertical diameter of the supratrochlear foramen of the right humeri was 3.271 ( $\pm$  1.017) mm and the left humeri was 4.643 ( $\pm$  3.422) mm.

This mean value of right humeri was nearly similar to the value described by Lalita et al.<sup>13</sup>, Arunkumar et al.<sup>10</sup>, Nayak et al.<sup>17</sup>, Mahitha et al.<sup>7</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup>, Silva et al.<sup>14</sup> and Kabakci et al.<sup>20</sup> as 3.12 ( $\pm$  1.09) mm, 3.84 ( $\pm$  1.2) mm, 3.81 mm, 3.4 mm, 3.88 ( $\pm$  2.391) mm, 3.653 ( $\pm$  1.983) mm and 3.91 ( $\pm$  1.91) mm respectively. But the value was lower than the value described by Erdogmus et al.<sup>1</sup>, Bahsi<sup>9</sup>, Bhanu & Sanka<sup>16</sup>, Kumar et al.<sup>8</sup> and Krishnamurthy et al.<sup>19</sup> as 4.12 ( $\pm$  0.98) mm, 4.81 ( $\pm$  1.38) mm, 5.75 ( $\pm$  1.5) mm, 4.64

( $\pm$  2.45) mm and 4.00 ( $\pm$  1.52) mm respectively. This mean value of left humeri was nearly similar to the value described by Erdogmus et al.<sup>1</sup>, Arunkumar et al.<sup>10</sup>, Nayak et al.<sup>17</sup>, Bahsi<sup>9</sup>, Bhanu & Sanka<sup>16</sup>, Mahitha et al.<sup>7</sup>, Kabakci et al.<sup>20</sup>, Krishnamurthy et al.<sup>19</sup> and Kumar et al.<sup>8</sup> as 4.04 ( $\pm$  0.9) mm, 3.84 ( $\pm$  1.2) mm, 4.85 mm, 4.82 ( $\pm$  1.33) mm, 4.86 ( $\pm$  1.2) mm, 4.2 mm, 4.21 ( $\pm$  1.29) mm, 4.70 ( $\pm$  1.69) mm and 4.76 ( $\pm$  2.64) mm respectively. But the value was higher than the value described by Lalita et al.<sup>13</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup> and Silva et al.<sup>14</sup> as 3.47 ( $\pm$  1.32) mm, 3.68 ( $\pm$  3.532) mm and 3.492 ( $\pm$  1.746) mm respectively.

According to the present study, the mean ( $\pm$  SD) transverse diameter of the supratrochlear foramen of the right humeri was 4.496 ( $\pm$  2.224) mm and the left humeri was 5.981 ( $\pm$  3.375) mm.

This mean value of right humeri was nearly similar to the value described by Mahitha et al.<sup>7</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup> and Silva et al.<sup>14</sup> as 4.6 mm, 4.50 ( $\pm$  3.183) mm and 4.853 ( $\pm$  2.934) mm respectively. However the value was lower than the value described by Lalita et al.<sup>13</sup>, Erdogmus et al.<sup>1</sup>, Arunkumar et al.<sup>10</sup>, Nayak et al.<sup>17</sup>, Bahsi<sup>9</sup>, Bhanu & Sanka<sup>16</sup>, Kabakci et al.<sup>20</sup>, Krishnamurthy et al.<sup>19</sup> and Kumar et al.<sup>8</sup> as 5.45 ( $\pm$  1.83) mm, 5.63 ( $\pm$  0.97) mm, 5.67 ( $\pm$  1.7) mm, 5.99 mm, 6.55 ( $\pm$  2.84) mm, 6.68 ( $\pm$  0.8) mm, 5.23 ( $\pm$  3.74) mm, 5.26 ( $\pm$  2.47) mm and 5.76 ( $\pm$  2.22) mm respectively. This mean value of left humeri was nearly similar to the value described by Erdogmus et al.<sup>1</sup>, Arunkumar et al.<sup>10</sup>, Nayak et al.<sup>17</sup>, Bahsi<sup>9</sup>, Bhanu & Sanka<sup>16</sup>, Mahitha et al.<sup>7</sup>, Silva et al.<sup>14</sup>, Krishnamurthy et al.<sup>19</sup> and Kumar et al.<sup>8</sup> as 6.01 ( $\pm$  1.86) mm, 5.39 ( $\pm$  1.57) mm, 6.55 mm, 5.64 ( $\pm$  1.96) mm, 6.92 ( $\pm$  2.0) mm, 6.2 mm, 5.427 ( $\pm$  2.540) mm, 6.50 ( $\pm$  2.59) mm and 6.36 ( $\pm$  2.88) mm respectively. But the value was higher than the value described by Lalita et al.<sup>13</sup>, Shivaleela, Afroze & Lakshmi Prabha<sup>15</sup> and Kabakci et al.<sup>20</sup> as 4.9 ( $\pm$  1.51) mm, 3.32 ( $\pm$  3.222) mm and 4.80 ( $\pm$  2.65) mm respectively.

## Conclusion

The present study provides new data to the research literature on supratrochlear foramen. It adds to the knowledge of population frequency and distribution while comparing to previously observed frequencies reported in studies. The presence of supratrochlear foramen is important for the orthopedic surgeon for preoperative planning in supracondylar fractures and for choosing an ideal intramedullary nail. The

radiologist will also find it beneficial during the interpretation of radiographs and CT scans of the lower end of the humerus as it helps differentiate from an osteolytic or cystic lesion.

### References

- Erdogmus S, Guler M, Eroglu S and Duran N. The Importance of the Supratrochlear Foramen of the Humerus in Humans: An Anatomical Study. *Medical Science Monitor*. 2014; 20:2643-50.
- Kate BR and Dubey PN. A Note on the Septal Apertures in the Humerus in the Humerus of Central Indians. *Eastern Anthropologist*. 1970; 33:105-110.
- Hirsh SI. Cited in Morton SH and Crysler WE. Osteochondritis Dissecans of the Supra -trochlear Septum. *J Bone Joint Surg*. 1945;27-A:12-24.
- Morton SH & Crysler WE. Osteochondritis Dissecans of the Supratrochlear Septum. *J Bone Jt Surg*. 1945;2
- Hazirolu RM and Ozer M. A Supratrochlear Foramen in the Humerus of Cattle. *Anat Histol Embryol*. 1990;19:106-8.
- Benfer RA and Tappen NC. The Occurrence of the Septal Perforation of the Humerus in Three Nonhuman Primate Species. *Am J Phys Anthropol*. 1968;29: 19-28.
- Mahitha B, Jitendra R, Janaki V and Navakalyani T. Supratrochlear Foramen of Humerus in Telangana State: A Morphometric Study. *Int J Anat Res* 2016;4(2):2450-3.
- Kumar UP, Sukumar CD, Sirisha V, Rajesh V, Krishna MS and Kalpana T. Morphologic and Morphometric Study of Supra trochlear Foramen of Dried Human Humeri of Telangana Region. *Int J Cur Res Rev*. 2015;07(09):95-8.
- Bahsi I. An Anatomic Study of the Supratrochlear Foramen of the Humerus and Review of the Literature. *European Journal of Therapeutics*, 2019;25(04):295-303.
- Arunkumar KR, Manoranjitham R, Raviraj K & Dhanalakshmi V. Morphological Study of Supratrochlear Foramen of Humerus and its Clinical Implication. *International Journal of Anatomy and Research*, 2015;03(03):1321-5.
- Jadhav M, Tawte A, Pawar P & Mane S. Anatomical Study of Supratrochlear Foramen of Humerus. *Journal of Research in Medical and Dental Science*. 2013;01(02):33-5.
- Sablan AHA & Calmon M. Supratrochlear Foramen Frequency in three Iraqi Populations', *Forensic Science International*. 2020. Reports, viewed 29 June 2022, <<https://www.sciencedirect.com/science/article/pii/S2665910720300566?via%3Dihub>>.
- Lalita BT, Francis YM, Balaji K, Raghunath G & Kumaresan M. A Comprehensive Study on Supratrochlear Foramen of Human Humerus and its Clinical Significance - A Review. *Biomedical & Pharmacology Journal*. 2021;14(3):1197-207.
- Silva FA, Silva TS, Souza PRFB, Reis RS, Ferreira MRS & Magalhaes CP. Morphological and Morphometric Study of the Supratrochlear Foramen. *Journal of Morphological Sciences*. 2018;35(01):54-7.
- Shivaleela C, Suresh BS, Kumar GV & Lakshmi Prabha S. Morphological Study of the Supracondylar Process of the Humerus and Its Clinical Implications. *Journal of Clinical and Diagnostic Research*. 2014;08(01):1-3.
- Bhanu PS & Sankar KD. Anatomical note of Supratrochlear Foramen of Humerus in South Costal Population of Andhra Pradesh. *Narayana Medical Journal*. 2012;01(02):1-7.
- Nayak SR, Das S, Krishnamurthy A, Prabhu LV & Potu BK. Supratrochlear Foramen of the Humerus: An Anatomico-radiological Study with Clinical Implications. *Upsala Journal of Medical Sciences*. 2009;114(02):90-4.
- Mathew AJ, Gopidas GS & Sukumaran TT. A Study of the Supratrochlear Foramen of the Humerus: Anatomical and Clinical Perspective. *Journal of Clinical and Diagnostic Research*. 2016;10(02):5-8.
- Krishnamurthy A, Yelicharla AR, Takkalapalli A, Munishamappa V, Bovinndala B & Chandramohan M. Supratrochlear Foramen of Humerus- A Morphometric Study. *International Journal of Biological & Medical Research*. 2011;02(03): 829-31.
- Kabakci AAD, Buyukmumcu M, Yilmaz MT, Cicekcibasi AE, Akin D & Cihan E. An Osteometric Study on Humerus. *Int. J. Morphol*. 2017;35(01):219-26.