



## INCIDENCE AND MORPHOMETRIC STUDY OF HUMERAL SEPTAL APERTURE IN SOUTH INDIAN POPULATION OF KARNATAKA REGION

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### ABSTRACT

A thin plate of bone usually separates coronoid and olecranon fossa in the distal end of humerus. In some humerii this bony plate is perforated to form an aperture. This present study was conducted on 500 dried adult humerii. The incidence of septal aperture, its shape, transverse diameter and vertical diameter was measured. The septal aperture was found in 31% of humerii. The incidence was more common on left side (37.6%) as compared to right side (24.4%). The aperture was oval and round in shape, of which oval shape was more common. Mean transverse diameter of septal aperture was  $4.55 \pm 2.39$  mm on right side and  $5.30 \pm 2.72$  mm on left side. Mean vertical diameter of septal aperture was  $3.29 \pm 1.57$  mm on right side and  $3.87 \pm 1.72$  mm on left side. Translucency of bony septum was seen in 48.4% of humerii. The anatomical knowledge of septal aperture may be beneficial for anthropologists, orthopedic surgeons and radiologists.

**KEYWORDS:** Humerus, septal aperture, translucent septum.



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## INTRODUCTION

The bony septum separating coronoid and olecranon fossa of humerus may become perforated to give rise to a foramen known as septal aperture as described first by Meckel in 1825<sup>1</sup>. A thin bony plate is always present until the age of seven years between the coronoid and olecranon fossa after which it becomes absorbed occasionally to form a foramen<sup>2</sup>. The septal aperture in humerus has been described in various other animals like dogs, hyenas, cattle and primates<sup>3</sup>. The incidence of septal aperture varies and it is racial dependent. The knowledge of septal aperture is important for preoperative planning of intramedullary fixation in fractures of distal end of humerus due to narrow medullary canal<sup>4, 5</sup>. On plain radiographs the septal aperture may appear as osteolytic lesion. Anatomical knowledge of this septal aperture is essential during evaluation of any pathological lesions in distal end of humerus to prevent faulty interpretation of plain radiographs. The present study of south Indian population is focused to highlight the incidence, morphological features and clinical importance of septal aperture of humerus which may be beneficial to orthopedic surgeons and radiologists.

## MATERIALS AND METHODS

This study was conducted in 500 (250 right and 250 left) dried humerus bones free from

pathological changes and of unknown sex obtained from Department of Anatomy, J. J M. Medical College, Davangere. The incidence and shape of septal aperture was noted on the right and left side humerii and only those apertures having regular margins were considered. Digital vernier caliper was used to measure the maximum transverse and vertical diameter of septal aperture. In bones where aperture was absent, translucency of septum was noted with help of transmitted light from behind.

## RESULTS

Out of 500 humerii studied, only 155 humerii (31%) showed the presence of septal aperture out of which septal aperture was present in 61 right sided (24.4%) and 94 left sided (37.6%) humerii (Table 1). The shape of septal aperture was found to be oval in 127 humerii (81.9%) and round in 28 humerii (18.1%) (Figure 1, Table 2). The mean transverse diameter was  $4.55 \pm 2.39$  mm on the right side and  $5.30 \pm 2.72$  mm on left side. The mean vertical diameter was  $3.29 \pm 1.57$  mm on right side and  $3.87 \pm 1.72$  mm on left side (Table 3). Remaining 345 humerii showed bony septum out of which translucency was observed in 242 humerii (48.4%) and 103 humerii (20.6%) had an opaque bony septum (Figure 2, Table 1).

**Table 1**  
*Incidence of septal aperture, translucent septum and opaque septum.*

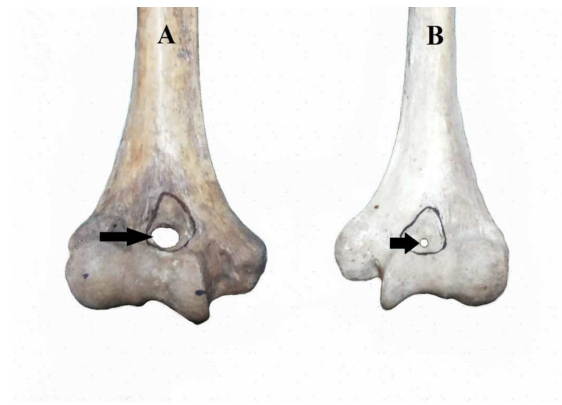
		Right (n=250)	Left (n=250)	Total (n=500)
Incidence	Septal aperture	61 (24.4%)	94 (37.6%)	155 (31%)
	Translucent septum	126 (50.4%)	116 (46.4%)	242 (48.4%)
	Opaque septum	63 (25.2%)	40 (16%)	103 (20.6%)

**Table 2**  
*Incidence of shape of septal aperture*

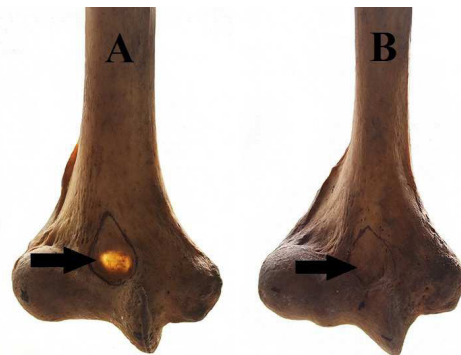
		Right (n=61)	Left (n=94)	Total (n=155)
Shape	Oval	44 (72.1%)	83 (88.3%)	127 (81.9%)
	Round	17 (27.9%)	11 (11.7%)	28 (18.1%)

**Table 3**  
*Diameter of septal aperture*

		Right (n=61)	Left (n=94)	Total (n=155)
Diameter	Transverse diameter	$4.55 \pm 2.39$ mm	$5.30 \pm 2.72$ mm	$5.00 \pm 2.61$ mm
	Vertical diameter	$3.29 \pm 1.57$ mm	$3.87 \pm 1.72$ mm	$3.64 \pm 1.68$ mm

**Shape of Humeral septal aperture****Figure 1**

*Photograph showing various shapes of septal apertures A: Oval, B: Round.*

**Translucency of bony septum observed with help of transmitted light from behind****Figure 2**

*Photograph showing A: Translucency of bony septum, B: Opaque bony septum.*

**DISCUSSION**

The frequency of humeral septal aperture varies from 6% to 60% in different human populations and is racial dependent<sup>6</sup>. The previous studies in worldwide population showed an incidence of 4.2% in White Americans<sup>7</sup>, 18.1% in Japanese<sup>8</sup>, 6.9% in Americans<sup>9</sup>, 7.9% in Egyptians<sup>6</sup>, 8.6 % in Turkish population<sup>10</sup>, 32.5% in South Africans<sup>11</sup>, 34.4% in Indian population<sup>12</sup> and 58% in Arkansas Indians<sup>7</sup> (Table 4). The previous studies in Indian population also showed an incidence of 27.4% in Eastern Indians<sup>13</sup>, 32% in Central Indians<sup>1</sup>, 27.5% in North Indians<sup>14</sup>, 28% in South Indians<sup>15</sup> and 34.4% in overall Indians<sup>12</sup> (Table 5). In the present study the incidence of humeral septal aperture was found to be 31% slightly higher

prevalence than previous studies and it is in correlation with the studies of Ndou R et al.<sup>11</sup>, Kate BR and Dubey PN<sup>1</sup>, P Sharmila Banu and K Devi Sankar<sup>16</sup>. In the present study, the shape of humeral septal aperture was oval in 81.9% and round in 18.1% humerii, which can be comparable with previous study of Rakesh KD et al.<sup>17</sup> where 82.47% humerii showed oval shaped aperture and 15.2% humerii showed round shaped aperture. The transverse diameter of humeral septal aperture varies from 5.1 mm to 8.3 mm on right side and 4.86 mm to 7.53 on left side in previous studies. In our present study transverse diameter of humeral septal aperture is 4.55 mm on right side and it is slightly lower compared to the previous studies and our study is almost in

correlation with studies of Raghavendra K et al.<sup>18</sup> and Asha Krishnamurthy et al.<sup>19</sup>. The transverse diameter of humeral septal aperture on left side is 5.30 mm and it is slightly lower compared to the previous studies and our study is almost in correlation with the study of Suba Ananthi Kumarasamy et al.<sup>20</sup>. The vertical diameter of humeral septal aperture varies from 3.81 mm to 5.75 mm on right side and 1.69 mm to 5.35 mm on left side in previous studies. In our present study vertical diameter of humeral septal aperture is 3.29 mm on right side and it is slightly lower compared to the previous studies and our

study is almost in correlation with studies of Raghavendra K et al.<sup>18</sup> and Soubhagya R Nayak et al.<sup>12</sup>. The vertical diameter of humeral septal aperture on left side is 3.87 mm and it is slightly lower compared to the previous studies and our study is almost in correlation with study of Suba Ananthi Kumarasamy et al.<sup>20</sup>. In our present study translucency of bony septum is 48.4% and it is lower compared to the previous studies. The opacity of bony septum is 20.6% in our present study and it is slightly higher prevalence than previous studies and it is in correlation with the study of Raghavendra K et al.<sup>18</sup>.

**Table 4**  
***Incidence of septal aperture in various human populations***

Author	Population studied	Incidence (%)
Hirsh IS (1927)	White Americans	4.2
Akabori E (1934)	Japanese	18.1
Benfer RA (1966)	Americans	6.9
Ozturk A et al. (2000)	Egyptians	7.9
Koyun N (2011)	Turkish	8.6
Ndou R (2013)	South Africans	32.5
Nayak SR (2009)	Indians	34.4
Hirsh IS (1927)	Arkansas Indians	58
Present study (2014)	South Indians	31

**Table 5**  
***Incidence of septal aperture in different regions of Indian population***

Author	Population studied	Incidence (%)
Chatterjee KP (1968)	Eastern Indians	27.4
Kate BR (1970)	Central Indians	32
Singh S (1972)	North Indians	27.5
Singhal S V (2007)	South Indians	28
Soubhagya R Nayak (2009)	Overall Indians	34.4
Present study (2014)	South Indians	31

Humeral septal aperture is considered to be an atavistic character as it is commonly found in primates. Septal aperture may be due to impact pressure on the bony septum in cases of hyper-flexion or hyper-extension of the elbow joint leading to its resorption where olecranon process and coronoid process of ulna would potentially make contact<sup>21</sup>. Another cause of occurrence of septal aperture may be osteoporosis or degenerative joint diseases like osteoarthritis and rheumatoid arthritis. Presence of septal aperture make treatment of supracondylar fractures more difficult in intramedullary nailing due to narrow medullary canal. It may lead to increased local stress and significantly alter the pattern and stability of fractures<sup>22</sup>. Septal aperture is a relatively translucent area commonly described as a

pseudo lesion in x-ray of upper limb can be mistaken as an osteolytic or cystic lesion<sup>23</sup>.

## CONCLUSION

This present study focused on humeral septal aperture which is an important variation in the distal end of humerus. Incidence of septal aperture in a South Indian population of Karnataka region is 31% with left side prominence. The awareness of humeral septal aperture is important for the orthopedic surgeons for preoperative planning in case of supracondylar fractures including other fractures of distal end of the humerus. Radiologists should be more familiar with the variants in order to avoid misdiagnosis during the interpretation of plain radiographs of the distal end of the humerus.

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