# **HUMAN SPLEEN-A STUDY OF ITS MORPHOLOGICAL VARIATIONS**

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# ABSTRACT

**Background:** Spleen is a large encapsulated mass of vascular and lymphoid tissue. Clinically, study of spleen is important in immunological and haematological disorders. The purpose of the study is to analyse the morphological variations of spleen and to compare them with previous studies.

Materials and methods: The present study was carried out with 35 spleens at the Department of Anatomy, Jawaharlal Nehru Institute of Medical Sciences, Imphal, Manipur and the various morphological variations were observed.

**Results:** Out of the 35 spleens studied, 6 spleens were tetrahedral, 12 spleens were triangular, 15 spleens were wedge shaped and 2 spleens were oval shaped. The mean length was 10.91cm, the mean breadth was 6.7cm and the mean width was 4.9cm.

**Conclusions:** 35 normal spleens were studied and their shapes, lengths, breadths, widths were analysed.

**KEY WORDS:** Shape of spleen, disorders of spleen, lymphoid organ.

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#### INTRODUCTION

The spleen consists of a large encapsulated mass of vascular and lymphoid tissue. Its shape varies from a slightly curved wedge to a domed tetrahedron.

The size and weight of the spleen vary with age and sex. It can also vary slightly in the same in the individual under different conditions. In the adult, it is usually 12cm long, 7cm broad and 3-4cm wide [1].

The two extremities of the organ are connected by superior and inferior borders. The superior border often possesses one or more notches near its anterior end while the inferior border is smooth. The organ has two easily distinguishable surfaces-the diaphragmatic surface and the visceral surface [2].

Filtration of unwanted elements from the blood by phagocytosis is the major function of spleen [3]. It filters blood and is the site of immune responses to blood borne antigens. During fetal life, the spleen is a haemopoietic organ producing granulocytes and erythrocytes. The spleen also serves as an important reservoir for blood [4]. It performs the same function for blood that lymph nodes perform for lymph [5]. The spleen has both morphologic and immunologic functions [6].

The spleen is lobulated in the fetus but the lobules normally disappear before birth. The notches in the superior border of the adult spleen are remnants of the grooves that separated the fetal lobules [7].

Despite the overwhelming indications for splenectomy, like traumatic rupture, hypersplenism, neoplasia, splenic cyst etc, the present tendency of the surgeons is to try for conservative management and to conserve as much splenic tissue as possible.

Hence developing an awareness of splenic variational anatomy is of importance from the fundamental view point. So, the present study was undertaken to describe the morphometric variations in spleen and compare it with the available literature which would prove useful to both clinicians and academicians.

#### **MATERIALS AND METHODS**

35 spleens were collected from Department of Anatomy, JNIMS, Imphal, Porompat. Normal human cadaveric spleens were removed from the abdominal cavity by detaching them from several attachments. Using an electronic weighing machine, spleens were weighed.

Measurements were calculated by Vernier caliper.

Length –greatest distance between two poles

Breadth – greatest distance between two points at superior and inferior borders

Width-greatest width

The measurements were analysed and compared

with previous studies. In all the 35 spleens studied, there were two poles anterior and posterior; there were two borders superior and inferior and two surfaces diaphragmatic and visceral.

The anterior poles of the spleens studied were broad and expanded and the posterior poles were narrow. The superior borders were characteristically notched. In the visceral surfaces, the gastric, renal, colic and pancreatic impressions were seen.

SI. No.	Length of Spleen (mm)	Number of Spleen	
1	70 mm to 79 mm	2	
2	80 mm to 89 mm	3	
3	90 mm to 99 mm	10	
4	100 mm to 109 mm	7	
5	110 mm to 119 mm	6	
6	120 mm to 129 mm	4	
7	130 mm to 139 mm	2	
8	140 mm to 149 mm	1	

Table 1: Length of Spleen in present study.

Table no.1 shows the lengths of the spleens measured by Vernier caliper in the present study.

The lengths varied in between 70mm to 142mm. There are 5 spleens whose lengths vary in between 70mm to 89mm. There are 3 spleens whose lengths vary in between 130mm to 149mm. The average length is 109.12mm.

Table 2: Breadth of Spleen in present study.

SI. No.	Breadth of Spleen (mm)	Number of Spleen	
1	30 mm to 39 mm	1	
2	40 mm to 49 mm	2	
3	50 mm to 59 mm	14	
4	60 mm to 69 mm	10	
5	70 mm to 79 mm	4	
6	80 mm to 89 mm	2	
7	90 mm to 99 mm	1	
8	100 mm to 110 mm	1	

Table no.2 in the present study shows the breadths of the spleens studied. The breadth varies in between 33mm to 100mm. The breadths of 4 spleens vary in between 80mm to 110mm. The breadths of 3 spleens vary in between 30mm to 49mm. The average breadth is 67.87mm.

Table 3: Width of Spleen in present study.	SI. No.	Width of Spleen (mm)	Number of Spleen
	1	20 mm to 29 mm	1
	2	30 mm to 39 mm	4
	3	40 mm to 49 mm	16
	4	50 mm to59 mm	10
	5	60 mm to 79 mm	2
	6	80 mm to 89 mm	1
	9	Jejunam to 100m	1
	8	100 mm to 110 mm	0

Table no.3 in the present study shows the widths of the spleens studied. The widths of 5 spleens vary in between 20mm to 39mm. There are 2 spleens whose widths vary in between 70mm to 89mm.

Table 4: Variation in shapes of Spleen.

Shape	Hollinshead WH [12]	Rao et al [11]	Chaware et al [9]	Present study	
Wedge	44%	40%	61.26%	42%	
Triangular	42%	32%	12.61%	34%	
Tetrahedral	14%	20%	21.62%	18%	
Oval		8%	3.60%	6%	

Table 5: Variation in length, breadth and width.

Measurement	Text book of Grey's Anatomy	Michels NA [8]	Rao et al [11]	Chaware et al [9]	Chaudhuri et al [10]	Present study
Length	12	11	10.5	9.66	9.59	10.9
Breadth	7	7	8.3	6.22	6.59	6.7
Width	3 to 4	3		3.06	4.54	4.9

Out of the 35 spleens studied, 15 were wedge shaped (Fig. 5), 12 were triangular (Fig.2), 6 were tetrahedral (Fig. 3) and 2 were oval (Fig.4). Fig. 1: Showing the measurement of the splenic morphometric parameters.



Fig. 2: Showing the triangular spleen



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Fig. 3: Showing the tetrahedral shaped spleen



Fig. 4: Showing the oval shaped spleen



Fig. 5: Showing the wedge shaped spleen



**Fig. 6:** Showing the comparison between the smallest spleen and the largest spleen in the study.



## DISCUSSION

In the present study the length of the spleen varied from 7.5cm to 14.2cm with an average of 10.91cm. The breadth varied from 3.3cm to 10cm

with an average of 6.7cm and the width varied from 2cm to 3.9cm with an average of 4.9cm.

The mean values of the length, breadth and width of the spleen in our study were 10.9cm, 6.7cm and 4.9cm respectively which were 11cm, 7cm and 3cm in the study done by Michels NA [8].

In the study done by Standring S [1], the values of the length, breadth and width of the spleen were 12cm, 7cm and 3 to 4cm respectively.

The studies done by Chaware et al [9] showed the values to be 9.66, 6.22 and 3.06 cms respectively.

In studies done by Chaudhari et al [10], the values were 9.59, 6.59 and 4.54 cms respectively which were comparable with our present study.

In studies done by Rao et al [11] the length was10.5cm which was comparable with our study where the length was 10.9cm. However, the breadth in their study was 8.3cm which was much higher than our study where the breadth was 6.7cm.

Among the four different shapes we observed, wedge shape (42%) was found to be most common, followed by triangular (34%), tetrahedral (18%) and the oval shape (6%). The proportion of wedge shape, tetrahedral, triangular and oval shaped spleens were comparable with studies done by Rao et al [11] but did not support the earlier findings of Chaware et al [9].

# CONCLUSION

Knowledge of the anatomy and function of the spleen is essential for the assessment of its role in disease. Morphometric analysis in present study will be helpful for surgeons and physicians in diagnosis and treatment of different disorders of spleen.

### **Conflicts of Interests: None**

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