



## Original Research Article

## Morphometric study of adult human spleen in a cadaver

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## ABSTRACT

**Introduction:** Spleen is the largest haemo-lymphoid organ located in the left hypochondrium and partly in the epigastrium between the fundus of the stomach and the diaphragm. The size and weight of the spleen varies with age and gender. In adults it is usually 12 cms in length, 7 cms broad and 3-4 cms in thickness. It weighs around 150gms. On the superior border, near the anterior end, there may be one or two notches, persisting from the lobulated form of the spleen in early foetal life.

Spleen acts as a filter for blood, storage of lymphocytes and platelets. Old red blood cells are recycled in the spleen. It metabolizes the haemoglobin removed from old senescent RBCs. The knowledge of morphometric variations of spleen helps clinicians, radiologist and surgeons to differentiate it from the various splenic injuries and pathologies.

**Aims:** The aim of the study is to find the morphometric variations of spleen.

**Materials and Methods:** The present study was done on 50 adult human spleens of unknown sex. The morphometric features like shape, presence of notches, length, breadth and thickness were noted.

**Results:** Out of 50 spleens studied, five different shapes of the spleen were observed. 19 spleens were wedge shaped (38%), 12 spleens were triangular shaped (24%), 9 spleens were tetrahedral (18%), 5 spleens were oval shaped (10%), 5 spleens were irregular shaped (10%). 31 spleens (62%) had notches on its superior border, 2 spleens (4%) had notches on its inferior border, 12 spleens (24%) had notches both in their superior and inferior borders, 5 spleens (10%) were found with absence of notch on either of its borders. The presences of splenic fissure on diaphragmatic surface were noted in 2 spleens. The length of the spleen varied between 7cms to 15cms, the breadth of the spleens varied between 4cms to 12cms and the thickness of the spleens varied between 2cms to 6cms.

**Conclusion:** The knowledge of morphometric features of the spleen is of great importance to the clinicians, radiologists and surgeons for their surgical procedure.

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## 1. Introduction

The spleen is a haemo-lymphoid organ which belongs to the reticulo-endothelial system. It is located in the left hypochondrium and partly in the epigastrium between the fundus of the stomach and the diaphragm. Spleen is reddish purple in colour. The size and weight of the spleen varies with age and gender. In adults it is usually 12 cms in length, 7 cms broad and 3-4 cms in thickness. It weighs around 150gms. Spleen usually measures 2.5

cms in thickness, 5 cms width and 12 cms long in a normal adult and weighs about 150- 220gms. Spleen has anterior and posterior ends, superior and inferior borders and two surfaces; diaphragmatic and visceral surfaces.<sup>1</sup> On the superior border, near the anterior end, there may be one or two notches, persisting from the lobulated form of the spleen in early foetal life.<sup>2</sup>

The spleen is the most vascular organ in the human body which is involved in the regulation of circulating blood volume. Approximately 350 liters of blood passes through it per day. The spleen receives approximately 5% of the cardiac output and 40% source of the blood in the portal

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circulation.<sup>3,4</sup>

The hematological and immunological function of spleen highlights the study of spleen and correlating it clinically. There is an increased risk for opportunistic infections post splenectomy. Nowadays total splenectomy is replaced by partial splenectomy by surgeons. Hence this study is undertaken to know the morphometric variations of spleen.

## 2. Aims and Objectives

The aim of the study is to find the morphometric variations of spleen.

## 3. Materials and Methods

The present study was conducted on 50 adult human cadaveric spleens collected from department of Anatomy, Mysore medical college and research institute, Mysore.

All the spleens were observed for their morphometric features like shape, number of notches on borders and measurements were taken for length, breadth and thickness using vernier calliper. All these observations and measurements were tabulated, statistically analysed and compared with previous studies.

1. Length - maximum distance between the two ends of the spleen.
2. Breadth - maximum distance between two points at the same level on the superior and inferior borders.
3. Thickness - Midpoint of both the visceral and diaphragmatic surfaces.

## 4. Results

Out of 50 spleens studied, five different shapes of the spleen were observed. 19 spleens were wedge shaped (38%), 12 spleens were triangular shaped (24%), 9 spleens were tetrahedral (18%), 5 spleens were oval shaped (10%), 5 spleens were irregular shaped (10%).

All the spleens were observed for the presence of notches. 31 spleens (62%) had notches on its superior border, 2 spleens (4%) had notches on its inferior border, 12 spleens (24%) had notches both in their superior and inferior borders, 5 spleens (10%) were found with absence of notch on either of its borders. The number of notches varied from zero to six, but in most of the spleens there were one or two notches. The presence of splenic fissure on diaphragmatic surface was noted in 2 spleens.

The length of the spleen varied between 7cms to 15cms and most of the specimens were in the range of 7-11 cms in length. The breadth of the spleen varied between 4cms to 12 cms and most of the specimens were in the range of 4-8 cms in breadth. The thickness of the spleen varied between 2cms to 6cms and most of the specimens were in the range of 2-4 cms.



**Fig. 1:** Wedge shaped spleen with one notch on superior border and two notches on inferior border



**Fig. 2:** Tetrahedral shaped spleen with three notches on superior border



**Fig. 3:** Oval shaped spleen with two notches on superior border

**Table 1:** Length of spleen

Length(cms)	No of specimens	Percentage (%)
7-9	17	34
9-11	18	36
11-13	11	22
13-15	4	8

**Table 2:** Breadth of spleen

Breadth(cms)	No of specimens	Percentage (%)
4-6	26	52
6-8	16	32
8-10	7	14
10-12	1	2

**Table 3:** Thickness of spleen

Thickness(cms)	No of specimens	Percentage (%)
2-3	23	46
3-4	23	46
4-5	3	6
5-6	1	2

**Table 4:** Comparison of measurements of spleen with previous studies

S. No.	Authors	No of specimens	Wedge	Shapes of Spleen (%)			
				Tetrahedral	Oval	Triangular	Irregular
1	Siva C et al <sup>5</sup>	60	73.33	6.67	6.67	13.33	-
2	Sangeetha et al <sup>6</sup>	53	33.9	15	9.4	33.9	7.6
3	Subhash et al <sup>7</sup>	66	40.91	27.27	18.18	4.55	4.55
4	Sudharani et al <sup>8</sup>	50	78	18	-	2	2
5	Present study	50	38	18	10	24	10

**Table 5:** Comparison of measurements of spleen with previous studies

S. No.	Authors	No of specimens	Measurements of spleen		
			Length (cms)	Breadth (cms)	Thickness (cms)
1	Sangeetha et al <sup>6</sup>	53	9.68	6.84	3.61
2	Subhash et al <sup>7</sup>	66	9.4	6.4	3.3
3	Sudharani et al <sup>8</sup>	50	9.5	7.1	3.7
4	Present study	50	10.29	6.37	3.4

**Fig. 4:** Triangular shaped spleen with four notches on superior border**Fig. 6:** Spleen with five notches on superior border**Fig. 5:** Irregular shaped spleen**Fig. 7:** Spleen with fissure on the diaphragmatic surface

## 5. Discussion

The spleen is an important haemo-lymphoid organ. Splenomegaly is commonly seen in case of malaria, typhoid, infectious mononucleosis and leukemias.<sup>9</sup> In these conditions, the clinicians can palpate the splenic notches commonly present on their superior border and differentiate it from other organs.<sup>5</sup>

The present study has observed the variations in the morphometry of spleen. The most common shape was the wedge shaped, followed by triangular, tetrahedral, oval and irregular. Among the 5 different shapes noted, more commonly were wedge shaped (38%) similar to the studies of Sangeetha et al.<sup>6</sup> and Subhash et al.,<sup>7</sup> followed by triangular shaped spleens (12%) similar to the study done by R Siva Chidambaram.<sup>5</sup>

The average length of spleen in present study was 10.29 cm, which is similar to the studies done by Rao et al.<sup>10</sup> (10.5 cm) and Michels et al.<sup>11</sup> (11 cm). The average breadth of spleen in present study was 6.37cm, which is similar to the studies done by Sangeetha et al.<sup>6</sup> (6.84 cm) and Subhash et al.<sup>7</sup> (6.4 cm).

The average thickness of spleen in present study was 3.4 cm, which is similar to the studies done by Sangeetha et al.<sup>6</sup> (3.61 cm), Subhash et al.<sup>7</sup> (3.3 cm) and Sudharani et al.<sup>8</sup> (3.7 cm).

In the present study, the splenic notches were observed on the superior border in 62% of the specimens. In the previous studies, the splenic notches on the superior border were observed in 50% Subhash et al.<sup>7</sup> 80% Sudharani et al.,<sup>8</sup> 83% Sangeetha et al.,<sup>6</sup> 50% Nayak et al.<sup>12</sup> and Das S et al.<sup>13</sup> observed in 98% of the specimens. The notch on the inferior border was observed in 4% in the present study similar to the study done by Archana N et al.<sup>14</sup> 3.3%. The notches in the both the borders were observed in 24% of the specimens.

## 6. Conclusion

The knowledge of morphometric variations is helpful for clinicians, surgeons and radiologists during routine clinical examinations. These variations are to be considered during splenic transplantations, surgical procedures and differentiate it from splenic injuries.

## 7. Source of funding

None

## 8. Conflict of interest

None

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