

**Original Research Article**

Morphometry of Human Cadaveric Spleen: An Institutional Study in the Population of Odisha

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Abstract

Introduction: Spleen is an important secondary lymphoid organ. Now a day's its immunological and haematological role in the body are well realised which enhances the clinical importance of spleen. As spleen shows a wide range of morphological variations in routine dissection classes for under graduate students warranted an understanding of splenic morphometry. The aim of the study is to find out different morphological variations of spleen in the population of Odisha with its clinical significances and comparison of the results with previous studies.

Material and Methods: In the present study 50 human cadaveric spleens were taken. The shapes, poles, surfaces and borders of the spleen were observed. The Morphological features like length, breadth and width were measured by verniers calliper and weight of the spleen was being measured by electronic weighing balance.

Results: In the present study morphological variations were observed. The mean length of the spleen was 11.86cm ranges from 8cm to 14 cm, the breadths of the spleen varied from 4cm to 10cm with an average breadth of 7.32cm and the width of the spleen vary from 2cm to 4.5cm with mean of 3.07cm. The weight of the spleen shows a wide range of variations ranging from 25grms to 300grms with an average weight of 106.65grms. Out of 50 spleens (52%) were wedge shaped followed by tetrahedral (24%) triangular (10%), oval (8%) and irregular (2%).

Conclusions: A clear concept about the morphological variations of the spleen are very useful to the physician, surgeons and the radiologists to compare and rule out the pathological conditions involved in various diseases of spleen.

Keywords: Secondary lymphoid organ, immunological and haematological role.

Introduction

The spleen consists of a large encapsulated mass of vascular and lymphoid tissue. It is situated in the upper left quadrant of the abdominal cavity

between fundus of stomach and the diaphragm.

Spleen is an intraperitoneal organ with two surfaces namely diaphragmatic surface and visceral surface. It has superior and inferior

borders and anterior and posterior poles or extremities^[1]. The diaphragmatic surface is smooth and convex and related to left dome of diaphragm. The visceral surface is irregular and marked by gastric, renal, pancreatic and colic impressions. The superior pole of spleen faces towards rounded vertebral column and anterior extremity or inferior pole is larger and less angulated faces laterally. The hilum of spleen is a long fissure pierced by the splenic vessels, nerves and lymphatics^[1]. The weight and size of the spleen vary with age and sex in the same individual under different conditions. The average weight of spleen is about 150grams with a wide normal range is between 80g to 300g depending on the amount of blood it contains^[1,2].

The spleen develops from both coelomic epithelium and from mesenchyme of dorsal mesogastrium. During development several lobules form which fused with each other to form the spleen at later stage. In adult the notched superior border of spleen is a foot print of lobulated development of spleen in embryonic period^[2,6]. In human the spleen is involved in immunological response against blood borne antigen, removal of particulate matter and aged or defective blood cells from circulation. Spleen is also involved in Haemopoiesis of normal fetus and adult with certain diseases^[3]. There is a wide spread clinical importance of spleen due to its haematological and immunological role. The surge of enthusiasm for preserving damaged spleen came because of the fear of overwhelming post splenectomy infections (OPSI), which has highlighted the immunological role of spleen^[4]. The current trend of surgeons to preserve as much splenic tissue as possible where partial splenectomy is required^[9]. So the aim of the study is to find out morphological variations of spleen in the population of Odisha and its clinical significance and compare the result with previous studies.

Materials and Methods

In the present observational study was undertaken in the department of anatomy, SCB medical

college, Cuttack, Odisha during routine dissection of abdomen and pelvis from 2015 to 2018. The spleens were removed from abdominal cavity by following standard dissection procedures. (2) they were washed with running tap water to clean the fatty tissue and debris. The numbering was done from 1 to 50 and detail morphological features of each spleen were studied carefully. Out of 50 spleens 31 were from male cadaver and only 19 belong to female and all the spleen were apparently healthy. We had excluded the damaged spleen. The shapes, Poles, borders, and surfaces of the each spleen were observed carefully. Lengths, breadths and widths were measured with the help of sliding caliper in centimeters with 0.05% accuracy with the following parameters.

The length of the spleen was recorded as the greatest distance between two poles of the spleen. The breadth was recorded as the greatest distance between two points at the same level on the superior and inferior borders.

The width was the greatest distances between diaphragmatic and visceral surfaces of the spleen. The average weight of the spleen was taken with the help of electronic weighing balance.

Presence of splenic notches and fissures were also noted.

The data was obtained from the study was tabulated, statistically analyzed by Graph Pad Software and compared with previous studies.

Results

In the present study 50 cadaveric spleen were taken, out of them 26 (52%) were wedge shaped and 15(30%) were tetrahedral [Table/Fig-1] and [Table/Fig-2]. The shapes like triangular, irregular and oval were 5(10%), 3(6%), and 1(2%) respectively [Table/Fig-1], [Table/Fig-3] and [Table/Fig-4].

Table/Fig-1]: Showing the shape of the spleen in percentage

Serial nos	Shape of the spleen	No of specimens	Percentage (%)
1	Wedge shape	26	52%
2	Tetrahedral	15	30%
3	Triangular	5	10%
4	Irregular	3	6%
5	Oval	1	2%

**[Table/Fig-2]:** Showing the shape of the spleen wedge and tetrahedral.**[Table/Fig-3]:** Showing the shape of the spleen triangular and irregular**[Table/Fig-4]:** Showing the shape of the spleen oval

[Table/Fig-5]: Showing the variations of the weight of the spleen in the study specimens.

Serial no	Weight of the spleen in grams	Number of spleen	Percentage
1	<50	2	4%
2	50 to 100	23	46%
3	101 to 150	15	30%
4	151 to 200	7	14%
5	201 to 250	2	4%
6	251 to 300	1	3%

In the [Table/Fig-5] the mean weight of the spleens were 103.95 grams (SD \pm 51.26) ranges from 25.14 to 300 grams and most of the specimens 38 (76%) were between 50 to 150gms.

There were 10(20%) specimens above 150 grams and only two specimens were below 50 grams constituting 2 (4%) of the total [Table/Fig-5].

[Table/Fig-6]: Showing the variations in length of the spleen in the study specimens.

Serial no	Length of spleen in cms	Number of spleen	Percentage(%)
1	7 to 9	4	8%
2	9.1 to 11	20	40%
3	11.1 to 13	20	40%
4	>13	6	12%

The length of the spleens in present study varied between 7cm to 14cm with an average length of 11.92 ± 2.14 centimetres, however in most of the spleens 40 specimens (80%) had the length

ranges from 9cm to 13cm followed by 6(12%) specimen had more than 13 centimetres and 4(8%) cases were between 7 to 9 centimetres [Table/Fig-6].

[Table/Fig-7]: Showing the variations in breadth of the spleen in the study specimens

Serial no	Breadth of spleen in cms	Number of spleen	Percentage (%)
1	4 to 6	13	26%
2	6.1 to 8	27	54%
3	8.1 to 10	6	12%
4	>10	4	8%

The observed mean breadth was 7.08 cm \pm 1.66 ranges 4 cms to 12 cms. Maximum breadth were seen in 27(54%) specimens ranges 6.1 cms to 8

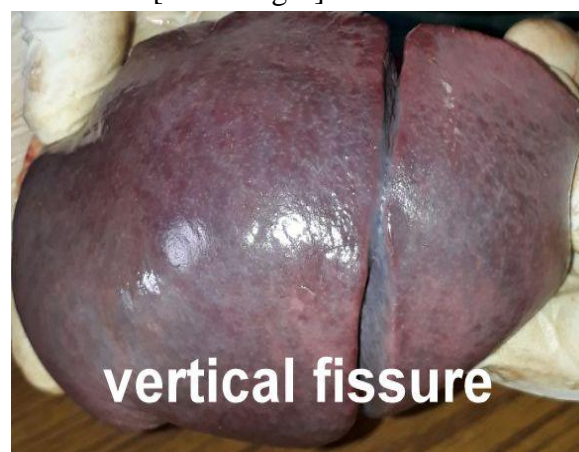
cms followed by 13(26%) specimens between 4 to 6 centimetres and 10 (20%) specimens between 8.1 to 12 centimetres [Table/Fig-7].

[Table/Fig-8]: Showing the variations in width of the spleen in the study specimens

Serial no	Thickness in cms	No of specimen	Percentage
1	2 to 4	20	40%
2	4.1 to 6	28	56%
3	>6	2	4%

In the present study the mean width was 3.08 ± 0.66 cms ranges 4cm to 12cm. Maximum specimens 28(56%) were between 4 cm to 6cm

followed by 20(40%) cases 2 to 4 centimetres and only 2(4%) specimens had breadth more than 6 centimetres [Table/Fig-8].

**[Table/Fig-9]:** Showing the spleens having fissures.

The typical lobulated appearance of spleen was seen in 2 (4%) specimens in the present study. The lobulations were due to linear and oblique fissures present on the spleen [Table/Fig-9]. The number of spleen showing notches in the superior border were found to be 25(50%) inferior border 4(8%) and both the borders was 21(42%).

Discussion

Many variations in the morphology of spleen are mentioned in Gray's anatomy and also reported by other Authors like Hollinshead and Michel ^[1,7].

The shape of the spleen varies from wedge to a domed" tetrahedron, the shape mostly determined by its relations to neighbouring structures during development and fusion of multiple spleniculi^[1]. In the present study we observed different shapes of spleen out of which wedge shaped 26(52%) was found to be most common, followed by tetrahedral, triangular, irregular and. oval. The percentage of different shapes of spleen differ from Rao et al and hollinshead but very close to Chaware et al. ^[5,8,10]

[Table/Fig-10]: Showing the Variations in shapes of spleen

Shape of spleen	Rao et. al.2013 ^[8]	Hollinshead WH 1986 ^[6]	Chaware et. al. 2012 ^[10]	Present study
wedge	40%	44%	61.26%	52%
tetrahedral	20%	14%	21.63%	30%
triangular	32%	42%	12.61%	10%
irregular	00	00	0.90%	6%
oval	8%	00	3.60%	2%

In the present study different dimensions of spleens were similar to previous studies. The length of the spleen varied from 8cm to 14cm with a average length of 11.86cm, the breadth varied from 4cm to 10cm with an average of 7.32cm and

width ranges from 2cm to 4.5cm with an average width of 3.07cms The mean value of length, breadth. and width of the spleen in present study were 11.88cm, 7.32cm, 3.07cm respectively. ^[1,7,8,10]

[Table/Fig-11]: Showing the Comparison of the dimensions of spleens with previous authors

Measurement	Michael et.al. 1942 ^[7]	Rao et. al. 2013 ^[8]	Chaware et al. 2012 ^[10]	Text book of Gray 41 th Edn ^[1]	Present study
Length	11	10.5	9.66	12	11.86
breadth	7	8.3	6.22	7	7.33
Width	3	00	3.06	3 to 4	3.07

In the present study weight of the spleen varied between 50 grams to 300 grams with an average weight of 106 grams and in two specimens weight was less than 50 grams. Which appear lower than the normal range 80 to 300 grams with an average weight of 150 grams reported by previous studies (1,6) this may be due to differences in socio economic status, feeding habits, geographical conditions in the population of odisha. The splenic notches were found in superior and inferior borders. The average number of splenic notches were seen as one or two ranges from 0 to 4. In the superior border 25(50%), inferior border 4(8%) and both the borders 21(42%) were observed,

which is similar to Nayak BS et.al.2011 ^[11]. There were two specimens having deep fissures giving appearance of lobulated spleen.

Conclusion

The morphometric anatomical variations of spleen may be helpful for the physician to access the progression of certain diseases process and surgeons for proper diagnosis before planning for cases of partial or total splenectomy. As the immune response plays a vital role in the body defence mechanism it is mandatory to preserve the spleen as far as possible during surgery. This knowledge will be helpful to the radiological

diagnosis of diseases related to spleen and last but not the least to the first year MBBS students in their classroom dissections.

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Conflict of interest: None to declare

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