ORIGINAL RESEARCH

Study to Find the Morphometric Variations of Spleen: A Cadaveric Based Analysis

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ABSTRACT

Introduction: The spleen is a large haemo-lymphoid organ that are situated in the left hypochondrium andis partly in the epigastrium. Anatomically, it is placed between the fundus of stomach and diaphragm opposite to the 9th to 11th ribs. Spleen is an enormously vascular, soft and friable organ which is more or less purple in colour and moves with respiration.The importance of the spleen in protection from infection was actively neglected and it was thought that the other lymphatic organs of the body could take over its functions. Currently, a total splenectomy is vastly replaced by partial splenectomy by surgeons. Therefore, this study is meant to be carried out to find the morphology of spleen and its variations.

Materials and Methodology: The present study was carried out on embalmed cadavers that include both the sexes in the Department of Anatomy, SMS Medical College, Jaipur, Rajasthan, India. This study comprised of 65 complete spleen samples whereas the specimens withdestructed surface and margins by any mechanical, pathological and other conditions were excluded from the study. Dissection was carried out by following the Cunningham's manual of practical anatomy. The specimens were allowed to be preserved in 10% formalin. All the collected samples were collected as per their weight, length, width, breadth was promptly measured, and the number of notches present were recorded. The weight of the spleen was calculated using the electronic weighing machine. The length was calculated as the greatest distance between the two poles of the spleen.

Results: The weight taken from 65 specimens ranges from 50-200 gm in 56 specimens (86%) and from 201-350 gm in 8 specimens (12%) and above 350 gm in 1 specimen (2%). The length of the spleen ranges from 6-9 cm in 31 (48%) and 9-15 cm in 34 (52%) specimens. Breadth of the spleen varies from 2-5 cm in 21 (32%) specimen, 5-9 cm in 42 (64%) specimen and 9-13 cm in 3 (4%) specimens. Thickness of the spleen varied from 2-4 cm in 62 (96%) and 4-6 cm 3 (4%) specimen respectively.

Conclusion: Despite the many indications for splenectomy, like traumatic rupture, hypersplenism, neoplasia, splenic cyst, the present tendency of the surgeons is to aid for conservative management and to remotely conserve as much splenic tissue as possible. Hence the sound knowledge on the variational anatomy of the spleen is of fundamental and is of utmost importance.

Keywords: Spleen, Lymphoid Organ, Vascular, Accessory Spleen, Splenectomy.

INTRODUCTION

It has been stated that the spleen is observably an encapsulated intraperitoneal organ that is entirely covered with peritoneum completely except that its hilum where the splenic branches of the splenic artery and vein seemed to be enter and leave.[1,2] It is mainly supported by a phrenico-colic ligament that basically originates from the colon from the bottom and are anchored to the stomach by gastro-splenic ligament and attached to the left kidney by a lien renal ligament.[3]The spleen is a large haemo-lymphoid organ that are situated in the left hypochondrium and ispartly in the epigastrium. Anatomically, it is placed between the fundus of stomach and diaphragm opposite to the 9th to 11th ribs. Spleen is anenormously vascular, soft and friable organ which is more or less purple in colour and moves with respiration. The size and weight of spleen is hugely different in variety of age groups.[4]When comparing the adults, it is usually 12 cmin length, 7cms in breadth and 3-4 cm in width. The weight of the spleen ranges between 80-300gm with an average of around 150 gm.[4,5] The spleen presents two ends- medial and lateral, two surfaces-diaphragmatic and visceral, two borders- superior and inferior and two angles- anterior basal and posterior basal.[3]The diaphragmatic surface is notably smooth and convex but the visceral surface observes with impressions for the stomach, left kidney, left colic flexure and tail of pancreas.[3]Accessory spleens might be found in the hilum, gastrosplenic ligament, lienorenal ligament, in greater omentum, along splenic vessels and very rarely scrotum.[7]

As discussed, spleen is observably the most vascular organ in the human body which is involved in the regulatingthe circulating blood volume. Approximately 350 litres of blood that passes through it per day. The spleen was observed to be received approximately 5% of the cardiac output and 40% source of the blood in the portal circulation. The spleen normally contains about one unit of blood at a given time, 25% of total lymphocytes in the body, 30 to 40 mL of mature RBC and one-fourth of the circulating platelets. The size of the spleen is directly proportional to the disease activity in a variety of reticulo-endothelial system. Measurement of the splenic length is a very good indicator of actual splenic size in routine clinical practice. Therefore, the importance of the spleen in protection from infection was actively neglected and it was thought that the other lymphatic organs of the body could take over its functions. Currently, a total splenectomy is vastly replaced by partial splenectomy by surgeons. Therefore, this study is meant to be carried out to find the morphology of spleen and its variations.

MATERIALS AND METHODOLOGY

The present study was carried out on embalmed cadavers that include both the sexes in the Department of Anatomy, SMS Medical College, Jaipur, Rajasthan, India. This study comprised of 65 normal cadaveric spleensand the specimens with destructed surface and margins by any mechanical, pathological and other conditions were excluded from the study. Dissection was carried out by following the Cunningham's manual of practical anatomy.[8]After proper ligation, spleen is detached from many attachments and splenic vessels were nearly cut down near the hilum following which splenectomy was carried out. All the collected specimens were washed out with tap water in order to clean the debris and fatty tissue on the surface. The specimens were allowed to be preserved in 10% formalin. All the collected samples were collected as per their weight, length, width, breadth waspromptly measured, and the number of notches present were recorded. The weight of the spleen was calculated using the electronic weighing machine. The length was calculated as the greatest distance between the two poles of the spleen. The greatest distance between two points at the same level on the superior and inferior borders is calculated as its breadth and the thickness of the spleen was measured at the midpoint of both the visceral and parietal surfaces.[9] These values were calculated with the help of non-stretchable inch tape and vernier calliper. The

presence of notches on the borders and impressions on the surfaces of the spleen were also noted. If there is any presence of accessory spleen at the point of hilum was duly noted. The data collected were tabulated, statistically analysed and were allowed to be compared with earlier studies.

RESULTS

The weight taken from 65 specimens ranges from 50-200 gm in 56 specimens (86%) and from 201-350 gm in 8 specimens (12%) and above 350 gm in 1 specimen (2%) as tabulated in table – 1. In the current study, the length of the spleen ranges from 6-9 cm in 31(48%) and 9-15 cm in 34 (52%) specimens as given in Table-2. Breadth of the spleen varies from 2-5 cm in 21 (32%) specimen, 5-9 cm in 42 (64%) specimen and 9-13 cm in 3 (4%) specimens respectively as seen in Table - 3. Thickness of the spleen varied from 2-4 cm in 62 (96%) and 4-6 cm 3 (4%) specimen respectively as tabulated in the Table 4. In the present study, it has been calculated that the number of notches present in superior border varied from one to two in 56 specimens (86%) and 3 to 6 in 9 specimens (14%) as seen in Table 5. There was no accessory spleen was recorded in the present study.

Table 1: Weight of spleen

Weight (gm)	No. of specimen	Percentage
50 – 200 gm	56	86
201– 350 gm	8	12
>350 gm	1	2
Total	65	100

Table 2: Length of spleen

Length (cm)	No. of specimen	Percentage
6 – 9 cm	31	48
9 – 15 cm	34	52
Total	65	100

Table 3: Breadth of spleen

Breadth (cm)	No. of specimen	Percentage
2- 5 cm	21	32
5 - 9 cm	42	64
9 – 13 cm	2	4
Total	65	100

Table 4: Width of spleen

Width (cm)	No. of specimen	Percentage
2- 4 cm	62	96
4 - 6 cm	3	4
Total	65	100

Table 5: Number of notches

No. of notches	No. of specimen	Percentage
1 – 2	56	86
3 – 6	9	14
Total	65	100

DISCUSSION

The spleen is a haemo-lymph organ because of the following reasons: (a) Spleen filters blood by taking out worn-out erythrocytes or any microbial antigens from the circulation, whereas lymph node filters lymph (b) In foetal life spleen manufactures erythrocytes and after birth it manufactures lymphocytes (c) Each splenic lymphatic follicle is traversed eccentrically by an arteriole and is surrounded by the red pulp. The spleen is the major repository of mononuclear phagocytic macrophage cells in the red pulp and of lymphoid cells in the white pulp.10

The weight of spleen varied between 80 to 250 grams according to*Hollinshead*,[11]*Kharat VidhyaShankarrao* and *Garud Rajendra*[12] in their study on 50 spleens showed the weight from 54 grams to 583 grams with a mean value of 143.74grams.In a study done by *Sivanageswara Rao* et al[13] the weight of spleen was observed to be noted from 80 to 250 grams.*Sangeetha* et al[14] observed that the weight of spleen ranged from 53 to 444 grams. As per*BahiruTenaw* et al[15] the weight ranged from 45.72 to 331.41 grams with an average of 147.40 grams.*Lizamma Alex* et al[16]carefully tested the weight of spleen in 70 spleens out of which 45 males and 25 females.It was recorded that the weight of males (88.29 ± 36.65) exceeded that in females (71.60 ± 29.67) in all age groups.[16]*Chaware* et al proposed that the weight of spleen varied from 80 to 150gms with an average of 145.76gms in their study on 111 spleens.[17]In a study conducted on 50 spleens the length of spleen was in range of less than 5cm in 2.5cm to 7cm in 8,7&1cm to 9cm in 32 and more than 9cm in 8.Breadth was noted to be less than 4cm in 4, 4.1cm to 6cm in 41 and more than 6cm in 5 spleens. Width of spleen was less than 2cm in 1, 2.1cm to 4cm in 40 and more than 4cm in 9.[10] In some studies carried out on 50 spleens the length of spleen varied from 7.5cm to 14.7cm with a mean value of 11cm.Breadth of spleen varied from 6cm to 11cm with an average of 8.5cm.Width varied from 3cm to 8.5cm with a mean value of 5.7cm.[12]*Chaware* et al observed that the length of spleen from 5 to 13 cm with a mean of 9.66cm,breadth from 3.5cm to 9.5cm with an average of 6.22cm and width of spleen from 1.5cm to 3.5cm with a mean of 3.06cms.[17]

Das et al[18] in their study showcased that the presence of notches on the superior border of spleen is noted to be found in 98%. *Skandalakis* et al[19]proposed that the notched were seen in 78.6%,in 50% by *Sateesha* et al.[20]The percentage incidence of spleens with absence of notches as observed by *Girish* et al and *Kharat Vidya* et al[12] were 1.67% and 6%.In the present study, no such variation is recorded. Presence of notches on the superior margin is reportedly helpful for the physician to promptly palpate the spleen during enlargement of spleen.[21] Splenomegaly in unnotched spleens might be misdiagnosed as renal swelling on left costal margin by most of the surgeons that suggests the importance of splenic notches in clinical practice.

As observed in the earlier studies, similarly in this study also it has been observed that the weight mostly varies from 80 and 300gm, except in 2% of the specimens, in which it was above 300gm.The values of the length, breadth, weight and width of the spleen in the present study had variations. This might be due to the differences in the genetic factors, body constitution, geographical conditions, feeding habits and the better socioeconomic status. In all the spleens that had been studies, two poles, two borders and two surfaces were duly observed. The diaphragmatic surface of the spleen displayed a uniform morphology, while its visceral surface seemed to be gastric, renal, colic and pancreatic impressions due to their pressure on the spleen.

CONCLUSION

Therefore, despite the many indications for splenectomy, like traumatic rupture, hypersplenism, neoplasia, splenic cyst, the present tendency of the surgeons is to aid for conservative management and to remotely conserve as much splenic tissue as possible.

Hencethe sound knowledge on the variational anatomy of the spleen is of fundamental and is of utmost importance.

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