VOLUME - 10, ISSUE - 09, SEPTEMBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anatomy

"A STUDY OF MORPHOLOGICAL VARIATION OF SPLEEN IN HUMAN CADAVER"

Dr. Nidhi	Tutor, Department of Anatomy PMCH PATNA.
Dr. Dhananjay Kumar*	Assistant Prof., Department of Radiology PMCH PATNA. *Corressponding Author
Dr. Mrityunjay Kumar	Assistant Prof., Department of Pathology PMCH PATNA.

ABSTRACT

Background: The spleen is an important lymphatic organ in the human body. Its immunological functions are being well realized. The shape, size and weight of the spleen in human vary with age, sex, and under different conditions in the same individual. The idea of morphological variations is important to avoid misinterpretation of the splenic variants.

Material and Methods: A cross sectional study of a total of 34 adult human cadaveric spleens was done in the Anatomy Department, at Patna medical college and hospital Bihar. The study observed the morphological features such as shape, number of notches, anomalous fissures, and morphometric measurements such as length, breadth, thickness and weight of all the spleen specimens.

Results: The wedge shaped spleen constituted 41.18% followed by triangular (23.53%), irregular (17.64%), oval (11.76%) and round (5.89%) shaped spleens. The maximum number of notches was present in the anterosuperior border and the number varied from 0-4 notches. There was no notch in 2.94% of the specimens. Mean values of splenic length, breadth and thickness were 9.91 cm, 6.14 cm and 3.35 cm respectively. The mean weight of the spleens was 149.09 g. Anomalous fissures were found on the diaphragmatic (2.94%) and visceral (2.94%) surfaces of the spleens.

Conclusion: The findings of the present study will be of fundamental importance to the physicians, surgeons and radiologists and gives clue for various clinical disease.

KEYWORDS : Spleen notch Cadaver, Splenic variations, shape of spleen.

INTRODUCTION

The Spleen is the largest lymphoid organ in the human body it is connected to the blood vascular system,it consists of a large encapsulated mass of lymphoid and vascular tissues. and is located in the left hypochondrium resting on the left colic flexure opposite to the 9th - 11th ribs.[1] It is one of the frequently damaged organs in blunt abdominal trauma and also in penetrating injury to the left upper abdominal quadrant.[2] Spleen has superior and inferior poles, superolateral diaphragmatic and inferomedial visceral surfaces, anterosuperior and posteroinferior borders. The superior pole corresponds to the posterior extremity and usually faces the vertebral column. The inferior pole which is less angulated than the superior pole connects the anterosuperior and posteroinferior borders anteriorly. The diaphragmatic surface is smooth and convex, faces mostly superiorly and laterally, although the posterior part may face posteriorly. The visceral surface is irregular, faces inferomedially towards the abdominal cavity. The anterosuperior border is usually convex and inferiorly, it may bear one or two notches. The size and weight of the spleen vary with age, sex, and can also vary slightly in the same individual under different conditions.

The adult spleen is usually 9-14 cm long, 6–8 cm wide and 3-5 cm thick. It reaches its largest dimension in puberty and diminishes thereafter. The average adult weight depends on the amount of blood in it. The weight ranges from 150 to 350 g in vivo and when emptied of blood, it weighs between 70 and 120 g.[3] Congenital anomalies of the spleen are believed to be rare and include spleen lobulation, wandering spleen, accessory spleen, polysplenia and absence of the spleen.[4]

Prenatally, the spleen is a hematopoietic organ, but after birth it is involved primarily in identifying, removing, and destroying worn out red blood cells (RBCs) and platelets. Moreover, this organ also acts as a reservoir of blood, stores RBCs and platelets.[1] The spleen participates in many different pathological processes e.g. generalised haematopoietic and lymphopoietic disorders, systemic infection, sepsis and immunologic-inflammatory processes. Despite its clinical significance, spleen seems to be "the forgotten organ" unless enlarged, traumatized, or infarcted.[5] Many researchers feel that radiologists and clinicians should be well aware of the normal spleen variants, as well as relevant congenital and acquired abnormalities so that they interpret correctly the variable spectrum of findings that may involve the organ. Measurement of the splenic length in the routine clinical practice is a very good indicator of actual splenic size, splenomegaly is an important diagnostic clue to the existence of underlying disorder.

MATERIALS AND METHODS

The study was a cross sectional study conducted in the Department of Anatomy, at Patna medical college and hospital patna Bihar. A total of 34 formalin fixed intact spleens were included. The spleens were collected during routine dissection of the donated adult human cadavers for the undergraduate medical teaching. The shape of the spleen, splenic notch and anomalous fissure on the surfaces were observed. In addition, the length, breadth, thickness and weight of the spleens were recorded using measuring tape, sliding caliper and weighing machine respectively.

The observations relating to the shape, splenic notch And anomalous fissures were expressed as percentages. The length, breadth, thickness and weight were summarised by descriptive statistics (numerical) and the mean values were compared with the findings of other workers by One- sample T test. $P<0.05$ was considered statistically significant. IBM SPSS statistics version 21 was used for data analysis.

RESULTS

The spleen specimens revealed different shapes and sizes. The wedge shaped spleen constituted 41.18% followed by triangular (23.53%), irregular (17.64%), oval (11.76%) and round (5.89%) shaped spleens (Table 1, Figure 1 - A, B, C, D & E). The maximum number of notches was present in the anterosuperior border and the number varied from 0-4. Two

notches in the border made up 41.18%, followed by single notch (26.47%), three notches (17.65%) and 4 notches (8.82%). In 5.89% of the anterosuperior border, there was no notch. The splenic notches in the posteroinferior border comprised of single notch (26.47%) and 2 notches (11.76%). In 23.58% of the spleen i.e. (2.94%) of the specimens. The anomalous fissures were found on the diaphragmatic (2.94%) and visceral (2.94%) surfaces of spleen specimens.

The length of the spleens varied from a minimum of 7.60 cm to a maximum of 12.70 cm with a mean value of 9.91cm. The breadth was observed to vary from 4.00 cm to 7.20 cm with a mean value of 6.14 cm. The mean thickness was 3.35 cm with the minimum and maximum limits of 2.70 cm and 4.30 cm respectively. A mean value of 149.09 g was observed for the weight of the spleens (Table 4).

Table 1: Splenic shape, number and percentage (n = 34)

Shape	Number	%
Wedge	14	41.18
Triangular	8	23.53
Irregular	6	17.64
Oval	4	11.76
Round	2	5.89

*** n = Total number of specimens.**

Table 3: Anomalous fissures on the splenic surfaces (n=34)

Surface	Number	%
Diaphragmatic	1	2.94
Visceral	1	2.94

Table 4: Measurements of length, breadth, thickness and weight (n=34)

Parameter	Minimum	Maximum	Mean	SD
Length (cm)	7.60	12.70	9.91	1.23
Breadth (cm)	4.00	7.20	6.14	0.76
Thickness (cm)	2.70	4.30	3.35	0.43
Weight (g)	60.00	210.00	149.09	33.88

specimens, the notches were present on both the borders. There was no notch in 2.94% of the spleens. The presence of a single notch in the superior pole was noticed in one

Table 4: Measurements of length, breadth, thickness and weight (n=34)

Parameter	Minimum	Maximum	Mean	SD
Length (cm)	7.60	12.70	9.91	1.23
Breadth (cm)	4.00	7.20	6.14	0.76
Thickness (cm)	2.70	4.30	3.35	0.43
Weight (g)	60.00	210.00	149.09	33.88

Splenic length, breadth, thickness and weight in some Indian studies

Author(s)	Length (cm)	Breadth (cm)	Thickness (cm)	Weight (g)
Agrawal D et al.[10]	10.15	6.01	3.23	156.01
Biswal R et al.[11]	11.92†	7.08†	3.08*	103.95†
Anusha D et al.[15]	9.82	8.24†	2.85†	131.00*
Agarwal KK et al.[19]	9.20*	6.70†	3.90†	114.70†
Present study	**9.91**	**6.14**	**3.35**	**149.09**

Values are expressed in Mean; *P<0.01 and †P<0.001 as compared to present study (One-sample T test).

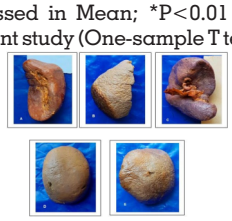

Figure 1: A - Wedge shaped, B - Triangular shaped, C - Irregular shaped, D - Oval shaped, E - Round shaped.

DISCUSSION

The present study noticed five different shapes of the spleen. The most common shape was the wedge shape followed by triangular, irregular, oval, and round shapes. The observation of wedge shaped spleen as the commonest shape, but differs from Srivani D et al.[9] and Swargam N[16] who observed tetrahedral and triangular shapes respectively as the commonest shapes. The tetrahedral shaped spleen was not found in our study, but the round shaped spleen constituted 5.89% of the total of 34 spleens observed. These findings were in contradiction to many studies in India. In a study of a total of 60 cadaveric spleens, Anusha D et al.[15] reported round shaped spleen in 10% of the specimens. The variations in the shapes are mostly determined by the relationships of the organ to neighbouring structures during development.[3]

The notches were found more frequently on the anterosuperior border and the maximum number was four in the current study. Different workers documented the superior border bearing more notches than the inferior border. We observed the notches on both the borders as reported by previous workers. In 2.94% of the specimens, there was no notch found, and the absence of the notch was also reported in other studies.The presence of notch on the superior pole could be a rarity. The notches in the spleen indicated incomplete fusion between lobules of splenic tissue. The presence of splenic notch could be helpful in palpating the spleen clinically, but variations in the number of notches could be misguiding the clinicians in differentiating the renal tumours from splenomegaly.

The anomalous fissures were seen on both the diaphragmatic and visceral surfaces in the current study and Anusha D et al. reported similar findings. The anomalous fissures might be due improper fusion of the splenic nodules during development or mechanical pressure by the adjacent viscera. The comparative assessment of the shapes (Table 5) and the mean values of the morphometric measurements (Table 6) of our study were attempted with the findings of some Indian studies. The assessment revealed that the mean value of the observed lengths of the current study was comparable with the those of previous workers.The value was less than that of Biswal R et al. but greater than the observations of Agarwal KK et al. significantly. The mean breadth was comparable with the finding of Agrawal D et al.[10] However, it was found to be significantly less (P<0.001) as compared to findings of other Indian studies. In terms of the thickness, the mean was significantly greater than the observations of some authors, but comparable with the finding of a study. The spleen develops from the mesoderm. During its development, different lobules are formed, Which fuse with each other later on, the indication of the lobulation in adult spleen is its notched upper border.

CONCLUSION

Morphometric analysis of spleen seem to be under reported and need to be carried out actively, that there are morphological variations of the spleen in different individuals. Therefore, such idea of possible morphological variations should be kept in mind by the radiologists and the clinicians, especially the surgeons to avoid misinterpretation of the splenic variants and avoid unnecessary invasive procedures.

REFERENCES

1. Moore KL, Dalley AF, Agur AMR. Moore clinically oriented anatomy. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2014.
2. Forsythe RM, Harbrecht BG, Peitzman AB. Blunt splenic trauma. Scand J Surg. 2006;95:146-51.
3. Petroinau A. Spleen. In: Standring S, editor. Gray's anatomy: The anatomical basis of the clinical practice. 41st ed. London: Elsevier; 2016. p. 1188-93.
4. Tenaw B, Muche A. Assessment of anatomical variation of spleen in an adult human cadaver and its clinical implication: Ethiopian cadaveric study. Int J Anat Var. 2018;11(4):139-42.
5. Varga I, Galfiova P, Adamkov M, Danisovic L, Polak S, Kubikova E, Galbavy S. Congenital anomalies of the spleen from an embryological point of view. Med

Sci Monit. 2009;15(12):RA269-76.
6. Chidambaram RS, Sridhar S. Morphological variations of spleen: A cadaveric study. Journal of Evidence Based Medicine and Healthcare. 2005;2(29):4248-54,
7. Nayak BS, Somayaji SN, Soumya KV. A study on the variations of size, shape and external features of the spleen in South Indian population. Int J Morphol. 2011;29(3):675-77.
8. Vancauwenberghe T, Snoeckx A, Vanbeckevoort D, Dymarkowski S, Vanhoenacker FM. Imaging of the spleen: what the clinician needs to know. Singapore Med J. 2015; 56(3):133-44.
9. Srivani D, P Sofia P, Pillai TJ, Devi CKL. A study on morphological variations of spleen in fetal and adult specimens and its clinical significance. Indian J Clin Anat Physiol. 2019;6(4):475-80.
10. Agrawal D, Sujatha GB, Mohanty BB, Rani VS. Morphometric variations in spleen: A study in dissected cadavers in Anatomy Department of a teaching hospital of India. Indian J Anat. 2018;7(3):237-40.
10. Biswal R, Mishra DN, Kanchan R, Mohapatra C. Morphometry of human cadaveric spleen: An Institutional study in the population of Odisha. Journal of Medical Science and Clinical Research. 2018;6(6):497-502.
11. Chaware PN, Belsare SM, Kulkarni YR, Pandit SV, Ughade JM. The morphological variations of the human spleen. J Clin Diagn Res. 2012;6(2):159-62.
12. Setty SRS, Katikireddi RS. Morphometric study of human spleen. International Journal of Biological & Medical Research. 2013;4(3):3464-68.
13. Khade A, Bondge V. Morphological study of spleen. Global Journal for Research Analysis. 2018;7(1):176- 78.
14. Anusha D, Madhavi D, Srinidhi K, Lakshmi BB. Morphometric study of spleen. Journal of Evolution of Medical and Dental Sciences. 2019;8(18):1469-73.
15. Swargam N. Clinical implications of morphological and morphometric variations in human spleen – A cadaveric study. Int J Sci Study. 2019;7(1):53-56.
16. Umarani S, Sivaraj R, Ananthi V, Muniappan V. Morphologic variations of spleen: A cadaveric study in South Indian population. International Journal of Anatomy and Research. 2018;6(1.2):4914-19.
17. Sangeeta M, Varalakshmi KL, Sahana BN. Cadaveric study of morphometry of spleen. Journal of Medical Sciences and Health. 2015;1(3):14-17.
18. Agarwal KK, Dwivedi AK, Saxena A, Airan N, Mittal A. Morphometric and morphological analysis of spleen in Garhwal region of Uttarakhand. Int J Sci Res. 2018;7(1) :10-12.