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Original Research Article

A study of splenic notches in human cadavers and its clinical implications

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ABSTRACT

Background: Spleen is the largest and secondary lymphoid organ with high vascularity which has important role in immunological and haematological functions of human body. Spleen developes from mesoderm and in the initial stages of development, different lobules are formed, which fuses later. The lobulated structure of spleen disappears, but is indicated by the presence of notches in superior border in adults.

Aim: The aim of study was to find morphological variations of spleen with respect to its number of notches in borders and anomalous fissure on its surfaces.

Material and Methods: The study was done on 40 formalin fixed cadaveric spleens from the department of Anatomy, Sri Siddhartha Medical College, Tumkur, and Karnataka.

Results: Out of 40 spleens studied, the various shapes such as wedge shaped, tetrahedral, oval and triangular were found. The number of spleen showing notches in superior border was 28(70%) and in the inferior border it was 3(7.5%). Absence of Splenic notches was observed in 5(12.5%) and 2(5%) spleens had notches in both borders. The anomalous fissure was found in 2(5%) spleen on its diaphragmatic surface.

Conclusion: The knowledge of variations in morphology of spleen are essential for physician, surgeon, radiologists and forensic surgeon to differentiate from the splenic pathology and splenic injury. Morphological variations of spleen and its clinical importance need to be discussed at dissection tables during routine anatomy dissection hours.

1. Introduction

Spleen is the largest lymphatic organ which is located in left hypochondrium of abdominal cavity.[1] The spleen lies just beneath the left dome of diaphragm close to 9^{th}, 10^{th}, and 11^{th} ribs.[2] The shape of the spleen vary from curved wedge shape to tetrahedral shape. The size of the adult spleen is usually 12cms long, breadth 7cms and 3-4cms width and weight from 80gms-300gms,average being 150gms.[3] The spleen has three borders-superior, inferior and intermediate. It has two poles-anterior and posterior and two surfaces diaphragmatic/superolateral and visceral/inferomedial. The anterior pole is broad and faces laterally. The posterior pole is narrow and faces medially towards vertebral coloumn.[4] The diaphragmatic surface is convex, smooth and is related to abdominal surface of left dome of diaphragm. The visceral surface is irregular and is characterised by renal, gastric, colic and pancreatic impression.[4] The upper border between gastric impression and diaphragmatic surface is sharp and well-defined except where it is well interrupted by notches.The lower border separates diaphragmatic surface and renal impression. While lateral end intervenes between diaphragmatic and colic impression.[5] The notches donot typically appear in intermediate and inferior border.[6]

Spleen developes in dorsal mesogastrium as a collection of mesenchymal cells.[7] Spleen is lobulated in foetus but

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lobules normally disappear before birth. The notches in superior border are the remnants of the grooves that separated the foetal lobules.[8] The number of notches varies from 0-6 but commonly only one or two notches are seen. The superior border of spleen possess characterstic notch on its anterior part.[9]

The knowledgeof anomalous size, shape, notches and other external features may are of importance for surgeons and radiologists.Splenic notches present on superior border are used as a clinical guide to palpate an enlarged spleen.Anomalous splenic notches and fissures can be misinterpreted as splenic injury[10] and splenic lobules are confused as mass originating from left kidney by radiologists.[11]

The aim of the study was to find morphological variations of spleen with respect to its number of notches in borders and anomalous fissure on its surfaces.

2. Material and Methods

The study was done by dissecting 40 embalmed human cadavers aged between 50-55yrs of which 34 were male cadavers and 6 were female cadavers. Cadavers with no history of poisoning, alcohol or drug abuse, no sign of decomposition and no evidence of trauma or abnormality of spleen were included in the study. Cadavers with any pathologic abnormality were excluded.

During routine dissection of the abdominal region by using standard dissection technique, spleens were removed by cutting the splenic vessels near its hilum and carefully detaching organ from peritoneum. Following the removal, the spleens were preserved in 10% Formalin. Each spleen was carefully examined to determine the presence of splenic notches, fissures and lobation. Splenic notches and fissures were studied with regard to its different borders. Spleen possessing abnormal notches, fissures and more than one lobe were photographed. The following parameters were noted: a) Shape of spleen b) Presence of splenic notches c) Presence of Anomalous fissure. All observations were analyzed and tabulated with their variable percentages which were compared with available literature.

3. Results

In the present study, 40 cadaveric spleens were studied and it was found that 17 (42.5%) spleens were tetrahedral shaped,12 (30%) spleens were wedged shaped, 6 (15%) spleens were triangular, 5 (12.5%)spleens were oval shaped. Observations are tabulated in Table 1.

Out of 40 spleens observed, majority of splenic notches were found to be in superior border and their notches number varied between 0-6. One notch were found in 4 spleens, two notches were found in 9 spleens, three notches in 15 spleens, four notches in 5 spleens and more than four notches were found in 2 spleens. A Spleen with an unusual presentation of an abnormal notch in the inferior border extending as a fissure into the diaphragmatic surface of spleen was noted. The fissure also extended into the visceral surface for a distance of 19mm. The superior border presented no notches. The fissure measured 20.5mm length and 15mm in depth.

In inferior border notches were absent in 33 spleens, in 6 spleens 1 notch were present and 1 spleen presented with 2 notches. Notches were absent in both the borders in 5 spleens.

A number of splenic notches observed in superior border and inferior border are tabulated in Table 2.

Table 1:

S. No.	Shape of spleen	No.of spleen	Percentage
1.	Wedge	12	30%
2.	Tetrahedral	17	42.5%
3.	Triangular	6	15%
4.	Oval	5	12.5%

Table 2: Variation in splenic notches and splenic fissure

S. No.	Type of variation	No. of spleen	Percentage
1.	Notches in superior border	28	70%
2.	Notches in inferior border	3	7.5%
3.	Notches in both borders	2	5%
4.	Absence of notches in both borders	5	12.5%
5.	Anomalous fissure in diaphragmatic surface	2	5%

Table 3: Variations in number of notches in borders

Borders	No. of notches	No. of spleen	Percentage
Superior border	0	5	12.5%
	1	4	10%
	2	9	22.5%
	3	15	37.5%
	4	5	12.5%
	>4	2	5%
Inferior border	0	33	82.5%
	1	6	15%
	2	1	2.5%
Presence of notches in both the borders		2	5%
Absence of notches in both the borders		5	12.5%

4. Discussion

In the present study, out of 40 spleens observed, shape of spleen varied from tetrahedral shape to wedge shaped. 28(70%) spleens showed notches only in the superior

Figure 1: Showing presence of two notches in superior border of spleen

Figure 2: Showing presence of >4 notches in superior border of the spleen

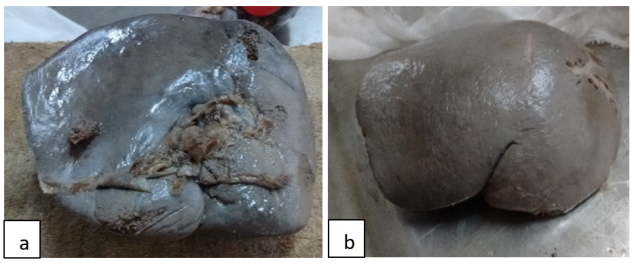

Figure 3: a): Showing absence of notches in superior border with fissure in inferior border; **b)**: Showing fissure extending into the diaphragmatic surface

border, 3(7.5%) spleen showed notches only in the inferior border, 5 (12.5%)spleens did not showed any notches in superior and inferior border. Majority of splenic notches were between 1 and 3. One spleen were noted with abnormal notch in inferior border and it was extending as fissure in diaphragmatic surface. The present study is compared with other studies and tabulated in Table 4.

Since spleen is an important organ in human body as it has immunological and haematological function. Most commonly Spleenomegaly is seen in malaria.typhoid, kalazar, acute and chronic leukaemias. The notch on the superior border helps to identify spleen in palpation method and also to differentiate it from other organ of the abdomen in left hypochondriac region. Sometimes splenomegaly can be misdiagnosed as renal swellings on left costal margin. The spleen with many notches are categorised as a distributed type with a large hilum, in which arterial branches are small and numerous.[6,12] Knowledge of this is important in management of haemorrhage in case of splenic surgeries where all these branches are carefully ligated.

Table 4:

S. No.	Study	Notches in superior border	Notches in inferior border	Splenic fissure
1.	R Sivachidambram et al[10]	63.33%	10%	6.6%
2.	Das et al[12]	98%	2%	1%
3.	Prashant Nachiket Chaware et al	74.76%	24.32%	-
4.	Srivangeswar Rao et al[13]	70%	14%	1%
5.	Girish V Patil et al[14]	95%	3.33%	-
6.	Present study	70%	7.5%	5%

5. Conclusion

The present study shows variations in shapes, presence of notches in border and number of notches which may provide a significant information to surgeons in planning surgeries related to spleen.

The knowledge of morphological variations in spleen is important for clinicians, surgeons and radiologists for the accurate diagnosis and treatment. The knowledge of notches in borders of spleen helps physician to palpate the enlarged spleen and differentiate it from adjoining organs, surgeons during spleen transplantation and radiologists to distinguish blunt injuries to spleen.

In this era of imaging and minimally-invasive approaches, it is imperative on the part of both the radiologists and operating surgeons to have a thorough knowledge of the anatomy and the commonly-occurring

variations in this organ. Accurate knowledge of anatomical variations is of vital importance for clinicians, surgeons & radiologists to improve diagnostic and therapeutic outcomes. Nevertheless, this knowledge is very important for anatomists during their routine classroom dissections.

6. Source of Funding

None.

7. Conflict of Interest

None.

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