Case Report

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Anatomy Section

Clinical Implication and Ontological Basis of Bilobed Spleen: A Rare Case Report

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ABSTRACT

Anatomical knowledge regarding the external morphology of the spleen is essential for surgical intervention and radiological diagnosis. A characteristic feature of the spleen is the presence of splenic notches at the superior border; however, such notches rarely extend deep enough to be considered fissures or to separate the spleen into multiple lobes. To date, there are very few cadaveric reports of complete splenic fissures. During a routine dissection class of the abdominal region, the spleen removed from the abdominal cavity exhibited a morphological variation in the form of a complete fissure. The spleen showed a complete notch extending as a fissure from the superior to the inferior border, dividing the spleen into two lobes. This study provides valuable information regarding the anatomy and prevalence of splenic fissures and bilobed spleens. A bilobed spleen is a rare congenital malformation that should be considered distinct from other known splenic anomalies. The presence of splenic fissures in bilobed spleens can serve as a guide for surgeons during conservative splenectomy procedures.

Keywords: Abnormalities, Anatomic variation, Congenital abnormalities, Splenectomy

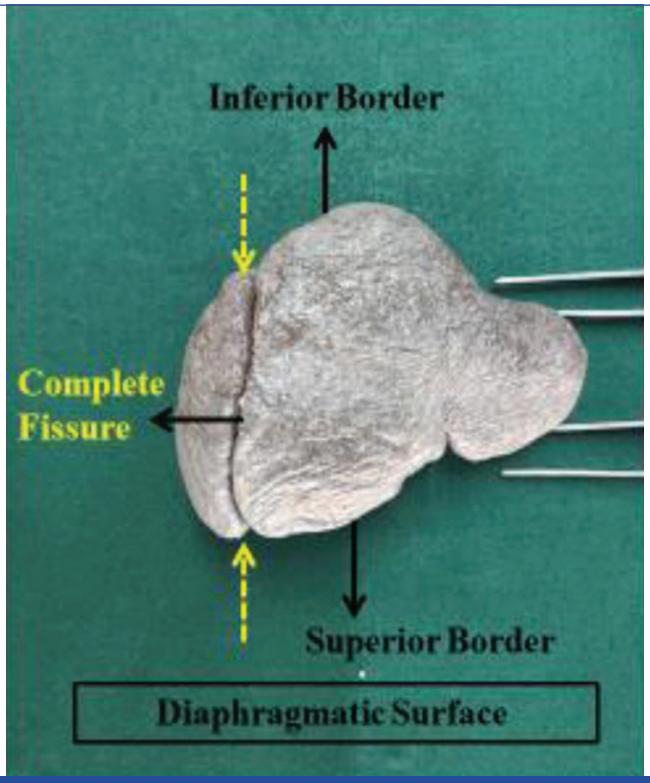
CASE REPORT

As part of the educational curriculum, during the routine dissections of first-year medical students, with the primary objective of understanding the anatomy of the abdominal cavity in-depth, the anterior abdominal wall of a male cadaver, with an unknown history and mode of death, was dissected. This was followed by the exploration and removal of the abdominal and visceral organs, as outlined in Cunningham's Guide to Dissection. As the dissection progressed to the spleen, the focus of our investigation, an unfamiliar divergence from the norm became apparent.

Instead of the usually shaped spleen (a tetrahedral lymphoid organ measuring 12 cm in length, 7 cm in breadth, and 4 cm in depth), an irregular and unusually shaped spleen was observed, divided into two distinct lobes by a fissure. The anthropometric measurements taken with a flexible measuring tape showed an increase in the spleen's dimensions, measuring 14 cm in length and 9.5 cm in width and 5 cm in depth, respectively. Its superior border featured one typical notch (approximately 2.5 cm from the lateral end) and an extensive fissure that separated the spleen into two different lobes, which were clearly visible on its diaphragmatic surface, as shown in [Table/Fig-1]. Another notable feature of this specimen was that the fissure was 11.5 cm long on the dorsal side but only 6 cm long on the visceral surface and had a depth of 1 cm throughout.

Significantly, the arterial supply to the spleen exhibited an intriguing arrangement. The splenic artery, which arises as a direct branch from the celiac trunk (a branch of the abdominal aorta), displayed a distinct branching pattern, dividing into four segmental branches. Three of these branches supplied the primary lobe, while the fourth branch entered the spleen medial to the fissure, reaching the aforementioned lobe, as illustrated in [Table/Fig-2]. This vascular pattern added a layer of complexity to the spleen's anatomical uniqueness.

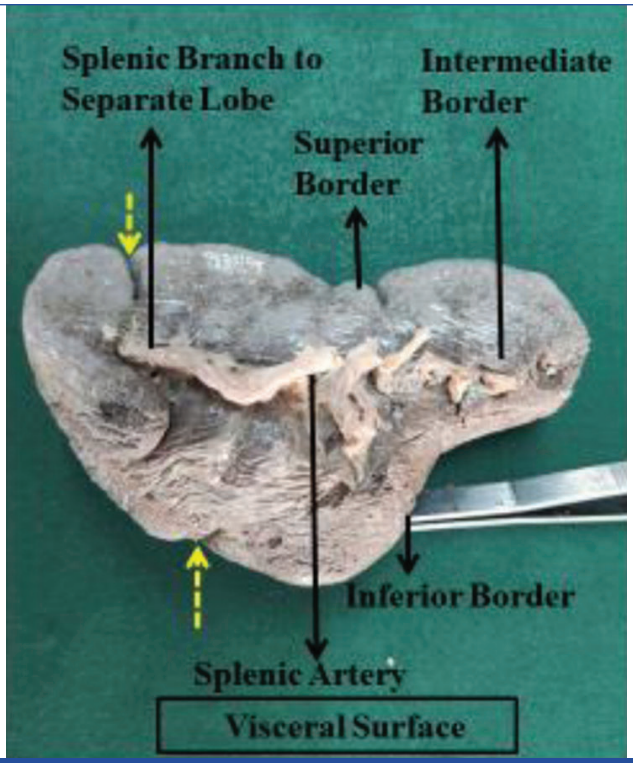
This unusual spleen, characterised by a single notch, a fissure separating two lobes, a segmented arterial supply and an irregularly formed inferior projection resembling a lobule, represents a notable discovery. It underscores the need for radiologists and surgeons to differentiate between anatomical variations and pathological splenic abnormalities such as splenic cysts, tumours, infarctions, or lacerations, which may present on diagnostic imaging as a bilobed spleen.



[Table/Fig-1]: Cadaveric spleen showing diaphragmatic surface with a complete fissure (yellow arrows) extending from superior to inferior border dividing it into a small and large lobe. The superior border also displays presence of a notch.

DISCUSSION

The spleen, the largest organised lymphoid tissue in humans, is usually described as a wedge- or tetrahedron-shaped, large encapsulated mass of vascular and lymphoid tissue. It is situated in the left hypochondrium, featuring a smooth and convex diaphragmatic surface and a visceral surface with relations to the abdominal organs [1]. The size and shape of the spleen vary with age, sex and other factors.



[Table/Fig-2]: The cadaveric spleen seen from its visceral surface demonstrating the intermediate border with splenic hilum and splenic artery. The splenic artery is seen to produce segmental branches where one of these branch independently supplies the smaller lobe. The extensive fissure encroaching the visceral surface is marked with yellow arrows.

In terms of its embryology, the spleen first appears as multiple lobules of splenic tissue in the dorsal mesogastrium during the 6th week of intrauterine life, which later fuse to form this single reticuloendothelial mass. The spleen has two borders: a peculiar superior border that separates the diaphragmatic surface from gastric relations and consists of 1-2 notches, implying its lobulated origin in early foetal life. In contrast, the inferior border is more blunt and rounded compared to the superior border, separating the spleen from renal and colic impressions [1-3].

The ontological origin of the spleen (both grossly and histologically) has been better elucidated chronologically using Carnegie Staging, a standard system comprising 23 stages that provide a unified framework for the development of a vertebrate embryo. The embryological development of the spleen begins at Carnegie Stages (CS) 13-15, during which it is not yet identifiable as a bulge, with the mesothelium composed of pseudostratified cells and the mesenchymal cells exhibiting no discernible differences. By CS 16, a bulge has developed, the mesenchymal cells have thickened, and some haematopoietic cells are observable. The mesothelium transitions to cuboidal or low columnar cells during CS 17-19, and folds that divide the spleen from the Dorsal Mesentery (DM) begin to appear. By CS 20, the intrasplenic folds resemble those of the adult spleen, and the spleen and dorsal pancreas can be clearly distinguished. A basement membrane becomes apparent as the mesothelium flattens. By CS 23, splenic vessels, including arteries and veins, form, and at the entry point of these vessels, the hilus appears. A capsule is seen for the first time, marking the spleen's final stages of embryological development [4].

Building upon the process of splenic development described previously, variations in spleen morphology can arise from errors in the migration and fusion of splenic primordia. Partial fusion or division of splenic primordia is believed to contribute to the development of a bilobed spleen. Additionally, Capsin, a helix-loop transcription factor and homeobox genes such as NKx2-5, Hox11, and Bapx1 are known to regulate splenic development in gene-targeting assays [5].

Bilobed spleens are among the rarest congenital splenic anomalies, with the occurrence of fissures estimated to be around 10% and the prevalence of fissures extending up to the diaphragmatic surface estimated to be around 6% in certain cadaveric studies [6]. While structural variations in the spleen, such as lobules and notches, do not frequently cause clinical symptoms, they must not be interpreted as lacerations in patients with a history of abdominal trauma [7].

In a case published by Ali HM in 2017, a rare instance of a bilobed spleen was discovered incidentally during an abdominal ultrasound due to recurrent left hypochondriac pain and was confirmed via Computed Tomography (CT) imaging [8]. Imaging techniques such as ultrasonography and CT typically show a homogeneous pattern for normal spleens; however, lobed spleens may exhibit a mottled, heterogeneous enhancement pattern during the arterial phase of CT, leading to a unique zebra-like appearance due to differing blood flow rates within the red pulp sinuses. These radiological features are essential for distinguishing bilobed spleens from other visceral abnormalities, providing critical information for radiologists and surgeons during imaging evaluations and potential splenectomy [8,9].

While recognising such splenic anomalies is crucial in clinical practice, it is also pivotal to understand the surgical approach for these challenging cases. Knowledge of the avascular planes formed by the splenic fissures allows surgeons to navigate these areas effectively, helping to minimise blood loss during subtotal splenectomy. These fissures serve as natural guides for the ligation of the splenic vessels, enhancing the safety and efficiency of the surgical procedure. Additionally, familiarity with variations in the splenic artery's terminal branches is essential to prevent complications during surgery, ensuring a thorough understanding of the specific anatomy involved in cases of bilobed spleens [10].

CONCLUSION(S)

The discovery of a bilobed spleen during cadaveric dissection demonstrates the rich tapestry of anatomical diversity in the human body. Radiologists should be aware that the spleen can exhibit unusual variants, such as bilobed spleens, which can affect diagnostic accuracy. Accurate diagnosis and management require an understanding of the embryological origins of anatomical abnormalities, such as bilobed spleens. Errors in the migration and fusion of splenic primordia can lead to these variations. While lobules and fissures in the spleen may not necessarily produce symptoms, understanding these features is critical for surgical planning and diagnosis. Anatomical details, such as splenic fissures in bilobed spleens, can benefit surgical procedures and may help reduce intraoperative complications.

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