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Normal Morphological Variations of Liver Lobes: A Study on Adult Human Cadaveric Liver in Vidarbha Region

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Abstract: ***Liver is the largest gland in the body. Morphological variations of liver are irregularities in form, occurrence of one or more accessory lobe. Less common abnormality is atrophy, or complete absence of one of the lobes. Aim: The present study includes the evaluation of morphological features of human liver specimens by macroscopic examination. Methods: The study was conducted on 50 specimens obtained from cadavers utilized for routine dissection for medical undergraduate students in the Anatomy department. Results: In the present study the livers as described in the standard anatomical literature with normal surfaces, fissures, and borders were considered normal. Out of 50 specimens studied 56% of liver were normal. 44% of liver showed one or the other variations. Two specimens were found to be having hypoplastic left lobe whereas lingular process of left lobe was observed in two specimens. The findings may be useful to surgeons and radiologists to avoid possible errors in interpretations and subsequent misdiagnosis, and for planning appropriate surgical approaches.***

Keywords: liver morphology, cadaveric liver,variations, accessory lobes and fissures

1. Introduction

A sound knowledge of the normal and variant liver anatomy is a prerequisite to having a favorable surgical outcome and commonly occurring variations assumes even more significance in the era of diagnostic imaging and minimally invasive surgical approaches. The liver has four lobes or eight segments, depending on whether it is defined by its gross anatomical appearance or by its internal architecture. Morphological variations of liver are irregularities in form, occurrence of one or more accessory lobe or presence of cysts. The liver is the largest abdominal viscera, occupying a substantial portion of the upper abdominal cavity, that is, right hypochondrium and epigastrium, and extending into left hypochondrium as far as left lateral line.[1] It is wedge shaped organ with its narrow end pointing towards left. It is convex in front, to the right, above, and behind and is somewhat concave inferiorly, where it is moulded to the shapes of the adjacent viscera.[2] Even though the surface is smoothly continuous, liver is customarily apportioned by anatomists into larger right and a much smaller left lobe by the line of attachment of the falciform ligament anteriorly and the fissure for ligamentum teres and ligamentum venosum on the inferior surface. In addition the right and left lobes, there are two additional lobes, a quadrate lobe in the front and the caudate lobe behind, separated from each other by the porta hepatis.

Hepatic imaging technique is usually performed to search for primary or metastatic liver diseases (Sahani &Kalva, 2004).[3] The major fissures are the important landmarks for interpreting the lobar anatomy and locating the liver lesions. In the era of imaging and minimally invasive approaches, it is very important on the part of both the radiologists and operating surgeons to have a thorough knowledge of the anatomy and the commonly occurring variations of this organ. Anatomists witness most of the variations of the lobes and fissures of the liver.

Gross abnormalities of liver are rare despite its complex development. The more common gross abnormalities are irregularities in form, number of lobules, and in the presence of cysts. A less common abnormality is occurrence of one or more accessory liver or lobes.[4] Although the segmental anatomy of the liver has been extensively researched, there are very few studies regarding the surface variations of the liver. Hence, we undertook this thorough study to observe and note the variations on the surface of the liver.

2. Materials and Method

Fifty liver specimens available in the Department of Anatomy constituted the study material. The liver specimens were removed from adult human cadavers during routine dissection for medical undergraduate students and then preserved in formalin. All the livers were apparently normal and free from any disease. These livers were observed for the changes in size, shape, and for the presence of any abnormal lobes and fissures.

3. Results

In the present study, out of 50 liver specimens 28 specimens (56%) showed normal fissures and lobes. The rest of the 22 specimens (44%) showed morphological variations. Accessory liver lobes were found in 8 cases (16 %). Accessory fissures and grooves in 10 cases (20%). Hypoplastic left lobe in 2 cases (4%). Lingular process of left lobe in 2 cases (4%).

Table 1: showing percentage of incidence of morphological variations of liver lobes

S.No.	*Types of variation*	*No. Of liver specimen*	*Percentage (%)*
1	Accessory lobes	8	16%
2	Accessory fissures	10	20%
3	Hypoplastic left lobe	2	4%
4	Lingular process of left lobe	2	4%

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Figure 1: Showing Accessory lobe and fissure caudate lobe

Figure 2: showing Accessory fissure between caudate and papillary process of caudate lobe

Figure 3: accessory fissures in left, caudate, and Accessory lobe in right lobe of liver

Figure 4: showing accessory lobe between left and quadrate lobe of liver and lingular process of left lobe

Figure 5: showing incomplete fissures on superior surface of right lobe of liver

Figure 6: showing hypoplastic left lobe

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4. Discussion

Liver may show abnormal or accessory lobes as anatomical variations. Of all the digestive organs, the liver is the one which starts its organogenesis early during 3rd week of intrauterine life and develops more rapidly.[5] Gross abnormdy alities of liver are rare inspite of its complex development. The more common gross abnormalities are irregularities in form and less common abnormality is the occurrence of one or more accessory liver lobes.[4] Bradley [6] has done a comprehensive study to elucidate the development of liver. The single liver in some lower animals like dog and pig has distinct lobules separated by strands of connective tissue and sometimes the human liver shows this variation by reversion.[4] The variations in the anatomy of human liver can be classified as congenital or acquired.[7] The congenital anomalies of liver can be divided into anomalies due to defective development and anomalies due to excessive development. Defective development of left lobe of liver can lead to gastric volvulus, whereas defective development of right lobe may remain latent or progress to portal hypertension.[8] The excessive development of liver results in the formation of accessory lobes of liver which may carry the risk of torsion.[8] Abnormal lobes may lead to wrong diagnosis radiographically. Fitzgerald *et al.* have reported the presence of an additional lobe. The preoperative imaging of this lobe had lead to the misdiagnosis as a lesser omental lymphadenopathy. [9] Pujari &Deodhare [10]have reported the presence of a symptomatic accessory lobe. The accessory lobes may herniate into the thorax through the diaphragm and cause serious problems (Feist & Lasser, 1959),[11] .

Hussein Muktya**z** et.al.[12] studied 41 adult liver specimens and found accessory lobes in 14.6% and accessory fissures in 12.1%. In the present study out of 50 liver specimens studied we found Accessory lobes and accessory fissures in 16% and 20% respectively.

Variations in the fissures are relatively rare. Accessory fissures may be present commonly on the anterosuperior surface (Macchi *et al*., 2003, 2005). The accessory fissures are the potential source of errors in diagnosis in imaging techniques (Auh *et al.*, 1984). Collection of any fluid in accessory fissures may be mistaken for a cyst, liver abscess or intrahepatic hematoma.

5. Conclusions

This study highlights some of the variations in the lobes and fissures of the liver. Knowledge of accessory fissures over various parts of liver is important for radiologists, which prevents misdiagnosis of cystic lesions or any macroscopic pathological lesions of liver. It may be useful for imaging specialist and surgeons to plan the surgical procedures.

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