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Original Research Article

A Cadaveric Study to Assess the Morphometry of Liver and its Clinical Implications

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Abstract

Aim: The aim of the present study was to assess the morphometry of liver and its clinical implications.

Methods: The study consisted of 50 forma line fixed cadaveric liver of unknown age and sex selected from the Department of Anatomy, Patna Medical College, Patna, Bihar, India for six months. Morphological features of the liver were studied and discussed under the following parameters. All the measurements are taken in inches using a measuring tape. Vertical and transverse diameters of Right lobe, left lobe, caudate lobe, quadrate lobe of the Liver was taken. Fissure, accessory lobe and external surface of the liver were observed in detail and variations were noted.

Results: The mean measurement across the vertical dimension was 6.36 inch and transverse dimension was 8.2 inch. Fissures were seen in the caudate, quadrate, right and left lobe of the liver. Caudate lobe, Quadrate lobe, right lobe, left.

Conclusion: The wide range of occurrence of morphological variations will contribute to the evolving document of liver morphology and ultimately will be helpful for anatomists. Additionally, this may aid interventions and surgeons to plan hepatobiliary surgeries, liver transplantation, and maximize targeted approach and curtail confusion, thereby mitigating morbidity.

Keywords: Morphometry of liver, clinical implications

Introduction

The segmental liver, although it has gathered immense attention with revisions over time, external variations have acquired consideration only recently and require in-depth study in view of increased interventions and hepatobiliary surgeries. The anatomy of the liver is complex and challenging owing to its widespread morphological variations which present as congenital or acquired, occurring in the form of varied shapes of lobes, fissures, congenital anomalies encompassing agenesis, atrophy or hypoplasia, accessory lobes and fissures, and undue size of a particular lobe, all due to interrupted development at a precise embryonic stage. [1,2] Whereas diaphragmatic, ligamentous anomalies and changes induced by various organs in close relation during lifetime could be the cause for acquired variations. Most of the accessory fissures disappear during the liver reformation in the postnatal period but some can persist for life. [3]

The localization of the major fissures contributes to the interpretation of lobar anatomy and localizing lesions. [4] Also, metastatic tumors could be lodged in these spaces mimicking focal lesions. [5] The morphological changes in cirrhosis and non-cirrhotic liver disease include atrophy of the right lobe (RL) and segment 4 with hypertrophy of the left lobe (LL) and expansion of the gall bladder (GB) fossa. [6] Therefore, with increasing dependence on radiological imaging, and laparoscopic procedures, precise knowledge of external variations of the liver is indispensable for favorable surgical and gastroenterological interventional results, preventing imaging misdiagnosis and curtailing unnecessary surgical complications.

The knowledge of normal and variant anatomy of the liver is important during radiological investigation and surgery. Variations in the liver morphology can be either congenital or acquired. The congenital abnormalities of the liver include

agenesis, atrophy or hypoplasia of lobes, accessory lobes, accessory fissures etc. It has been found out in Indian population, that accessory lobes are present in 10% of the population. [6] The mini accessory lobe might be mistaken for a lymph node due to its small size and removed during the surgeries.[6] The accessory fissures are the potential sources of diagnostic errors during imaging. It may be mistaken for a liver cyst, hematoma or abscess when there is a collection of fluid in these fissures. Metastatic tumor cells getting lodged into these spaces may mimic intrahepatic focal lesions. [7] Various other anomalies like pons hepatis connecting the left lobe with the quadrate lobe [6], hypoplasia of right lobe of the liver [8] have been reported. Acquired variations in liver could be due to the pressure given by diaphragm, peritoneal ligaments and other organs in relation with liver so developed during lifetime of a person. [9]

The aim of the present study was to assess the morphometry of liver and its clinical implications.

Materials and Methods

The study consisted of 50 forma line fixed cadaveric liver of unknown age and sex selected from the Department of Anatomy, Patna Medical College, Patna, Bihar, India for six months. Morphological features of the liver were studied and discussed under the following parameters. All the measurements are taken in inches using a measuring tape. Vertical and transverse diameters of Right lobe, left lobe, caudate lobe, quadrate lobe of the Liver was taken. Fissure, accessory lobe and external surface of the liver were observed in detail and variations were noted.

The measurements for the right and left lobe were taken as follows: vertical- 1-inch lateral to porta hepatis, Transverse- at the level of porta hepatis.

The measurements for the caudate and quadrate lobe were taken as follows: Vertica- at the level of porta hepatis, transverse- ½ inch above and below the porta hepatis respectively.

The measurements for the liver were taken as follows: Vertical-at the level of porta hepatis from the superior to the inferior surface, Transverse- at the level of porta hepatis from the lateral to the medial border.

Results

Table 1: Measurements of the right lobe, left lobe, caudate lobe, quadrate lobe, and the whole liver

	Measurements of the right lobe of the liver		Measurements of the left lobe of the liver		Measurement of the caudate lobe of the liver		Measurement of the quadrate lobe of the liver		Measurement of the entire liver	
	vertical	transverse	vertical	transverse	vertical	transverse	vertical	transverse	vertical	transverse
Minimum	4.6	2.8	3.2	2.6	1.2	0.6	1.1	1.1	4.6	6.2
Maximum	7.6	4.9	5.5	4.9	3.9	2.1	3.2	2.8	8.4	10.2
Average	6.14	3.8	4.3	3.67	2.5	1.25	2.07	1.86	6.36	8.2
Mean	5.68	3.57	4.43	3.55	2.76	1.17	2.38	1.36	5.78	7.90

The mean measurement across the vertical dimension was 6.36 inch and transverse dimension was 8.2 inch. Fissures were seen in the caudate, quadrate, right and left lobe of the liver. Caudate lobe, Quadrate lobe, right lobe, left.

Discussion

The liver is responsible for a wide range of vital functions including blood detoxification and purification, synthesis of plasma proteins, production of bile, and the metabolism of carbohydrates, fats and proteins. In man, the liver is essential for survival since there is currently no artificial organ or equipment that can compensate for the absence of liver function. [10] Historically, the gross anatomical appearance of the liver has been divided into the right, left, caudate and quadrate lobes by the surface peritoneal and ligamentous attachments. Demarcation of the right and left lobes anteriorly is along the line of attachment of the falciform ligament. Posteriorly, it is along the fissure for ligamentum venosum, and inferiorly, along the fissure for ligamentum teres. The caudate lobe on the posterior surface and the quadrate lobe on the inferior surface lie to the right of these two fissures, separated from each other by the porta hepatis. Towards the left, the caudate and quadrate lobes are bounded by the groove for the inferior vena cava and the gall bladder fossa, respectively.

The classification of the liver, depending on the internal architecture, differs from the above description. The most widely-accepted nomenclature is that described by Couinaud (1957) and Healy and Schroy (1953). According to these classifications, an imaginary "principal parasagittal plane" passing through the gall bladder fossa, divides the liver into functional right and left lobes. Segments I, II, III, and IV make up the functional left lobe, and segments V, VI, VII, and VIII make up the functional right lobe. This classification is also accepted by the Federative Committee on Anatomical Terminology. [11] The mean measurement across the vertical dimension was 6.36 inch and transverse dimension was 8.2 inch. Fissures were seen in the caudate, quadrate, right and left lobe of the liver. Caudate lobe, Quadrate lobe, right lobe, left.

The author Charls G. Fraser, has presented a case of a large, movable accessory lobe of the liver which presented itself as an unexplained abdominal mass until exploration uncovered its true nature. [12] The caudate lobe is considered as an independent segment according to Couinaud classification. Isolated resection of caudate lobe and resection of caudate lobe combined with major hepatectomy procedures for hepatocellular carcinoma or hilar bile duct carcinoma has increased in number. Therefore the knowledge of the morphological variations of the caudate lobe is essential for the surgeons. Accessory fissures and accessory lobes in the caudate lobe have been described earlier. [13] Phad et al [14] reported enlarged caudate process and pericaval portion in 10% of the specimens studied. In the present study, hypertrophied caudate process were noted only in 2.86% of the livers studied while the underdeveloped caudate process was observed in 4.29%. A mini accessory lobe was reported by Nayak Satheesha Bet al [15] at the posterior part of fissure for ligamentum teres. A small accessory lobe connected to the tuber omen tale by mesentery containing portal and biliary elements was reported by Jurkovikj. [16] One of the complications of accessory liver lobe is torsion especially in pedunculated form which requires emergency surgical intervention. In addition, they may be mistaken for lymph node or may be accidently removed during surgery which would result in excessive bleeding in abdomen due to damage to liver lobe or vascular pedicle. [17]

Conclusion

The wide range of occurrence of morphological variations will contribute to the evolving document of liver morphology and ultimately will be helpful for anatomists. Additionally, this may aid interventions and surgeons to plan hepatobiliary surgeries, liver transplantation, and maximize targeted approach and curtail confusion, thereby mitigating morbidity.

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