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A Quest into the Morphology of Cadaveric Livers: An Analytical Study

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Abstract

Background: Abnormalities of liver are rarely reported. Even though they are present in society, most of them are asymptomatic and remain undetected. The morphological abnormalities of liver can cause diagnostic confusion for physicians, surgeons, radiologist and anatomists. A sound knowledge of the normal and variant liver anatomy is a prerequisite for a favorable surgical outcome. Eventhough the segmental anatomy of the liver has been a field of extensive research, there are very few studies regarding the surface variations of the liver.

Materials and Methods: Observational study on 60 cadaveric livers ranging from 40-60 years undertaken.

Results: 35 livers showed various types of morphological variations.

Conclusion: This study highlights patterns of variations in the lobes and fissures of the liver and useful for the radiologists and surgeons to ward off the possibility of misdiagnosis and also in planning surgical procedures related to Liver and Gallbladder.

Keywords: Liver; Morphological variations; Cadaveric Livers; Surgeons; Radiologist.

INTRODUCTION

Liver is the largest gland in the body mainly situated in the right upper quadrant of the abdomen. It occupies a major part of the right hypochondrium, upper epigastrium and extends into the left hypochondrium. Diaphragmatic surface is smooth, dome shaped and covered with visceral peritoneum, except posteriorly in the bare area of the liver. Anteriorly left lobe and right lobe are separated by falciform ligament which extends from liver to anterior abdominal wall. Abnormalities of liver are very rare despite its complex development in the ventral mesogastrium. (1) Externally liver is divided into two anatomical lobes and two accessory lobes by the reflections of peritoneum. Internally on the basis of the blood supply Knowledge of commonly occurring variations in Liver assumes more significance in the era of diagnostic imaging and minimally invasive surgical approaches. Accessory lobe may be confused with tumor. Accessory fissure may mimic internal trauma at the time of the autopsy. In any operative procedure involving the liver, a surgeon's knowledge of hepatic anatomy is vital in determining

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the outcome. (3) Hence to alert clinicians, surgeons and radiologists and to add information to the data base of anatomists, this study is undertaken.

OBJECTIVE

Although segmental anatomy of liver has been extensively researched, very few studies have dealt with the surface variations of liver. Aim of present study is to find out the morphological variation of Liver. A multidemensional knowledge of the normal and variant anatomical possibilities of Liver is essential for a successful surgical outcome. This knowledge is of high significance in thepresent era of diagnostic imaging and minimally invasive surgical procedures.

MATERIALS AND METHODS

The materials used for present study comprises 60 adult livers with age ranging from 40 to 75 years which were harvested during routine dissection classes for medical undergraduate students over a period of 12 years in Department of Anatomy, Yenepoya Medical College, Mangalore and Believers Church Medical College, Thiruvalla. The Formalin fixed livers were carefully studied for the presence morphological variations such as presence of accessory lobes, accessory fissures, atrophy of lobes, elongated lobes, presence of Hartmann's pouch, absence of cystic notch, accessory processes etc. Livers with features of cirrhosis or any damage or diseases were excluded from this study. This was anobservational study with no usage of any experimental instruments. Appropriate measurements were taken by calipers and measuring tape. The specimens were photographed and the findings were appropriately documented.

RESULTS

In our study out of 60 livers studied, we found morphological variations in 35 liversie; 58.3%. We found Accessory liver lobes in 20cases.i.e. 33.3%. Atrophy of left lobe of liver in 2cases i.e. 3.3%, Accessory fissures (ranging from 1-5) in 23 cases i.e. 38.3%. Elongated right lobe in 2 cases i.e. 3.3%, interconnected left lobe and Quadrate lobe with absence of fissure for ligamentum teres in 1 case i.e. 1.6 % and 1 case (1.6%) showed fissure for ligamentum teres not extending into the inferior border. In 13 cases ligamentum teres is found to run in a tunnel. (21.6%). 2 cases (3.3%) showed up with additional quadrate lobe and 7 cases (11.6%) showed accessory process from quadrate lobe. One liver (1.6%) showed additional caudate lobe and one liver (1.6%) had an unusually prominent caudate process. 2 cases (3.3%) showed an exaggerated cystic notch whereas 2 livers (3.3%) had no cystic notches in their inferior borders with Gallbladder not extending into the inferior border. One case also showed the presence of Hartmann's pouch. (table:1)

Table.1: Percentage incidence of morphological variations of liver lobes

Serial Number	Type of Variation	No: of Livers Showing the Variation	Percentage of Variation (%)
1	Accessory Fissures	23	38.3
2	Accessory Lobes	20	33.3
3	Absence of Fissure for Ligamentum Teres	1	1.6
4	Tunnel for Ligamentum Teres	13	21.6
5	Left Lobe Atrophy	2	3.3
6	Additional Quadrate Lobe	2	3.3
7	Accessory Process from Quadrate Lobe	7	11.6
8	Additional Caudate Lobe	1	1.6
9	Unusualy Prominent Caudate Process	1	1.6
10	Absent Cystic Notch	2	3.3
11	Exaggerated Cystic Notch	2	3.3
12	Elongated Right Lobe	2	3.3

Fig.s- liver

Fig. 1: Atrophy of left lobe

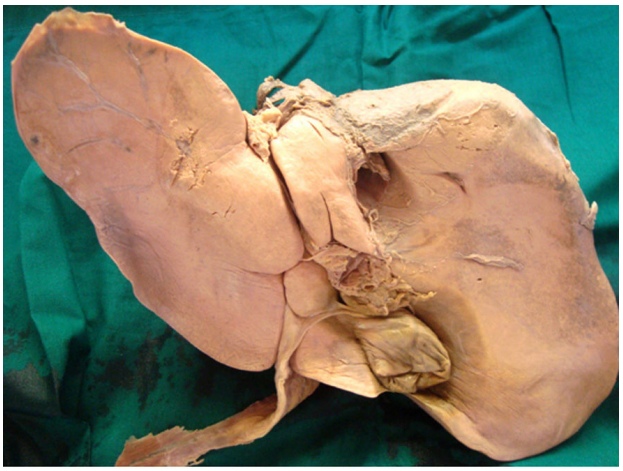

Fig. 2: Additional quadrate lobe

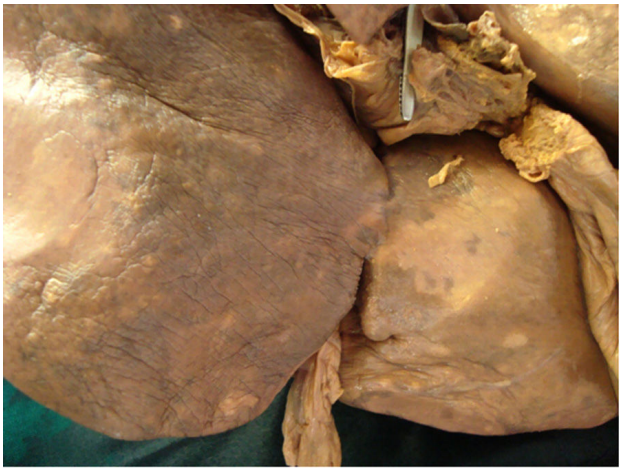

Fig. 3: Tunnel for ligamentum teres

Fig. 4: Gall bladder showing Hartmann's pouch

Fig. 5: Accessory sulci and fissure

Fig. 6: Accessory process on quadrate lobe

Fig. 7a: Absence of fissure for ligamentum teres

Fig. 7b: Ligamentum teres coming out through anterior aspect

Fig. 8: Unusual fissure on superior surface of liver

Fig. 9: Liver showing multiple fissures

Fig. 10: Elongated right lobe

Fig. 11: Accentuated cystic notch

Fig. 12: Prominent caudate process

Fig. 13: Presence of accessory lobe on right inferior aspect of caudate lobe

Fig. 14: Presence of additional lobe on fissure for ligamentum venosum

Fig. 15: Short gallbladder with absence of cystic notch

Fig. 16: Fissure on ligamentum teres not extending to inferior border

DISCUSSION

According to Champetier J. et al[2] hepatic anomalies can be divided into two categories, i.e. anomalies due to defective development and anomalies due to excessive development of the liver. The liver tissue in the communicating with the main mass of liver is termed as accessory lobe while the liver tissue lying in the vicinity of the liver termed as ectopic liver. Accessory lobe of the liver is very rare variation which may remain silent in many subjects. Accessory lobes, if present, are usually seen on the inferior surface of the liver, but also reported to be seen on the gall bladder surface and hepatogastric ligament.[3] In our study we found accessory lobes in 33.3% of livers. (Fig. 13,14)[8] cases showed its presence in Right lobe, 3 cases in left lobe,[4] in quadrate and 5 in caudate lobes respectively. This study showed presence of accessory fissures in 23 cases i.e; 38.3% of livers. (fig. 5,8,9) of which inferior surface showed their presence in 7 cases, superior surface 4 cases, caudate lobe 4 cases, anterior surface and posterior surface showed fissures in 1 case each. Multiple accessory fissures may mimic pathologic liver nodules on CT and may be associated with diaphragmatic scalloping or eventration on the chest film. When only parts of these fissures are seen sonographically, they may be mistaken for echogenic liver lesions. Usually the diaphragm which is related to the superior surface may exert costal pressure to give rise to diaphragmatic fissures.[4] Any collection of fluid in these fissures may be mistaken for a liver cyst, intrahepatic hematoma or liver abscess. Implantation of peritoneal disseminated tumor cells into these spaces may mimic intrahepatic focal lesions.[3] Shailaja et al[5] in her studyrevealed the presence of accessory lobes (6%) and accessory fissures (24%). Hussein Muktyaz et al found accessory liver lobes in 6 cadavers 14.6%, atrophy of left lobe in 2 cadavers 4.8%, accessory fissures in 5 cases 12.1%.[6] In this study we got 3.3% of cases with atrophy of left lobe.(fig. 1) Lobar atrophy of the liver due to causes other thanliver tumor or liver cirrhosis is a relatively rare pathological condition, and there are only a few reports in the literature.[6] Hepatic lobar atrophy usually occurs in the setting of combined biliary and portal vein obstruction. A significant correlation exists between hepatic lobar atrophy and ipsilateral portal vein obstruction.[7] liver showed complete absence of fissure for ligamentum teres with hepatic tissue bridging where the ligamentum teres come out through the anterior surface (fig. 7a,7b) and in 1 liver the fissure was not extending up to the inferior border (fig. 16). In 13 cases, (21.6%) ligamentum teres is found to run in a tunnel (fig. 3). Ebby et al. reports acase of liver with the presence of complete tunnel instead of fissure for ligamentum teres.[11] During development, the liver is separated into 2 lobes by the falciform and round ligaments by the second month of gestation, failure of which may cause the fusion of lobes to variable extent resulting in formation of a tunnel for ligamentum teres. When the patient lie in supine position, the fissure for ligamentum teres contains some air in case of pneumoperitoneum. This air is visible in radiographs as a vertically directed area of hyperlucency which may be masked by the presence of hepatic tissue in case of a tunnel.[12,13] One liver (1.6%) showed additional caudate lobe and one liver (1.6%) had an unusually prominent caudate process (fig. 12) During the formation of caudate lobe, a small portion of caudate lobe may have become separated from it and included in mesentery of ductusvenosus to form the accessory lobe (15). 2 cases (3.3%) showed up with additional quadrate lobe (fig. 2) and 7 cases (11.6%) showed accessory process from quadrate lobe (fig. 6). Joshi SD et al studied 90 livers where quadrate lobe was absent in 2 cases. (10) 2 cases (3.3%) showed an exaggerated cystic notch (fig. 11) whereas 2 livers (3.3%) had no cystic notches in their inferior borders with Gallbladder not extending into the inferior border (fig. 15). One case also showed the presence of Hartmann's pouch (fig. 4). The observations are tabulated in table 1. (table. 1) The gall bladder is situated in the fossa for gall bladder on the inferior surface of Liver. Its fundus produces a cystic notch on the inferior border of the liver and projects beyond the inferior border and may touch the anterior abdominal wall near the tip of right ninth costal cartilage causing infective pathologies to spread easily into parietal peritoneum. Short gall bladders hiding in their fossa, may lead to confusions in imaging and also in laparoscopic approaches.[14]

CONCLUSION

In this study we have described morphological variations of the liver lobes. Atrophy, presence of accessory fissure or lobe, can cause diagnostic confusion for surgeons during surgery and for physicians, radiologist and anatomist. Presence of variations in the liver may cause complications during transplantation surgeries and may present as incidental findings at autopsy creating confusions. This variations may complicate a liver transplantation surgery.

The findings of study may be helpful to radiologists and surgeons respectively, to avoid

possible errors ininterpretations and subsequent misdiagnosis, and for planning appropriate surgical approaches.

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