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Original Research Article

Study on Morphological Surface Variations in Human Liver

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ABSTRACT

Background: Day to day advances in the fields of radiology like sonography and CT need to revive interest in the cadaveric study of morphological features of liver, as the accessory fissures are a potential source of diagnostic errors. Accessory fissures vary from single to multiple over different parts of the liver. Aim: in the present study the morphological features and its variations were observed macroscopically and noted.

Methods: Study was conducted on 50 specimens obtained from the routine dissection of human cadavers utililized for undergraduates from the year 2009 – 2014 in the department of anatomy at HIMS, Hassan. Morphological variations like accessory lobes, fissures, and abnormal shapes of lobes of liver were observed and reported.

Conclusion: In the present it can be observed that diaphragmatic grooves are more common morphological variations occurring, knowledge of which is paramount important and again presence of accessory fissure is also more common thus though morphological variations remains asymptomatic but can lead to the misinterpretations during various radiological and surgical procedures. Thus the present study could serve in this purpose.

Key words: Accessory, Caudate, Reidel's, fissures, liver.

INTRODUCTION

The liver is a wedge shaped organ which is considered as the largest gland in the human body. Anatomically it is divided into right, left, caudate and quadrate lobes based on the attachment of its peritoneal ligaments. The congenital abnormalities of human liver are rare. The anomalies may be very high in society but we do not notice them very often because these cases are usually asymptomatic. The absence of normal fissures and lobes or the presence of additional lobes and fissures might lead to confusion on a radiological diagnosis of a liver disorder. 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**.** [1] 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 comprehensive study to observe and note the variations on the surface of liver. [2]

MATERIALS AND METHODS

The present study was on 50 human cadaveric liver specimens obtained from the department of anatomy, Hassan medical college, Hassan. The morphological variants like accessory fissures, accessory lobes, and abnormal shapes of lobes of liver, diaphragmatic grooves were observed and photographed. Percentage of each variation were calculated and tabulated. Any diseased liver or with any gross abnormalities were excluded from the study.

RESULTS

Among the 50 specimens obtained from the department of anatomy the following observation was made and reported: accessory fissures on right and left lobe was observed in 5(10%), accessory fissure in caudate lobe was 06(12%), accessory fissure in quadrate lobe 5(10%), lingual process in 2(4%) fig(8), diaphragmatic grooves 6(12%) fig (1), fissure extending over postereo-superior surface in 13(26%) fig(2), abnormal caudate lobe 4(8%) fig(3), abnormal quadrate lobe 5(10%) fig 6, were observed and tabulated.

Table 1: Findings of the study.

Morphological features	No. of specimens	Percentage (%)
Accessory fissures on right/left lobe	05	10
Caudate lobe – accessory fissure	06	12
Quadrate lobe- accessory fissure	05	10
Lingual process	02	04
Diaphragmatic grooves	06	12
Fissure of lig. teres over anterior surface	13	26
Abnormal caudate lobe	04	08
Abnormal quadrate lobe	05	10
Small gall bladder	01	02

Fig no.1: diaphragmatic groove

Fig no.2: fissure of ligamentum teres extending to postereo-superior surface with accessory lobe

Fig no.3: Enlongated papillary process.

Fig no.4: lingual process

Fig no.5: absence of lobe

Fig no.6: abnormal quadrate lobe

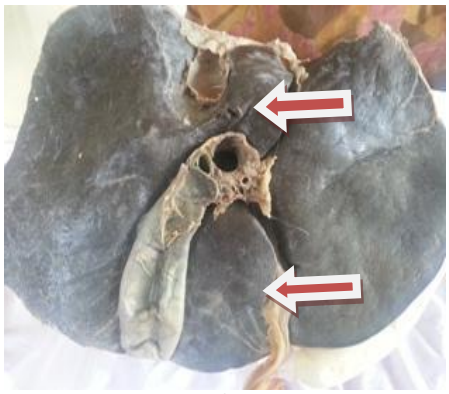

Fig no.7: accessory fissure in caudate and quadrate lobe.

Fig no.8: papillary process of caudate lobe

DISCUSSION

Knowledge of anatomical and morphological variations of liver is important for anatomist as well as for radiologist and surgeon. Variations in lobes and fissures are become very important for radiologist and surgeons with developing imaging technique and minimal invasive approaches. In some circumstances the anomalies of liver may be associated with conditions like diaphragmatic hernia, gastric volvulus and portal hypertension. The anomalies of liver can be divided into two categories, anomalies due to defective development and those due to excessive development. These Anomalies are sometimes associated with malformations of other organs like diaphragm and suspensory apparatus of the liver.[3] Gross abnormalities of the liver are rare in spite 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 livers or lobes. [4] Acquired changes in the liver morphology are represented by the following characteristic features: (1) linguiform lobes, (2) costal organ with very small left lobe, (3) deep renal impressions and "corset" type constriction and local inflammation of the organ or gallbladder Defective development of the left lobe of liver can lead to conditions like gastric volvulus. In contrast, defective development of the right lobe can remain clinically latent or progress to portal hypertension. The anomalies related to excessive development of the liver lead to the formation of accessory lobes of liver which may carry the risk of torsion. The accessory lobes arise most commonly from the right lobe and may project in any direction. Among them the Riedel's lobe is most common, which descends inferiorly along the right lateral. [5]

The accessory hepatic fissures are potential sources of diagnostic errors on both sonography and CT. Majority of the diaphragmatic sulci had been frequently detected during radiological investigations. The diaphragmatic sulci are located on the diaphragmatic surface of the liver. Diaphragmatic sulci that are observed during autopsy studies is due to the pressure exerted by the ribs and the diaphragm, and which is usually located on the superficial surface of the liver. The diaphragmatic sulci result from uneven growth of the hepatic parenchyma caused by variable resistance offered by different bundles of the diaphragm muscle. But more recently, radiological and corrosion cast studies have attributed the formation of sulci to the existence of weak zones of hepatic parenchyma, represented by the portal

fissures between the adjacent sagittal portal territories. These weak zones offer a lower resistance to external pressure of the diaphragm. [6] Macchi et al suggested that the diaphragmatic sulci could represent a useful landmark for surface projection of the portal fissures and of the hepatic veins and their tributaries running through them. [7] The mini accessory lobe which is being reported is surgically and radiologically very important due to its small size. Due to the small size, it might be mistaken for a lymph node. It might be accidentally removed during the surgeries in and around the porta hepatis. Damage to the lobe or its vascular pedicle might result in bleeding into the abdominal cavity. Accessory lobes need attention when there is torsion of the vascular pedicle or metastasis occurring in them. Torsion of the accessory lobes is a surgical emergency and it has to be attended to early. An accessory lobe could be formed by the displacement of the primitive rudiment of the organ, or by persistence of the mesodermal septa during its proliferation. Its presence occurs due to an error in the formation of the endodermal caudal foregut and segmentation of the hepatic bud in the third month of the intrauterine life. Normal-sized or small papillary process may be mistaken for enlarged porta hepatis nodes. An enlarged papillary process may mimic a pancreatic body mass, if it extends so far to the left that it displaces the body of the stomach anteriorly. The different shapes of the quadrate lobes encountered in the study, and the presence of the pons hepatis bridging the fissure for ligamentum teres are important findings. A very narrow, buried or absent quadrate lobe may create confusion in the mind of the radiologist, as the fissure for ligamentum teres in such cases would be very near to the left margin of the gall bladder fossa. [8]

According to Sunitha Vinnakota and Sachin et.al following observations was made and their observations were correlated with the present study. [9,10]

Table 2: Comparison of present study with other studies.

Morphological features	Sunitha (vinnakota)	Sachin (et.al)	Present study(50)
Accessory fissure rt/lt.lobe	5.1%(10/6)	10%	10%
Accessory fissure-caudate	13.7(08)	00	12%
Accessory fissure-quadrate	15.5(09)	04%	10%
Diphragmatic grooves	00	2%	12%
Fissure over anterior surface	00	00	26%
Abnormal caudate shape	00	00	08%
Abnormal quadrate shape	00	00	10%
Small gall bladder	00	00	02%
Lingual process	1.72%(01) Lt lobe	02% (Rt lobe)	04% (Lt.lobe

Varied shapes of the caudate and the quadrate lobes were encountered. Notching along the inferior border of the caudate lobe was seen in 18 percent of livers, a vertical fissure was observed in 30 percent, and prominent papillary process was seen in 32 percent. Accessory fissures and grooves were more common in the right lobe. Multiple prominent vertical grooves were observed on the anterosuperior surface of the liver in six percent of livers. Quadrate lobe was absent in four percent, and in two cases, it was found to be deeply buried. Presence of a pons hepatis, bridging the left and the quadrate lobes, was observed in 30 percent of the livers examined. [11] Among the 55 livers studied, 33 livers (60%) were normal in their external appearance, number of lobes and fissures. However 22 livers (40%) showed anomalies in lobes, fissures, shape or in the size of gall bladder. Additional lobes were seen in five livers (9.09%). These additional lobes were small and were situated in the vicinity of the porta hepatis, caudate and quadrate lobes. Additional fissure was found in one liver

(1.81%). This fissure separated the left lobe into two parts. An abnormal, dumbbell like caudate lobe was found in one liver (1.81%) The papillary process of the caudate lobe was very large in one liver (1.81%). In ten livers (18.18%) the gall bladder was short and its fundus did not project beyond the inferior border of the liver. The fissure for ligamentum teres was absent in one liver (1.81%) and it was on the anterior surface of the liver in one case (1.81%). The left lobe was extremely elongated in one liver (1.81%) and the liver was very flat in a single case (1.81%). [12]

It has been proposed that the superficial part of the portal fissures weakens the surface hepatic parenchyma, allowing the development of accessory sulci caused by diaphragmatic pressure. To evaluate the relationship of the sulci in the antero-superior surface of the right liver with the right portal fissure, macroscopic post mortem examination of 85 livers was carried out. Diaphragmatic sulci were found in 32 cases. They were found in 28 instances and in 16 cases they were multiple. The 28 sulci, with similar position and course, showed variable characteristics (mean length = 7.6 ± 2.7 cm, mean width = 0.8 ± 0.7 cm, mean depth = 1.4 ± 0.8. [13]

Absence of the left lobe was observed in 1(1.85%). The fusion of the left lobe and quadrate lobe in 8 (14.81%). The fusion of the right lobe and quadrate lobe 6(11.11%). Transverse fissure in the quadrate lobe was observed in 2(3.70%). Absence of the quadrate lobe in 2(3.70%). The fusion of the caudate lobe and right lobe with fissure in right lobe was in 2(3.70%). Absence of the caudate lobe in 4(7.41%).The incidence of the lobe anomalies was seen very high in our study especially in the cadaver .It could be very high in society also but the reason why we do not notice them very often may be that these cases are usually asymptomatic. On the other hand it is especially important to keep in mind these liver anomalies in the correct preoperative diagnosis, because it will be helpful for the surgeon in planning biliary surgery or a portosystemic anastomosis**.** [14]

CONCLUSION

A sound knowledge of the normal and variant liver anatomy is a prerequisite to having a favourable surgical outcome. Knowledge of the commonly-occurring variations assumes even more significance in the era of diagnostic imaging and minimally-invasive surgical approaches. Although the segmental anatomy of the liver has been extensively researched, very few studies have dealt with the surface variations of the liver**.** In the present study it can be observed that the diaphragmatic grooves and occurrence of accessory fissures are very common thus the findings of our study may be helpful for surgeons and radiologist to avoid possible errors in interpretations and subsequent misdiagnosis, and to assist in planning appropriate surgical approaches.

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