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MORPHOLOGICAL VARIATIONS OF LIVER AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Background: The liver, the largest gland in the human body, often displays morphological variations such as accessory fissures, lobes, and notches, which are seldom emphasized in standard anatomical literature. Understanding these variations is crucial for accurate radiological interpretation and safe surgical procedures.

Aim: To study the morphological variations of the liver and their clinical significance through cadaveric examination.

Methodology: A total of 50 formalin-fixed cadaveric livers of unknown age and sex were studied over four years at Smt. Kashibai Navale Medical College & General Hospital, Pune. Livers with no visible damage were included. Morphological variations such as accessory fissures, lobes, and surface features were observed and photographed.

Results: Out of 50 livers, 25 showed normal morphology while the remaining 25 exhibited variations. Accessory fissures were the most common variation, found in 30% of specimens, followed by accessory lobes (10%), Riedel's lobe (10%), Rouviere's sulcus (10%), and Pons hepatis (8%). One specimen showed absence of the quadrate lobe. Variations were classified based on Netter's classification. No significant vascular or ductal variations were noted upon further dissection.

Conclusion: Morphological variations of the liver, particularly accessory fissures and lobes, are relatively common and may pose diagnostic challenges during imaging or complications during surgery. Awareness of these anatomical differences is essential for radiologists and surgeons. Although cadaveric studies limit direct clinical correlation, they provide valuable anatomical insights for clinical practice.

KEYWORDS: Lobe, Fissure, Morphology, Sulcus, Surface, Variation.

BACKGROUND

Liver is the largest gland in the body. The liver is wedge shaped, with broad base directed to the right, occupies whole of the right hypochondrium, upper part of epigastrium and part of left hypochondrium up to left lateral plane. Liver presents anatomical and physiological right and left lobes, caudate and quadrate lobes and sometimes Riedel's lobe (1). Surface variations are seen in the liver. They are seen such as accessory fissures and accessory lobes but they are hardly mentioned in the routine textbooks.

METHODOLOGY

We studied 50 formalin fixed cadaveric livers of unknown age and sex from Maharashtrian population. Livers without any visible damage were studied, study was conducted over the period of 4 years at the Smt. Kashibai Navale Medical College & Hospital Pune. Livers were removed carefully after cutting surrounding attachments of ligaments and inferior vena cava. Lobes and accessary fissures were observed and photographs were taken.

RESULTS

In present study, we studied 50 livers, 25 livers were normal without any morphological variations. Remaining 25 specimens exhibited several variations. We categorised these variations as accessory hepatic notches/grooves, accessory lobes, Pons hepatis, absence of quadrate lobe. In some livers combinations of all of these were observed. Below is the classification of morphological variations of liver by Netter(2).

NETTER'S CLASSIFICATION OF MORPHOLOGICAL VARIATIONS OF LIVER

Types	Description
Type 1	Normal
Type 2	Very small left lobe, deep costal impressions
Type 3	Complete atrophy of left lobe
Type 4	Transverse saddle like liver, relatively large left lobe
Type 5	Tongue like process of right lobe
Type 6	Very deep renal impression and corset construction
Type 7	Diaphragmatic grooves

Table 1

studies	Accessory fissures	Accessory lobes	Accessory fissures + absent quadrate lobe	Rouviers sulcus	Riedels lobe	Pons hepatis
Present study	30%(15specimens))	10%(5)	2%(1)	10%(5)	10%(5)	8%(4)

Right lobe- bulged right lobe with small left lobe was observed in 6 (12%) specimens. This was categorised as Netter's type 2 as seen in figure 1,2,3.Accessory fissures were observed on the visceral surface of 15 livers(30%) specimens- Figure 5,6,7.Riedel's lobe was observed in 5 specimens like in figure 9.Multiple diaphragmatic grooves were observed on right anterosuperior surface like in figure 1,2,3,4.

Caudate lobe-total 5 specimen showed variations in caudate lobe. Figure 6,7,10 specimen showed accessory fissure on caudate process.

Quadrate lobe-Pons hepatis, hepatic ridge joining left lobe of liver with quadrate lobe covering inferior vena cava was seen in 4 specimens. Absence of quadrate lobe was observed in one specimen.

Left lobe-no accessory fissures were observed in any specimen. Some livers showed elongated tongue shaped process as seen in figure 4,11.

DISCUSSION

ACCESORY HEPATIC NOTCHES/ FISSURES-. We observed extra fissures on the anterosuperior surface of 15 livers. Those fissures were present on superior/diaphragmatic surface of the liver. Along with these extra fissures other associated variations were also observed. All notches were present on right lobe of liver. Vertical deep notches/fissures were observed. These notches were minimum one to maximum 6 notches. These livers were of Netter's type 7.

We dissected livers to see segments and branching pattern of portal veins to observe any variation in branching pattern of portal vein and hepatic artery but no modifiable variation in branching pattern were noticed (3).

Accessory fissures are present on diaphragmatic surface; they are most common on the diaphragmatic surface right lobe. During scan 25% of liver showed such accessory fissures (4). diaphragmatic fissures/notches were due to hypertrophic diaphragm muscle bands resulted in variable resistances and resulted uneven hepatic parenchymal growth (5). During laparoscopic cholecystectomy fissure of Ganz/Rouvier's fissure can be used to avoid injury to bile duct but the fissure is inconsistent (6). Direct palpation of accessory fissures may be

mistaken as laceration in case of abdominal trauma or during imaging fissures may mislead the clinical correlations. In present study Rouvier's fissure was seen in 5 livers. Percentage of livers with accessory fissures were 30% in study by S.Saritha et al. (2015) and 31.10% in study by Tallapeni et al. which is similar to present study. (7,8)

ACCESSORY LOBES

Riedel's lobe was described by Corbin in 1830 and defined by Riedel in 1888 as a round tumour on the anterior side of the liver(7). Accessory lobes are supernumerary liver lobes which are in continuity with liver parenchyma in contrast to ectopic liver lobes which do not have continuity (8). In present study accessory lobes were seen in 5 livers and Riedel's lobe was observed in 5 specimens. Accessory lobes are asymptomatic and prevalence is 1-12 %(9), Riedel's lobe and other liver projections are clinically asymptomatic. Hypochondriac or epigastric pain may be due to torsion or inflammation of these lobes (10).

Pons Hepatis-Von Haller in 1743 described hepatic bridge which connect qudrate lobe to left lobe over the fissure for ligamentum teres(11,12).Pons hepatis in this study is referred to as hepatic tissue encapsulates inferior vena cava as seen in figure 13,14,15,16.In present study it was observed in 4 livers.

Table 2

Similar studies	Accessory Fissures %	Accessory fissures on right lobe %	Accessory fissures on left lobe%
S.Saritha(2015)	**30**	16	2
Tallapaneni Sreekanth	**31.10**	26.66	4.44
Present study	**30%**	30%	0

Arrows showing multiple fissures on the anterosuperior surface of the liver

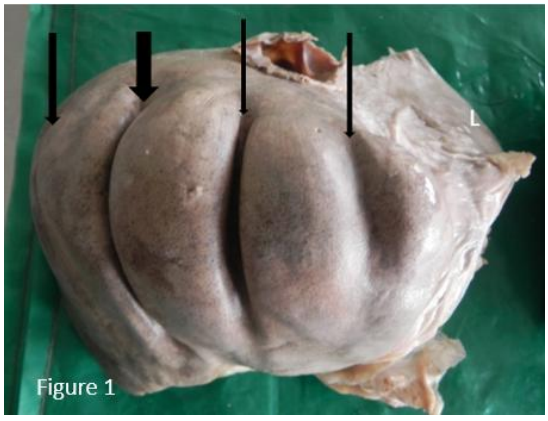


Figure 1

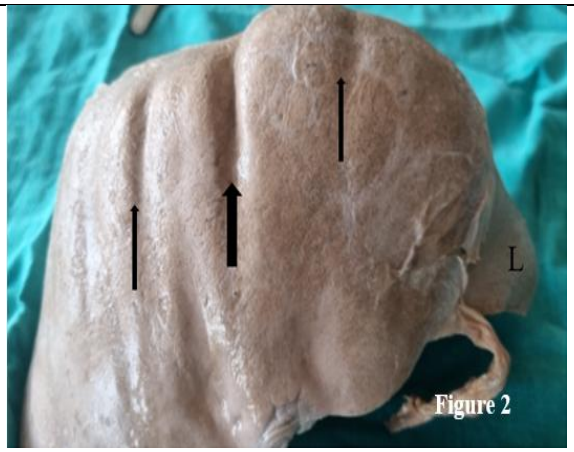


Figure 2

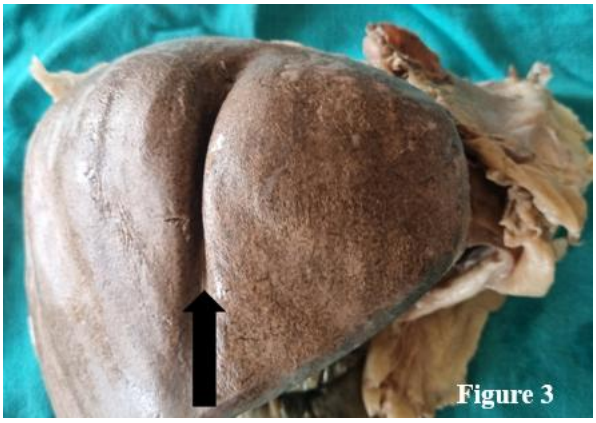
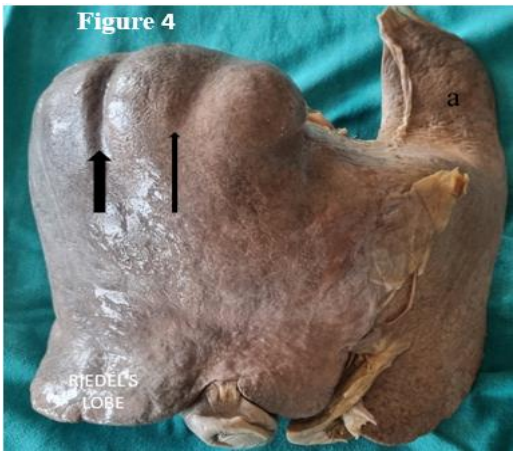
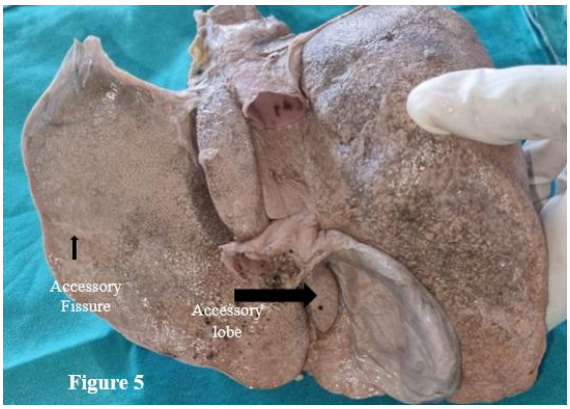
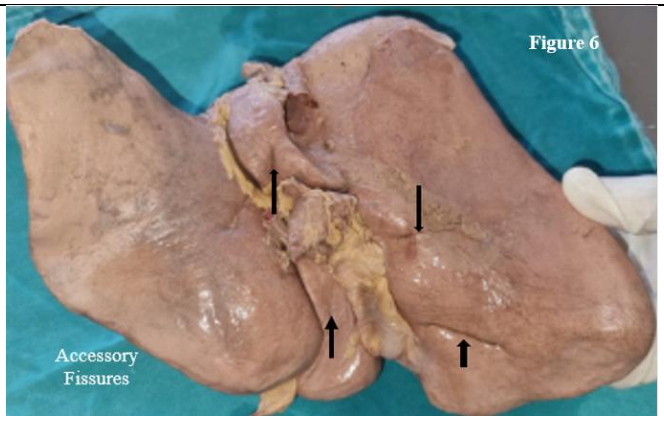


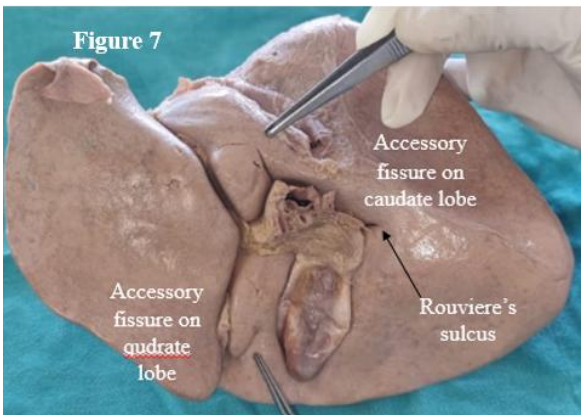
Figure 3

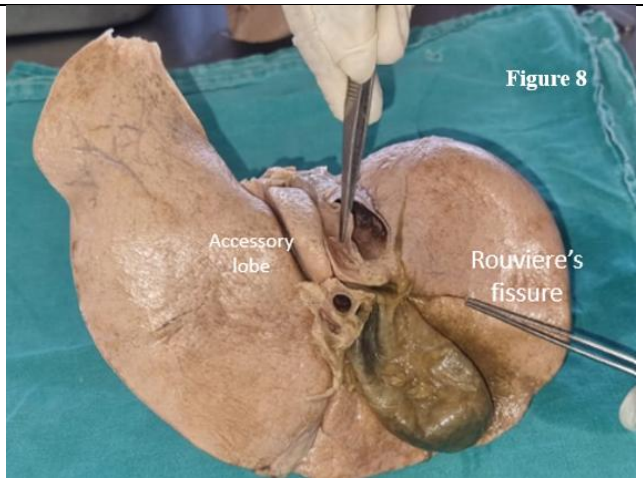


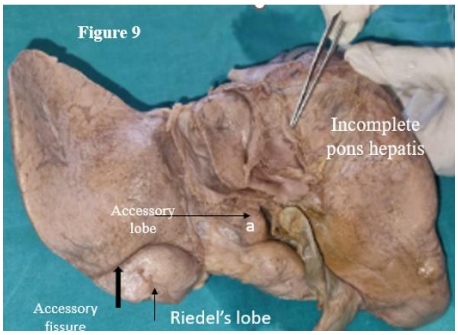
Arrows showing accessory fissures, accessory lobes

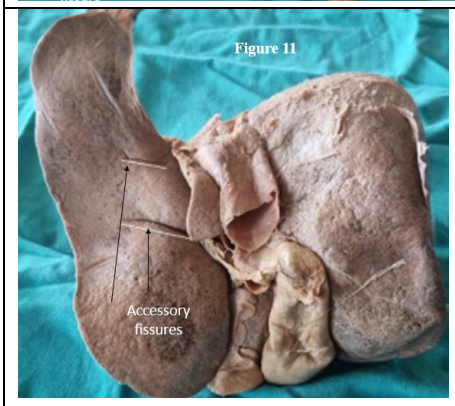


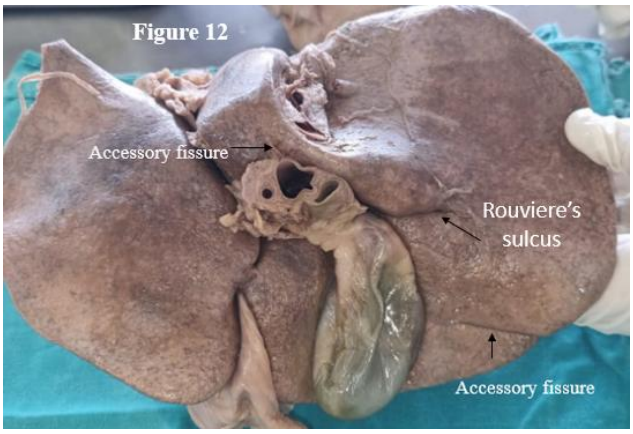




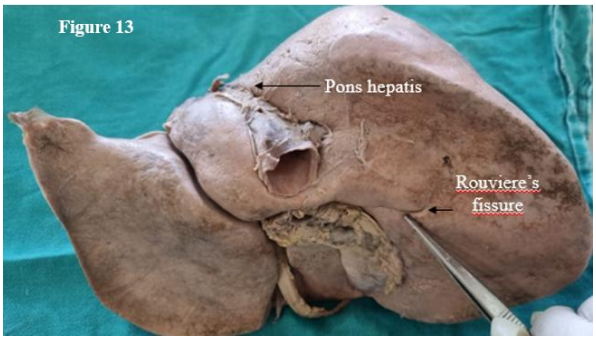


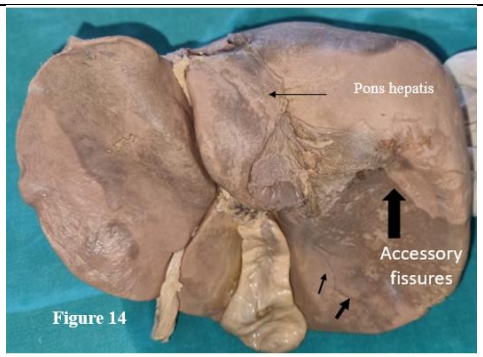


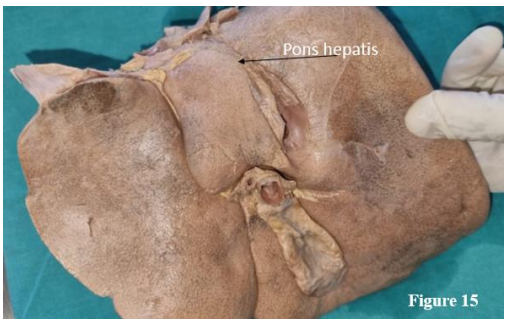


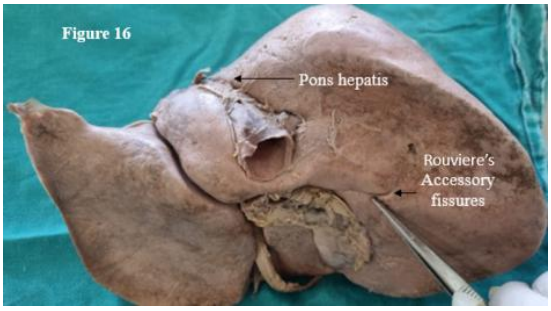


Arrows showing Pons Hepatis









CONCLUSION

Accessory fissures, accessory lobes are not uncommon until they are asymptomatic. Radiologists and surgeons should have knowledge about these variations. Present study showed high incidence of accessory fissures. Accessory lobes may undergo inflammation, torsion leading to epigastric pain. This is cadaveric study and restrictions are there to correlate it clinically. This may help radiologist and surgeons to some extent.

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