

Clinical Aspects of Morphological Variations of the Liver

Dr S. Muralikrishna¹, Dr A. Himabindu²

¹Associate Professor, Department of Anatomy, GITAM Institute of Medical sciences & Research, Rushikonda, Visakhapatnam, India

²Professor & HOD, Department of Anatomy, GITAM Institute of Medical sciences & Research, Rushikonda, Visakhapatnam, India

Abstract: Introduction: Liver is the largest abdominal gland that develops from caudal part of foregut as hepatic diverticulum. Abnormal growth and differentiation of the hepatic tissue leads to accessory lobes and fissures that may misdiagnose the liver diseases. Aim: The present study was focused on the variant morphology of liver like accessory lobes and fissures, hypertrophy, atrophy or absent lobes of the adult human liver and their clinical significance. Materials & Methods: The present study was conducted on 40 human liver specimens that were removed during routine dissection classes to undergraduate medical students. The detailed normal & variant morphology was studied. Results: The anatomical variations like accessory lobes and fissures, liver with pons hepatis, anomalous left lobes, absence of quadrate lobe and enlarged papillary process were identified in this study. Conclusion: The anomalous presentations are due to excessive or defective development of liver tissue. Even though they are asymptomatic they mimic carcinomatous lesions in radiological images and enlarged left lobe may compress the surrounding structures. Clinical knowledge of these anomalous structures is useful to the radiologists in interpreting radiological images and for surgeons during surgical resections of liver.

Keywords: liver, hepatic bud, accessory lobes and fissures

1. Introduction

Liver is the largest gland of the abdomen. Normally it has right lobe, left lobe, caudate lobe & quadrate lobe. In embryonic period it arises from foregut as hepatopancreatic bud in ventral mesogastrium and from the mesenchyme of septum transversum. Anomalies of liver in the form of additional lobes or fissures are due to disturbances in the development of liver bud in the form of defective or excessive growth of the tissue (1). Accessory lobes can occur at different sites and will mimic as the carcinomatous lesions in hepatic imaging. Normally in diseases of the liver the major fissures are important guidelines to read the lobar anatomy in order to locate the site of lesions. (2) The accessory sulci mislead the hepatic image while searching for metastatic liver diseases. The aim of the present study on morphological variations of liver will give additional information to the clinicians that help them in diagnostic imaging and surgical procedures.

2. Materials & Methods

The study was done on 40 human liver specimens that were removed during routine dissection for undergraduate medical students of 1st year MBBS. The surfaces, borders, fissures and lobes of the liver were studied in all specimens. Any variations in the number and shape of the lobes were noted. Presence of accessory fissures on any surfaces or borders of liver were observed. The normal and varied extent of ligamentum teres that separates left lobe from quadrate lobe was identified in all the specimens. Hypertrophy or atrophy of any part of the liver was noted.

3. Results

Varied morphology of liver was identified in the form of accessory lobes (AL) and accessory fissures (AF). The accessory lobes were seen on the quadrate lobe (QL) (fig.1)



Figure 1: Showing Accessory lobe, Accessory fissures

Pons hepatis, a bridge that lies over ligamentum teres connecting the left lobe with quadrate lobe was identified in this study (fig.2).

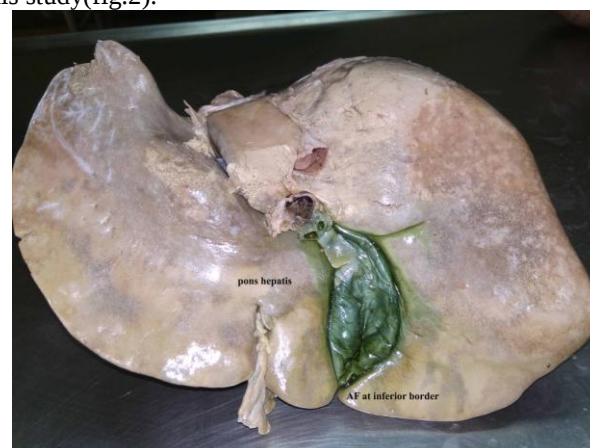


Figure 2: Showing fused lobes with pons hepatis

Anomalous left lobes in the form of lingual expansion and atrophy of left lobe of the liver were identified in this study.



Figure 3: Showing anomalous left lobes

In this specimen quadrate lobe was absent so ligamentum teres was seen by the side of gallbladder. Elongated left lobe of liver and enlarged papillary process of caudate lobe was seen.(Fig.4)

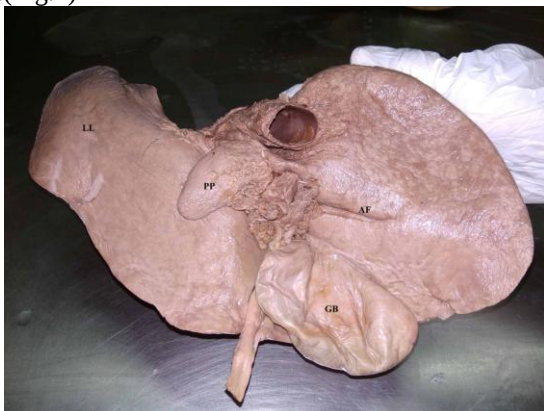


Figure 4: Absent quadrate lobe with papillary process

Prominent papillary process of caudate lobe was identified in two specimens.accessory lobe and fissure was identified on this enlarged papillary process (Fig.5)

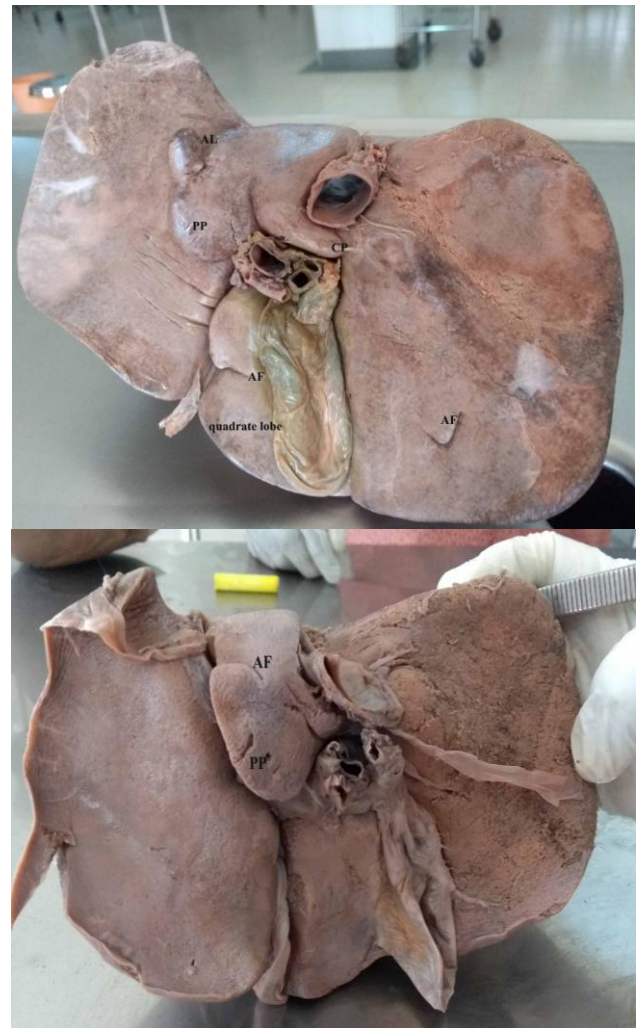


Figure 5: Showing prominent papillary process of caudate lobe with accessory lobes & fissures

4. Discussion

Variations in the liver morphology though common sometimes lead to complications. Abhilasha et al in their study on morphological variations of human cadaveric livers described accessory lobes, accessory fissures, elongated and hypoplastic left lobe of the liver[3]. Anatomical research through necropsies of 172 rats confirmed that accessory lobes are congenital anatomical malformation, rarely associated with an autosomal recessive gene [4]. Development of accessory lobes are due to embryonic heteroplasia in the caudal part of foregut in the third gestational week and segmentation of the hepatic bud[5] Recent hypothesis regarding the development of accessory lobes are outward curling of the embryonic liver during early stage of development[6] and rarely following trauma or surgery[7].

The major fissures are the important landmarks for interpreting the lobar anatomy .Auh et al described accessory fissures in 25% of CT scans as diagnostic errors [8].Any fluid collection in these fissures may be mistaken for liver cyst. Radiological and corrosion cast studies have correlated to the formation of sulci as weak zones of hepatic parenchyma, which offers less resistance to the external pressure of surrounding viscera[9]

Joshi SD et al., study on 90 specimens of liver observed pons hepatis in 30% of liver. He described variable diameter of pons hepatis that joins quadrate lobe and left lobe, it bridges the fissure for ligamentum teres and normal appearance of the fissure would not be possible and diameter of both right and left lobes of liver may be mistaken [10]. Patil S et al. also described the similar variation in 10% specimens [11].

Tongue like elongation of left lobe was reported by SS Joshi et al in their study on 80 livers.[12] . These elongated lobes may reach up to spleen and may be mistaken for spleenomegaly.

During development hepatoduodenal and hepatogastric ligaments connect the gastroduodenal tract with the hepatic hilum. Altered conditions of development like irregular ligament orientation, malrotation of gastroduodenal tube leads to preferential growth of left lobe between the fixed ligament and the abdominal wall that forms shape alterations of the left lobe. They were caused by compression of the hepatic parenchyma during development.[13] Hypoplasia of left lobe with accessory caudate lobe was mentioned by Rajani singh[14] .The congenital factors associated with hypoplasia of the hepatic lobe are anomaly of the umbilical vein or thrombosis of the portal venous segment during embryonic growth[15]. Defective development of the left lobe of liver can lead to conditions like gastric volvulus[14].

Joshi SD et al [10] have also found prominent papillary process in 33% of the livers in their study and Sarala et al observed prominent papillary process in 21% of the livers.[16] When enlarged papillary process extends on to left side it can mimic pancreatic body mass and such an enlargement is common in cirrhosis of liver.[17]

The correct identification of the papillary process can be made by its contour and its continuity with that of caudate lobe in coronal and sagittal planes of CT. The probability of misinterpretation on CT increases if the papillary process is involved by focal disease or diffusely enlarged.[17]. Sateesha described absence of quadrate lobe and mentioned that when the quadrate lobe is absent, the gallbladder is shifted more to the left, which could be important for surgeons while performing laparoscopic cholecystectomy.[18]

The sulci may be the sites for collection of pus or ascitic fluid, which appear as echo free appearance area[17,19] and accessory lobes were reported with torsion, infarction and hemorrhage. Hepatic dysfunction and hemangioma of accessory lobes are also present in literature [19,20,21] .The knowledge of normal and variant liver anatomy has clinical and surgical importance. It helps the radiologists when interpreting liver images preoperatively and the surgeons during segmental resection and in planning biliary surgery.

5. Conclusion

Abnormal growth of liver during embryonic period leads to formation of accessory lobes and fissures. The accessory lobes are asymptomatic and mimic as carcinomatous lesions misleading the clinicians in diagnostic images. The enlarged

left lobe may cause compression on the surrounding organs. Knowledge of absent quadrate lobe helps in laparoscopic surgical procedures.

References

- [1] Champetier J, Yver R, Létoublon C, Vigneau B.: A general review of anomalies of hepatic morphology and their clinical implications: *AnatClin* (1985) 7(4): 285 – 299.
- [2] Mohini M.Joshi , Sushama K. Chavan Morphological study of adult human cadaveric liver *International Journal of Anatomy and Research, Int J Anat Res* 2017, Vol 5(3.2):4284-89
- [3] Dr. Abhilasha Wahane1 , Dr. Charulata Satpute2 Normal Morphological Variations of Liver Lobes: A Study on Adult Human Cadaveric Liver in Vidarbha Region *International Journal of Science and Research (IJSR)* Volume 4 Issue 5, May 2015
- [4] Pujari BD, Deodhare SG. Symptomatic accessory lobe of liver with a review of the literature. *Postgrad Med J.* 1976;52:234- 36.
- [5] Carrabetta S, Piombo A, Podestà R, Auriati L. Torsion and infarction of accessory liver lobe in young man. *Surgery.* 2009;145:448-49.
- [6] Ito F, Ando H, Watanabe Y, Seo T, Murahashi O, Harada T, et al. An accessory lobe of the liver disturbing closure of the umbilical ring. *Pediatr Surg Int.* 1999;15:394-96
- [7] Garba ES, Ameh EA. Isolated rupture of an accessory liver from blunt abdominal trauma in childhood. *Pediatr Surg Int.* 2002; 18:62-63.
- [8] Auh YH, Lim JH, Kim KW, Kim KW, Lee DH, Lee MG, Cho KS Loculated fluid collections in hepatic fissures and recesses: CT appearance and potential pitfalls. *Radiographics* 1994;14(3):529-40.
- [9] Vishwajit Ravindra Deshmukh*, Suryakanta Seth, Chetan Sahniet al *International Journal of Research in Medical Sciences.* 2017 Apr;5(4):1718-1720
- [10] Joshi SD, Joshi SS, Athavale SA. Some interesting observations on the surface of the liver and their clinical implications. *Singapore Medical journal* 2009; 50(7): 715-719
- [11] Patil S, Sethi M, Kakar S. Morphological study of human liver and its surgical importance. *Int J Anat Res.* 2014;2(2):310–14.
- [12] SS Joshi1 , Namrata Reddy2 , SD Joshi1 , Pragatisheel Mittal Morphological Variations of Left Lobe of Liver *International Journal of Contemporary Medical Research* Volume 4 | Issue 9 | September 2017
- [13] Carlo Martinoli, MD, Giuseppe Cittadini, MD, Raffaella Conzi, MD, Caterina Pastorino, MD, Carlo Emanuele Neumaier, MD, GianAndrea Rollandi, MD, Giampaolo Grozio, RT, Giacomo Garlaschi, MD Sonographic Characterization of an Accessory Fissure of the Left Hepatic Lobe determined by Omental Infolding *J Ultrasound Med* 11:103 - 107, 1992
- [14] Rajani Singh Case Report Hypoplastic Left Lobe of Liver with Accessory Caudate Lobe *Case Reports in Medicine* Volume 2013, Article ID 604513, 3 pages
- [15] Suzuki T, Sakurabayashi S, Yoshino K, Yamamoto Y, Nishimura S, Abe K, Yamada F. A case of the

- hypoplasia of the hepatic left lobe complicated with cholangiocarcinoma. *J Gastroenterol.* 1996;93:276–81
- [16] Sarala HS *1, Jyothilakshmi TK 2, Shubha R 3 Morphological variations of caudate lobe of the liver and their clinical implications. *International journal of anatomy and Research, Int J Anat Res* 2015, Vol 3(2):980-83. ISSN 2321- 4287
- [17] Auh YH, Rosen A, Rubenstein WA, Engel IA, Whalen JP, Kazam E. CT of the papillary process of the caudate lobe of the liver. *Am J Roentgenol.* 1984;142(3):535-8.
- [18] Satheesha B. Nayak, Snigdha Mishra, Bincy M. George, Surekha D. Shetty, Naveen Kumar, Anitha Guru, Srinivasa S. Rao and Ashwini Aithal. A peculiar liver with surgically and radiologically important variations: a case report. *Anat Cell Biol.* 2013Mar (1);46:82-84.
- [19] Auh YH, Rubenstein WA, Zirinsky K, Kneeland JB, Pardes JC, Engel IA, Whalen JP, Kazam E. 1984. Accessory fissures of the liver: CT and sonographic appearance. *Am J Roentgenol* 143(3):565-572.
- [20] Ladurner R, Brandacher G, Mark W, Iannetti C, Lottersberger C, [15] Steurer W, et al. Complete hepatic ischemia due to torsion of a large accessory liver lobe: First case to require transplantation. *Transpl Int.* 2005;18:467-69.
- [21] Fogh J, Tromholt N, Jørgensen F. Persistent impairment of liver function caused by a pendulated accessory liver lobe. *Eur J Nucl Med.* 1989;15:326-27.