

# Study of Morphological Variations of Liver and it's Clinical Significance

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## ABSTRACT

**Aims and objectives:** It is very important for radiologists and surgeons to update knowledge of normal and variant liver morphology before diagnosing any liver diseases.

**Methods:** 50 formalin fixed livers were utilized for the studying the

morphological variations of livers.

**Results:** In the present study, 20 livers were normal and 30 livers showed morphological variations out of which 6 livers were with accessory lobes, 8 with accessory fissures, 6 with lingular process and 5 with diaphragmatic sulci.

**Conclusion:** This study highlights presence of morphological variations, whose knowledge is important for surgeons and radiologists.

**Key Words:** Morphology, Variations, Accessory, Fissur, Sulci

## INTRODUCTION

The liver is the largest wedge-shaped abdominal viscera, occupying upper abdominal cavity extending in right hypochondrium, epigastrium, and left hypochondrium till left lateral line. It weighs 2% of the body weight [1].

In this new generation, where diagnosis mainly depends on imaging techniques and minimally invasive approaches, it is very important for the radiologists and surgeons to have a detailed knowledge of anatomy and related variations of this organ. Anatomists witness variation of lobe and fissure of liver [2].

The current study was undertaken to study the morphology of cadaveric liver and analyze the incidence of anatomical variations of liver and its significance in clinical diagnosis.

## MATERIALS AND METHODS

Present study was conducted on 50 livers obtained from formalin fixed cadavers, used for routine dissection classes of medical undergraduate students for 4 years. Intact livers of above 20 years of age and with normal anatomical features were included. Torn livers, livers adherent to other visceral organs, livers with surgical marks and livers of less than 20 years of age were excluded. Each specimen was studied for morphological variations. Livers were held in anatomical position to ease the better viewing of diaphragmatic and visceral surfaces. Each lobe of liver that is right lobe, left lobe, caudate lobe and quadrate lobe was studied in detail for size, accessory fissures, accessory lobes and various impressions present on them.

## RESULTS AND OBSERVATIONS

Different shapes of liver are seen in variable frequencies (Tables 1 & 2). Variation in the morphological features of liver such as accessory fissure, accessory lobes, Lingular process and Diaphragmatic sulcus occur in various frequencies (Table 3). In this study frequency of accessory fissures were seen more in caudate lobe (Table 4) and that of accessory lobes were seen more common in right lobe (Table 5). All tables given below are original is original and showing normal liver with morphological variations.

Table 1

Incidence of variation in the shape of liver.

Serial no	Shapes	Number of specimen	Incidence
1	Wedge	30	60%
2	Irregular	8	16%
3	Dome	5	10%
4	Large left lobe	3	6%
5	Large right lobe	4	8%

Table 2

Incidence of variation in the weight of liver.

Serial no	Range of weight(grams)	Number of specimen	Incidence
1	Below 500	2	4%
2	500-1000	10	20%
3	1000-1500	30	60%
4	1500-2000	5	10%
5	Above 2000	3	6%

Table 3

Incidence of normal and variant livers.

Serial no.	Morphological features	Number of livers	Incidence
1	Normal liver	20	40%
2	Liver with accessory fissures	8	16%
3	Liver with accessory lobes	6	12%
4	Liver with lingular process	6	12%
5	Liver with diaphragmatic sulci	5	10%
6	Liver with deep renal impressions	4	8%
7	IVC and caudate process extending to superior surface	1	2%

Table 4

Incidence of accessory fissures in various lobes of liver.

Lobe	Accessory fissure	Incidence
Right lobe	2	4%
Left lobe	1	2%
Caudate lobe	3	6%
Quadrate lobe	2	4%

## DISCUSSIONS

Knowledge of morphological variations of liver is important for anatomists as well as for radiologists and surgeons. Gross abnormalities of liver are rare, despite of its complex development [3]. Variation in anatomy of human liver is classified into congenital and acquired. Congenital

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Table 5

Incidence of accessory lobes.

Lobe	Accessory lobes	Incidence
Right	3	6%
Left	1	2%
Quadrangle lobe	1	2%
Caudate lobe	1	2%

abnormalities are a) Absence of right/left lobe. b) Partial atrophy of one lobe. c) Presence of accessory lobes d) presence of accessory fissures [4]. Acquired are a)deep renal impressions and corset type constriction b) local inflammation of organ c)coastal organ with very small left lobe [5]. In the present study, we found 20(40%) normal liver and 30(60%) liver has morphological variations (Table 3).

In this study 30% of the liver had normal wedge shape and remaining 20% had variant shape [Table 1] which may be due developmental or acquired abnormalities.

60% of liver had normal weight(1000-1500grams). 24% of livers were with weight less than 1000grams. The reduced weight may be due to alcoholic liver disease, chronic hepatitis, auto-immune diseases or inherited diseases.616% of the liver are with weight above 1500grams. Increased weight or hepatomegaly may be due to fatty liver, portal hypertension, carcinoma of liver, metastatic cancer of other organs [7].

The variations in anatomy of human liver have been classified as congenital/acquired [8]. The inborn anomalies of liver can be divided into anomalies due to imperfect development and anomalies due to uncontrolled development. Imperfect development of left lobe of liver can lead to gastric pathology commonly the intestinal obstruction. The imperfect/ defective development of right lobe may remain quiescent or may advance into portal hypertension [9].

The consequence of excessive/uncontrolled development of liver is the generation of accessory lobes which may lead to torsion [9].

Accessory lobes are composed of normal hepatic tissue, containing their own hepatic blood vessels and bile duct which are connected to rest of the liver [10]. The accessory lobes are also could be formed by displacement of primitive rudiment of organ/persistence of mesodermal septa during it's proliferation [11]. In our present study, accessory lobes were found mainly in right lobe of 3 livers and left lobe and quadrangle lobe of one liver each had accessory lobe.

The causes of formation of accessory fissures can be multiple such as gastric volvulus/pathology, diaphragmatic hernia, portal hypertension, obstructive pulmonary diseases [6,12,13]. In present study, accessory fissures were seen 2 on right lobe, 2 on left lobe, 4 on caudate lobe and 3 on quadrangle lobe. These fissures are the major source of diagnostic errors during ultrasound/computed tomography. Any collection of fluid in these fissures may be mistaken for liver cyst, intrahepatic hematoma or liver abscess which would require further radiological workup. Implantation of peritoneal disseminated tumour cells into these fissures may mimic intrahepatic focal lesion [14]. In case of abdominal trauma, direct palpation/imaging of sulcus prior to laparotomy may give false impression of liver laceration [15].

5 livers showed deep diaphragmatic impressions/sulci, normally due to pressure of ribs and diaphragm. These sulci result from uneven growth of hepatic parenchyma caused by resistance offered by different bundles of diaphragm muscles. Current radiological studies have assigned the formation of sulci to the presence of weak zones of hepatic parenchyma, depicted by portal fissures between adjoining sagittal portal territories [16]. Diaphragmatic sulci can be a principal indicator for forecasting of portal fissures. Hepatic veins and their tributaries pass through these sulci [17].

6 livers showed lingular process/elongated left lobe with the normal right lobe. These lingular processes may be misdiagnosed as distention of splenic flexure of colon, gastroptosis, hydatid cyst or sarcoma of liver [18]. Patients with extended left lobe may present asymptotically or with non-specific abdominal pain, pressure symptoms. Hence for diagnosis of such cases, imaging by ultrasonography/computed tomography is recommended. Knowledge of this anomaly helps surgeons in planning biliary surgery/portosystemic anastomosis.

3 livers show deep renal impressions/Corset type constriction which may be due to perfusion defect or focal fatty infiltration [8].

### CONCLUSION

This study lightens the knowledge of various morphological variations of liver, thus avoiding diagnostic error during interpretation by radiologists and surgeons. This awareness helpsto avoid fatal or serious surgical complications and assist in planning appropriate approaches.

Hence this study updates the knowledge of morphological variations among surgeons and radiologists.

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