Human Liver Morphology: Anatomical Study about the External Aspects

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Abstract

Knowledge of the anatomy of liver is a prerequisite for a complete understanding of the mechanics of diagnostic imaging and minimally invasive surgical approaches. So the aim of the study is to carry out the morphological feature of right lobe, left lobe, caudate lobe, quadrate lobe and surfaces of liver. This is retrospective observational study done on 75 human livers irrespective of age and sex in Department of anatomy, Smt. B.K. Shah Medical Institute and Research Center, Vadodara, Gujarat. The livers were studied for morphological variationsuch as accessory fissure, accessory mini lobe, Quadrant lobe with tongue like projection, Pons hepatis connecting left lobe with quadrate lobe, Riedel's lobe present, Narrow and elngated left lobe, Absence of quadrant lobe, Absence of fissure for ligamentum teres, Bilobed caudate lobe and classified according to Netter's classification.Out of 75 embalmed human liver 23 (30.67%) livers were normal and 52 (69.33%) livers shown one or more than one morphological variation of liver. Out of 52 liver found abnormal fissures were in 23 (30.67), pons hepatis in 2 (2.66%), riedel's lobe in 3 (4%), absence of quadrant lobe in 1(1.33%) deep renal impression and corset constriction observed in 15 (20%) specimens of liver, diaphragmatic deep groove were observed in 1 (1.33%) specimen. The presence of knowing extra lobes and fissure lies in the fact that might help to interpretation during imaging of hepatobilliary system and may intern lead to surgical implication in operation theater.

Keywords: *Liver, Accessory fissures, Accessory lobes, Caudate lobe, Quadrate lobe, Pons hepatis, Riedel's lobe, Hepatectomy.*

Introduction

Knowledge of the anatomy of liver is a prerequisite for a complete understanding of the mechanics of diagnostic imaging and minimally invasive surgical approaches. Liver is one of the key organ of body which is responsible for detoxifying the blood coming via portal vein, storing glocose, manufacturing cholesterol and secreting bile for digesion of fat. Liver is invariably involved in alcoholism there by causing cirrosis of liver. Liver exibits various lobes viz right, left caudate and quadrate lobe, also has two fissures viz fissure for ligamentum teres and fissure for ligamentum venosum. It has a porta hepatis for the passage of vessels nerves and exit of hepatic ducts, lympatics[1].

There are wide variety of variation in size and number of lobes. It may exibit accessory lobes. Its important to know these anatomical facts and variations regarding liver as they are of utmost importance to hepatobiliary surgeons. So the aim of the study is to carry out the morphological feature of right lobe, left lobe, caudate lobe, quadrate lobe and surfaces of liver.

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Materials and Method

This is retrospective observational study done in Department of anatomy, Smt. B.K. Shah Medical Institute and Research Center, Vadodara, Gujarat. The ethical approval for the study was taken before the study. There are 75 cadevaric livers of unknown age and sex collected from routine dissection of medical undegraduate student during dissection and preserved in 10% formalin solution. Any damage or pathology of livers were excluded from the study. The livers were studied for morphological variation such as Accessory fissure, Mini accessory lobe,Pons hepatis which connecting qudrate lobe with left lobe of liver, Riedel's lobe present, Elongated and narrow left lobe,Absence of quadrate lobe,Absence of fissure for ligamentum teres, Quadrate lobe with tongue like projection, Bilobed caudate lobe on right lobe, left lobe, caudate lobe, quadrate lobe and surfaces of liver and classified according to Netter's classification[2]. Each morphological variation was documented carefully with photograph. All data were recorded and calculated.

Results and Discussion

Out of 75 embalmed human liver 23 (30.67%) livers were normal not showing any variant feature. 52 (69.33%) livers shown one or more than one morphological variation of liver. These data suggest a highincidence of morphological variation in the liver.

Very common the accessory fissure on right lobe seen in 13 (17.33%) specimens (Figure 1A, 3A) and accessory fissure on left lobe in 1 (1.33%). Accessory fissure on caudate lobe observed in 5 (6.66%) specimens (Figure 1B) and access or fissure on quadate lobe in 4(5.33%) specimens (Figure 3A). Mini accessory lobe were present in 4(5.33%) (Figure 2C). Quadrate lobe with tongue like projection were found in 4(5.33%) specimens (Figure 2B, 2D) and Riedel's lobe which was extra lobe on right lobe were present in 3 (4%) specimens(Figure 2A).Pons hepatis which connecting left lobe to quadrate lobe were seen in 2 (2.66%) specimens(Figure 1C). Narrow and elongated left lobe seen in 7 (9.33%) specimens (Figure 3B).

Other variations noted were absence of quadrate lobe in 2 (2.66%) specimen, absence of fissure for ligamentum teres in 2 (2.66%) specimens (Figure 1C, 1D). A complete transverse fissure dividing quadrate lobe in bilobed were present in 2 (2.66%) specimens (Figure 2C). The enlarge papillary process and caudate process found in 2 (2.66%) (Figure 2D) specimens. And alsodone classification of livers were as stated by Netter's into six types. (Figure 3B, 3C)[2].

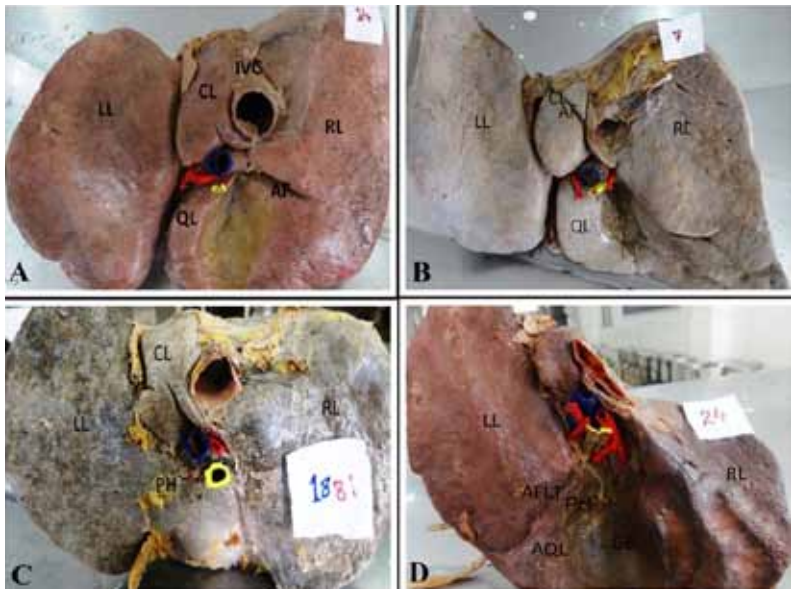

Figure 1 A: Liver showing RL- Right Lobe, LL- Left lobe, QL- Quadrate Lobe, CL- Caudate Lobe, AF- Accessory Fissure on Right lobe, IVC- Inferior Vena Cava, Figure B: Liver showing RL- Right Lobe, LL- Left lobe, QL- Quadrate Lobe, CL- Caudate Lobe, AF- Accessory Fissure on Caudate Lobe, Figure C: Liver showing PH- Pons hepatic connecting left lobe with quadrate lobe, RL- Right Lobe, LL- Left lobe, QL- Quadrate Lobe, CL- Caudate, Figure D: Liver showing AFLT- Absence of Fissure for Ligamentum Teres, AQL- Absence of Quadrate Lobe, GB- Gall Bladber, PH- Pons hepatic connecting left lobe with quadrate lobe, RL- Right Lobe, LL- Left lobe, QL- Quadrate Lobe, CL- Caudate.

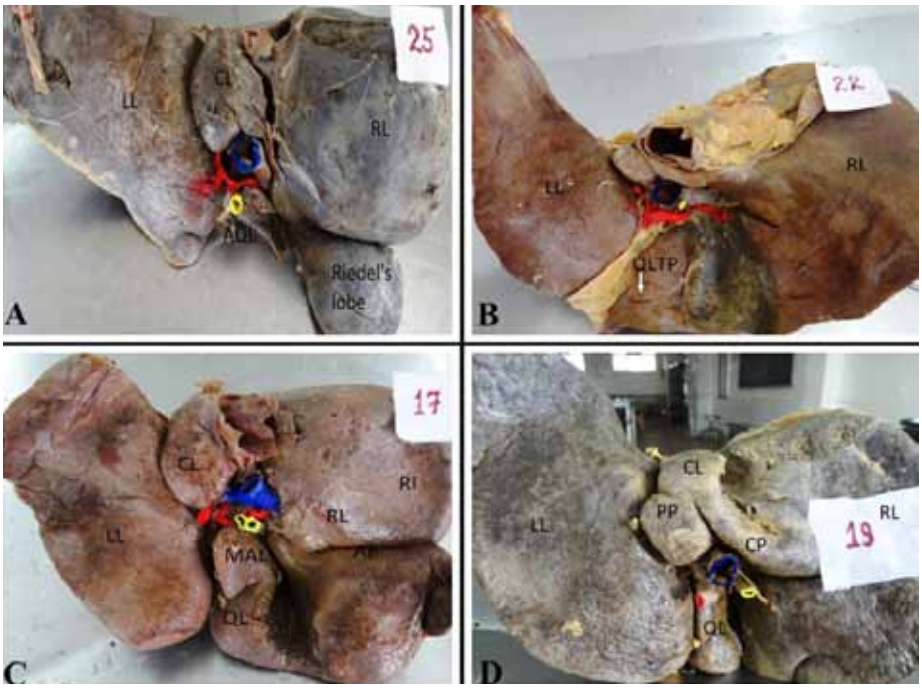

Figure 2 A:Liver showing Riedel's lobe, AQL- Absence of Quadrate Lobe, RL- Right Lobe, LL- Left lobe, QL- Quadrate Lobe, CL- Caudate, Figure B:Liver showing LL- Narrow and Elongated Left lobe, QLTP- Quadrate Lobe with Tongue like Projection, RL- Right Lobe, CL- Caudate, Figure C:Liver showing MAL- Mini Accessory Lobe, AS- Accessory Lobe, RI- Deep Renal Impression LL- Left lobe, RL- Right Lobe, CL- Caudate, Figure D: Liver showing, CL- Caudate, PP- Large Papillary Process, CP- Long Cuadate Process, QL- Quadrate Lobe, LL- Left lobe, RL- Right Lobe.

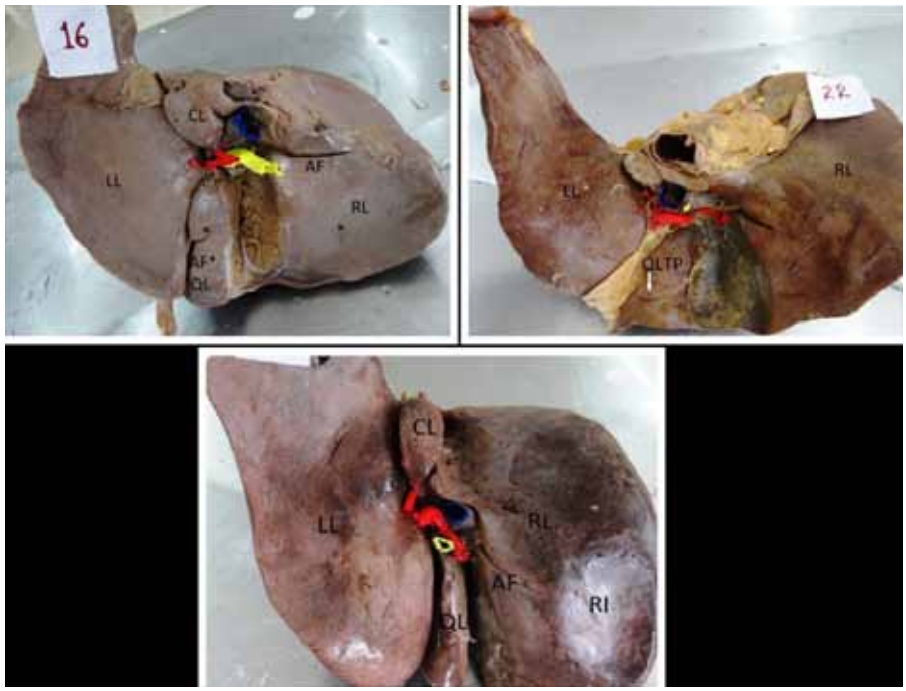

Figure 3 A:Liver showing AF- Accessory Fissure on Right Lobe, AF*- Accessory Fissure on Quadrate Lobe, RL- Right Lobe, CL- Caudate, LL- Narrow and Elongated Left lobe, Figure B: Netter's Type 4 - Liver showing QLTP- Quadrate Lobe with Tongue like Projection, RL- Right Lobe, CL- Caudate, LL- Narrow and Elongated Left lobe,Figure C:Netter's Type 5 - Liver showing CL- Caudate Lobe AS- Accessory Fissure, LL- Left lobe, QL- Quadrate Lobe, RI- Deep Renal Impression, RL- Right Lobe.

Table 1: Different morphological features of liver.

S.No.	Morphological features	Number of specimens	Frequency %
1	Normal	23	30.7
2	Accessory fissures right lobe	13	17.3
3	Accessory fissures on left lobe	1	1.3
4	Accessory fissures on caudate lobe	5	6.7
5	Accessory fissures on quadate lobe	4	5.3
6	Mini accessory lobe	4	5.3
7	Quadrant lobe with tongue like projection	4	5.3
8	Riedel's lobe present	3	4
9	Pons hepatis connecting left lobe with quadrate lobe	2	2.7
10	Elongated and left lobe	7	9.3
11	Absence of quadrant lobe	2	2.7
12	Absence of fissure for ligamentum teres	2	2.7
13	Superior and Inferior quadrate lobe	2	2.7
14	Bilobed caudate lobe	2	2.7
15	Large papillary process of cuadate lobe	1	1.3
16	Long caudate process of cuadate lobe	1	1.3

Table 2: Classification of liver morphology according to Netter[2]

S.No.	Netter type	Number of specimens
1	Type 1 (Very small left lobe, deep costal impressions)	1
2	Type 2 (Complete atrophy of left lobe)	-
3	Type 3 (Transverse saddle like liver, relatively large left lobe)	1
4	Type 4 (Tongue like process of right lobe)	3
5	Type 5 (Very deep renal impression and corset constriction)	15
6	Type 6 (Diaphragmatic grooves)	2

Congenital anomalies of liver confront are lobes does not developed or a segment, lobes may be malform or may be tiny. These anomalies may occur due to abnormal cell lines in the septum transversum in which the liver develops[3]. Most of the times the liver exibits malformation due to any chang in the microenviornment during organogenesis[4] and it need to be research such studies have been carried out by many research workers throughout world and in the country bu no such research work has been carried out in rural Gujarat.

The present study conducted on various lobes of liver. Variations in the fissures were studied by many researchers[5-13]. A study carryout by *Joshi D et al*[6] reported 30% of accessory fissures in their study. Similar another study was conducted by *Patil et al*[14] *and Chadhari et al*[4] revealed 14% and 17.5 % of the livers had accessory fissures. In the present study, the accessory fissures were also present in 30.67% of livers.

Presence of accessory lobes persented on caudate lobe, quadrate lobe and left lobe. It was found to be 5.33% of livers in preent study. The similar finding was seen by *Chaudhari et al*[4], 3.7 %. And Patil et al fonud lower incidence was 2%.

Pons hepatis is connecting left lobe with quadrate lobe. Pons hepatis was seen 2.66% of the liver in the present stydy. The similar finding was observed by *Chaudhari et al*[4] reported in 1.25%. Where in other studies found higher incidence as *Patil et al* reported 10%, Joshi et al[6] reported 30%.Clinically, metastatic

hepatomas have been found originating from the pons hepatis as well as harboring site of peritoneal disseminated tumor cells.

In present study,it was seenabsence of fissure for ligamentum teres in 2.66%. The similar finding was seen by *Nayak et al* repoeted 1.81 % and Patil et al observed 4% incidence in liver. Where in other studies found higher incidence as *Chaudhari et al*[4] reported 11.2%, *Muktyaz et al*[9] seen 9.7%.

The prominent papillary process and long caudate process were seen in 1.25% specimen in our study, similar to findings of Nayak et al[11] and chaudhari et al results. When enlarged papillary process or prominent papillary process it is look like body mass of pancrease in cirrosis of liver. Caudate lobe enlargement commonly accompanies occlusion of the hepatic veins; along with patchy areas of low and high attenuation on CT.

Elongated and narrow left lobe found in 9.33% incidence in our study which was similar with that of *Chaudhari et al*[4] observed in 12.5%. Where as it was found low incidence in *Nayak et al*[11], 1.81%.

Table: 3 Comparison between present study and other studies.[4]

Morphological features	Chaudhari et al[4] (%)	Joshi SD et al [6] (%)	Nayak BS [11] (%)	Patil S et al [14] (%)	Sarita et al[15] (%)	Present study (%)
Normal liver	17.5	-	60	56	66	30.7
Accessory Fissures	12.5	30	1.81	10	34	30.7
Accessory Fissures on caudate lobe	3.7	-	-	-	6	6.7
Bilode Quadrate Lobe	7.5	20	-	4	-	2.7
Pons hepatis connecting left lobe with quadrate lobe	1.25	30	-	10	-	2.7
Absence of fissure for ligamentum teres	11.2	-	1.81	4	-	2.7
Riedel's lobe present	1.25	-	-	-	2	5.3
Elongated left lobe present	12.5	-	1.81	-		9.3
Accessory Mini lobe present	3.7%	-	-	2%		5.3
Large papillary process	1.25%	32%	1.81	-	4	1.3

Conclusion

It is emphasized the importance of the liver morphology of the Gujarati population. The findings of our study highlights some of variations in fissure and lobes of the liver. With advances in liver surgical procedures like laparoscopic thermal ablation for patients with hepatic tumour and laparoscopic hepatectomy, these variations presume more importance. The presence of knowing extra lobes and fissure lies in the fact that might help to interpretation during imaging of hepatobilliary system and may intern lead to surgical implication in operation theater.

Acknowledgement: I express my sincere gratitude to the generous donors who donated their bodies for academic and research purposes. Without cadavers this research would have not been possible.

Source of Funding: No funding.

Conflicts of Interest: The author declares no conflict of interest.

Ethical Clearance: Ethical approval to undertake the present study was obtained from the Institution Ethical Committee (IEC).

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