



A MORPHOMETRIC STUDY OF FORMALIN FIXED HUMAN LIVER SPECIMENS IN PAURI GARHWAL REGION OF UTTARAKHAND

Anatomy

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ABSTRACT

Morphometric study of liver has immense importance due to its involvement in infective as well as metabolic disorders. In the present study we measured shape, weight, height, thickness of right and left lobe of the liver as well as parameters of the gall bladder fossa. These important indicators are essential for radiological, pathological and medicinal diagnosis. The statistical analysis of above parameters was done by 't' test. The weight of liver specimens varied from 407.5 gm to 1502 gm and was found to be significant with p value <0.001. The overall height of right and left lobes of the livers was also found to be significant with p value <0.001. The majority of the livers were wedge shaped.

KEYWORDS

Liver, Wedge shape, ligament, Lobe.

Introduction:

The liver is the largest of the abdominal organs situated in upper abdominal cavity. It occupies right hypochondrium, epigastrium and left hypochondrium. The ratio of liver/body weight decreases from infancy to adulthood. The weight of liver is approximately 5% of the body weight in infancy. It is the second largest organ in the body with the average weight of 1.5 kg in adult human(1). Anatomically, liver is divided in right and left caudate and quadrate lobes by peritoneal and ligamentous attachments(2). It has anterior, superior and posterior surface with relatively flat or concave visceral surface(1, 3).

Anteriorly right and left lobes are separated by falciform ligament. Right lobe is 4 to 5 times larger than the left lobe(4). On visceral surface, liver is divided into the right and left lobes by the ligamentum venosum and ligamentum teres. An adult human liver generally measures 21 cm to 22.5 cm in transverse diameter [width], 15 cm-17.5 cm at its maximum vertical points [height], and 10 cm -12.5 cm from front to back [thickness](2, 5).

The major fissures are important landmarks for the interpretation of lobar anatomy and locating liver lesions, therefore, it is important for radiologists and surgeons to have the knowledge of anatomy and commonly occurring variations of the organ(6). Congenital anomalies related to liver are rare(7) as compared to any other organs of the body(8).

Size of liver increases in case of viral infections, malaria, congestive heart failure, Haematological disorders like Thalassaemia, Sickle cell disease, Haemolytic anaemia, Myeloma, Leukaemia etc. The size of liver decreases in cirrhosis and chronic hepatitis C (9, 10).

The present study was conducted to assess the weight and normal dimensions of formalin-fixed livers in the specimens in order to evaluate the regional variations for its use in radiological, pathological and medical practices.

Materials and methods:

The present study was conducted on 22 formalin fixed adult human livers obtained by standard dissection procedure in the department of Anatomy, Veer Chandra Singh Garhwali Government Institute of

Medical Science & Research [VCSGGIMS&R], Pauri Garhwali Uttarakhand. Morphometric analysis was done by taking following parameters- weight [in grams by using digital weighing machine], height measured [in cm] of right and left lobe by taking highest point, total transverse diameter of liver using maximum width point [in cm] by using vernier caliper. The transverse diameter of right and left lobe was measured by using the same method. The thickness of right and left lobe at maximum point was measured by using vernier caliper [in cm]. The height and width of gall bladder fossa was also taken into the consideration. All the parameters were tabulated and compared with the available data. The statistical analysis was done by using Statistical Package for Social Sciences [spss] version 17. The data was analysed by applying student 't' test.

Results:

In the present study, 85% of the livers were wedge shaped, 10% were quadrangular and remaining 5% were pear shaped.

The data from the 22 liver specimens was tabulated. The weight of the liver ranged from 407.5 gm to 1094.5 gm with Mean 990.4+ 259.53 gm. The height of right lobe ranged from 9.6 cm to 18.4 with mean 13.93+ 1.90 cm. The height of left lobe varied from 9.3 cm to 1.57 cm with mean 12.25 +1.80 cm. Total transverse diameter of livers ranged from 15.6 cm to 22.7 cm with mean 22.32 +1.82 cm. Transverse diameter of the right lobe ranged from 11.1 cm to 17.1 cm with mean 14.65 +1.60 cm. Transverse diameter of the left lobe ranged from 5.8 cm to 18.1 cm with mean 9.75 +2.82 cm. Overall, total diameter of the liver specimens was found less than the combined transverse diameter of right and left lobe of the liver which is due to the convexity of superior surface and concavity of visceral surface. The thickness of right lobe varied from 6.6 cm to 12.3 cm with mean 9.5 +1.54cm. The thickness of left lobe varied from 3.7cm to 7.4 cm with mean 5.7 + 0.90. The height of gall bladder fossa varied from 3.4 cm to 8.3 cm with mean 5.85 + 1.24 cm. The width of the gall bladder fossa varied from 2.4 cm to 5.1 cm with mean 3.5 +0.67 cm.

In most of the specimens [96%], the right lobe of the liver was found to be larger as compared to the left lobe. The height versus width ratio of gall bladder fossa in all the specimens was found to be more than 1.0.

Table-1: Morphometric parameters of liver specimens.

SN	Weight[g]	Height Rt lobe[cm]	Height left lobe[cm]	Transverse diameter[total in cm]	Transverse Diameter Rt Lobe [cm]	Transverse Diameter Lt Lobe [cm]	thickness Rt lobe [cm]	thickness Lt lobe [cm]	GB fossa Ht [cm]	GB fossa width [cm]
1	1087.0	14.5	12.2	22.2	13.3	11.7	8.9	4.8	3.9	3.5
2	680.0	12.3	10.6	19.9	13.4	11.8	11	6.3	3.6	2.6
3	765.0	12.3	15	19.5	14.8	5.8	8.3	5.6	5.4	5.1
4	1059.0	12.8	11.7	21	15.5	9.4	9.8	6.9	6.8	3.3
5	1182.5	14.1	12.1	20.5	16.4	8.2	9.8	5.7	7.1	4.2
6	1116.0	14.5	10.4	20.1	15.8	8.7	8.6	5.1	6.8	3.6
7	1502.0	16.8	15.7	22.7	16.6	14.3	10.2	7.4	6.4	2.9
8	1367.5	15.5	13.3	20.8	15.3	10.2	11.6	7.4	6.3	3.1
9	1126.5	13.8	9.4	22.3	14.8	9.1	10.8	6	5.3	2.4
10	1201.5	18.4	13.6	22.6	16	9.8	10	6.1	6.2	3.6
11	971.5	13.4	12.1	18.9	14.5	9.5	10	5.4	5.7	3.8
12	609.5	11.2	11	15.6	12.4	7.1	7.5	4.6	4.7	3.4
13	835.5	13.4	12.5	21.4	17.1	7	9.8	5.6	5.8	3.1
14	1128.0	13.2	12.8	21.2	15.6	18.1	12.3	5.7	6.3	3.4
15	407.5	9.6	9.3	16.4	11.1	7.6	7.4	3.7	4.8	2.8
16	986.0	14.9	12.4	20.8	15.8	7.6	9	5.5	7.8	4.6
17	761.0	12.8	15.2	20	14.6	7.2	6.8	5.6	8.3	3.5
18	1083.5	15.7	13.8	20.2	12.8	12.1	8.9	4.5	6.2	4.2
19	1220.0	14.2	9.8	22.6	15.8	9.8	10.3	6.2	6.4	3.8
20	1025.0	16.1	13.4	18.9	11.8	7.1	6.6	5.4	5.8	4.2
21	690.0	13.2	10.8	20.2	13.8	12.2	11.6	6.8	3.4	2.8
22	985.0	13.8	12.6	19.3	15.1	10.2	9.8	5.6	5.8	4.2

Discussion

In the present study, the majority of livers [85% of the liver specimens] were wedge shaped, 10% were quadrangular, and remaining 5% were pear-shaped. The wedge shaped morphology observed in the present study is consistent with as mentioned in Grey's anatomy(2). However, in contrast with the triangular shape of liver as reported by John, 1976 (11), the same was not observed in this study.

In the morphometric data of liver, we noticed the mean weight range of 990.43+259.53g; however, it was reported to be the 2% of total body weight [1200g] in Grey's anatomy(2) and 1500g by Moore(1). Further, in a study by Nagato et al 2011(12), the mean weight was recorded as 668.4+302.3. This difference of weight may be due to the ethnicity and the effect of formalin on the specimens.

Transverse diameter in our study ranged from 15.6cm to 22.7cm with mean 20.32+1.82cm while in the study conducted by Moore(1), the transverse diameter ranged from 21cm to 22.5 cm, on the other hand, in the study conducted by Nagato et al, 2011 (12), it was 19.6+ 22.6 cm which is consistent with our findings.

The thickness of right lobe varied from 6.6 cm to 12.3 cm with mean 9.5 +1.54cm. The thickness of left lobe varied from 3.7cm to 7.4 cm with mean 5.7 + 0.90 cm. According to moore (1), the maximum thickness of liver was 10-12cm and in the study by Nagto et al, 2011 (12), the thickness was 8.6+1.8cm. These finding coincide with the present study.

The height of right lobe ranged from 9.6 cm to 18.4cm with mean 13.93+ 1.90 cm. The height of left lobe varied from 9.3 cm to 1.57 cm with mean 12.25 +1.80 cm, whereas in the study of Moore (1), the height was recorded as ranging from 15 cm to 17.5cm, and 14.59+2.9cm in the study conducted by Nagto et al, 2011 (12) which is near to our study.

In our study, the height of gall bladder fossa varied from 3.4 cm to 8.3 cm with mean 5.85 + 1.24 cm. The width varied from 2.4 cm to 5.1 cm with mean 3.5 +0.67 cm.

Conclusion:

In this study we conclude that the different morphometric parameters of liver have significant role in the diagnosis of hepatomegaly and hypoplastic liver for surgeons, radiologists as well as for clinicians.

Acknowledgement: We acknowledge the contribution of supporting staff of Anatomy department Sonu, Anil, Dinesh, Hemlata Chand and Jyoti Rawat for their help during the conduct of the study.



Figure 1: Measurements of transverse diameter



Figure 2: Quadrangular liver



Figure 3: Pear-shaped liver



Figure 4: Liver with small left lobe

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