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ABSTRACT

Introduction: Liver is the largest gland of the body. It is situated under the right dome of the diaphragm and mainly occupies the right hypochondriac and epigastric regions. It is divided into anatomical right and left lobes by the line of attachment of falciform ligament, fissure for ligamentum venosum and fissure for ligamentum teres. It has caudate and quadrate lobes as the parts of right anatomical lobe. The hilum of the liver and porta hepatitis is situated on its visceral surface and it transmits various ducts, veins and arteries. The fossa for gall bladder is situated on the posterior surface of the liver. The fossa for gall bladder is usually projects beyond the inferior border of the liver. The fundus of the gall bladder is situated on the inferior surface of the right lobe of the liver and gall bladder is situated in it. The fossa for gall bladder is usually projects beyond the inferior border of the liver.

Material and Methods: The present study was conducted in 160 human livers from embalmed cadavers in the Department of Anatomy, KIMS, Karad, during the study duration of July 2017 to August 2018. The liver specimens were removed from adult human cadavers during routine dissection for medical undergraduate students and then preserved in 10% of formalin.

Results: We analyzed 160 livers, with its morphological characteristics and structural variations. Mean weight of the liver was reported to be 1.05 Kg (Minimum 0.461 and Maximum 2.137 Kg) with SD of 0.34 Kg. Mean breadth of the liver was reported to be 18.44 cm (Maximum 25.5 cm and Minimum 2.4 cm) with SD of 2.45 cm. Mean thickness of the liver was reported to be 10.52 cm (Maximum 18.3 and Minimum 3.4) with SD of 1.82 cm.

Conclusion: The present study focuses upon the frequent occurrence of morphological variations on the surface of the liver.

Keywords: Human Liver, Anatomy, Morphological Variations, Fissures, Lobes

INTRODUCTION

Liver is the largest gland of the body. It is situated under the right dome of the diaphragm and mainly occupies the right hypochondriac and epigastric regions. It is divided into anatomical right and left lobes by the line of attachment of falciform ligament, fissure for ligamentum venosum and fissure for ligamentum teres. It has caudate and quadrate lobes as the parts of right anatomical lobe. The hilum of the liver and porta hepatitis is situated on its visceral surface and it transmits various ducts, veins and arteries. The fossa for gall bladder is situated on the inferior surface of the right lobe of the liver and gall bladder is situated in it. The fundus of the gall bladder usually projects beyond the inferior border of the liver. It has caudate and quadrate lobes as the parts of the right anatomical lobe. The fossa for gall bladder is situated on the inferior surface of right lobe of the liver and gall bladder is situated in it. The fundus of the gall bladder usually projects beyond the inferior border of the liver.

In terms of gross anatomy, the liver may be divided intofour lobes based on surface features. The falciform ligament, which is visible on the anterior side of the liver, divides the organ into the right and left anatomical lobes. Two additional lobes may be observed on the visceral surface, these being the superior caudate lobe and below this the quadrate lobe. From behind, the lobes are divided by the ligamentum venosum and the ligamentum teres (anything to the left of these constitutes the left lobe), whilst the transverse fissure (or porta hepatitis) separates the caudate from the quadrate lobe, and the right sagittal fossa (over which runs the inferior vena cava) separates these two lobes from the right lobe. Each of the lobes is made up of lobules, veins from the centre of which join the hepatic vein and carry blood out from the liver. Various ducts, veins and arteries are present on the surface of the lobules that allow the inflow and outflow of fluids. Morphological variations of the liver are common like one or more accessory lobes, liver cyst, atrophy of liver and absence of one of the lobes.

The liver is responsible for a wide range of vital functions including blood detoxification and purification, synthesis of plasma proteins, production of bile, and the metabolism of carbohydrates, fats and proteins. In man, the liver is essential for survival since there is currently no artificial organ or equipment that has the capacity to compensate for the absence of liver function. Hence knowledge of variation in liver anatomy is required for good surgical outcome, diagnostic imaging and minimally invasive surgical procedures.

The present study was conducted with the objectives to study the various morphological and structural variations in the anatomy of the liver.

MATERIAL AND METHODS

The study was conducted on 160 cadaveric livers after

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obtaining the ethical clearance from Research Board of KIMS Karad, during the study duration of July 2017 to August 2018. As number of sample is huge these specimens were obtained from different colleges. Prior permission from higher authorities of our college and other colleges was taken. Names of these colleges are mentioned below:
1. Krishna Institute of Medical Science, Deemed To be University Karad.
2. Government Medical College, Miraj.
3. Bharti Vidyapeeth Deemed University And Hospital, Sangli.
5. Rajarshi Chhatrapati Shahu Maharaj Government College, Kolhapur.
6. Shrimati Kashibai Navale Medical College And Hospital, Narhe, Pune.
7. Bharti Vidyapeeth Deemed University And Hospital, Pune.

The liver specimens were removed from adult human cadavers during routine dissection for medical undergraduate students and then preserved in 10% of formalin. The lobes of the liver, right lobe, left lobe, caudate lobe and quadrate lobe were studied in detail for their morphological features and classified according to Netter’s classification.

**Measurements of the liver**
1. **Weight of Liver**: It is measured by electronic weighing machine.
2. **Height of the Liver**: It is measured by soft tissue measurement board, by keeping the liver in normal anatomical position. Height is measured from lowermost part of right lobe till highest convexity of superior surface of liver. We have measured the vertical height.
3. **Breadth of Liver**: It is measured from maximum convexity of right lateral surface of right lobe to the lateral most part of left lobe (greatest transverse measurement). Measured the by soft tissue measurement board by keeping the liver in normal anatomical position.
4. **Thickness of the Liver**: Will take it at greatest antero-posterior diameter, it is on the level with upper end of right kidney.

The data was collected with the help of standard, pre-validated case record proforma. The data was entered and descriptive statistics was calculated with the help of Microsoft excel software.

**RESULTS**
The present study was conducted among 160 cadaveric livers stored in 10% formalin under the department of anatomy, KIMS, Karad over the period of 12 months.
We analyzed 160 livers, with its morphological characteristics and structural variations. Mean weight of the liver was reported to be 1.05 Kg (Minimum 0.461 and Maximum 2.137 Kg) with SD of 0.34 Kg. Mean breadth of liver was reported to be 18.44 cm (Maximum 25.5 cm and Minimum 2.4 cm) with SD of 2.45 cm. Mean thickness of liver was reported to be 10.52cm (Maximum 18.3 and Minimum 3.4) with SD of 1.82 cm. (Table 1)
In the present study, we analysed morphological variations in liver (According to Netter’s classification). No variation was seen in 83 liver specimens (51.9%), while 16 liver specimens (10%) showed each of Type 3 and type 6. 13 liver specimens reported (8.1%) type 5 (Netter’s) variation. 12 specimens (7.7%) showed Type 1 variations, while 7 cases (4.4%) showed type 1 and 6 variations.

In the study conducted by SANGEETA.M et al among 70 livers, 5 livers showed small left lobe with deep costal impressions (Netters Type 1 classification), 3 livers showed atrophy of left lobe (Netters Type 2 classification) 5 livers were transverse saddled like with relatively large left lobe (Netters Type 3), 6 livers showed tongue like projection of left lobe (Netters Type 4). 4 livers showed deep renal impression and corset constriction (Netter Type classification) 5 livers showed deep diaphragmatic grooves (Netters Type 6). 25 livers showed accessory fissures and lobes. 1 liver showed biliary vesicle extending on to diaphragmatic surface. 25 livers showed deep diaphragmatic grooves (Netters Type 6). 25 livers showed accessory fissures and lobes. 1 liver showed biliary vesicle extending on to diaphragmatic surface. 25 livers showed accessory fissures and lobes.

No variation was observed in our study on the liver surface among 11 (6.8%) liver specimens, followed by Diaphragmatic groove on 3 (1.9%) liver surfaces and Fissure on right post surface on 2 (1.2%) liver surfaces. Variations like Fissure on left post surface, Fissure on right border, Fissure on right lobe, Fissure on superior surface, Lobe on left border, Notch on right border were reported on 1 liver specimen for each respectively.

Amongst the variations on inferior border of liver: Notch was found to be the commonest variation among 20 (12.5%) liver specimens, followed by Notch on inferior border among 4 (2.5%), Fissure 2 (1.2%) and Lobe 1 (0.6%) (Table 2).

DISCUSSION
The present study was conducted in the department of anatomy, in 160 liver specimens, with the aim of analyzing various structural and morphological variations in liver according to Netter’s classification system.

Mean weight of the liver was reported to be 1.05 Kg ± 0.34 Kg. Mean breadth of liver was reported to be 18.44 cm ± 2.45 cm. Mean thickness of liver was reported to be 10.52 cm ± 1.82 cm. A similar kind of study was conducted by Nagato, AC et al, they reported that the mean weight ± standard deviation (SD) was 854.7 ± 256.7 g.7 The 70 liver specimens studied by SANGEETA.M et al presented a mean weight of 1.14 ± 0.38, mean height of 129.33±21.73, mean breadth of 174.48±47.90, mean thickness of 80.25 ±/ 25.7

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specimens. Variable size and shape of pons hepatis joining the left lobe with quadrate lobe was seen in 1(1.25%) specimen

CONCLUSIONS

The present study focuses upon the frequent occurrence of morphological variations on the surface of the liver. Knowledge of these types of morphological variations in (surgical anatomy) are very important while operating various cases using laparoscopic techniques or thermal ablation of liver mass, for surgeons and gastroenterologists in planning and performing the surgical procedures, for the radiologists to prevent a possible misdiagnosis and for the anatomists to find out new variants and further research.

REFERENCES


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