

A Morphological Study of Caudate Lobe in Human Cadaveric Liver

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Abstract

The liver is the largest abdominal visceral organ, occupying a substantial portion of the upper abdominal cavity. The liver has four lobes, Caudate lobe is a separate and distinct liver lobe. It is located on liver at the posterior surface. The caudate lobe has two portions joined by a narrow parenchymal bridge that is called the caudate isthmus. Caudate lobe also has its separate blood supply and biliary drainage. The complexity of liver function and its importance in body homeostasis has encouraged this study of morphology and variations of caudate lobe to better the diagnosis and analysis of clinico-pathological conditions. For present study 100 cadaveric livers were obtained. Caudate lobe was studied on various parameters such as shape, size and dimensions. Various measurements were taken and data was analyzed using descriptive statistics and relational statistics. 'Z' test was computed to find out the association between the parameters of the present study and the studies of similar background. It was found that majority of the caudate lobes in all livers are rectangular 67 (67%) in shape followed by pyriform 21 (21%) and irregular 12 (12%) shaped. The average transverse diameter of caudate was measured 28.69 ± 7.73 . The average longitudinal diameter of caudate lobe was measured 54.67 ± 10.73 . A sound knowledge of the normal and variant liver anatomy is a prerequisite to having a favorable surgical outcome and commonly occurring variations assumes even more significance in the era of diagnostic imaging and minimally invasive surgical approaches.

Keywords: Liver, Caudate Lobe, Surgical resection, Harbin's measurements.

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INTRODUCTION

The liver is one of the largest abdominal organs, occupying a large portion of the upper abdominal cavity. It is present in right hypochondria and epigastrium, and extending into left hypochondria as far as left lateral line [1]. The liver has four lobes; gross anatomical appearance of the liver has been divided into the right, left, caudate and quadrate lobes by the surface peritoneal and ligamentous attachments [2]. Various ducts, veins and arteries are present on the surface of the lobes that allow the inflow and outflow of fluids [3]. Caudate lobe is a separate and distinct liver lobe. It is located on the posterior surface of the liver between the groove for inferior vena cava (IVC) to the right and fissure for Ligamentum venosum to the left and on the anterior side of porta hepatis. The caudate lobe has two portions joined by a narrow parenchymal bridge called the caudate isthmus. This lobe also has separate blood supply and biliary drainage [4].

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 [5]. The complexity of liver function and its importance in body homeostasis has encouraged many anatomists to study the morphological features of the organ in considerable detail [6]. For the surgeons it is of paramount importance to have clear knowledge of the structure of the normal organ and its variations during the period of growth and ageing.

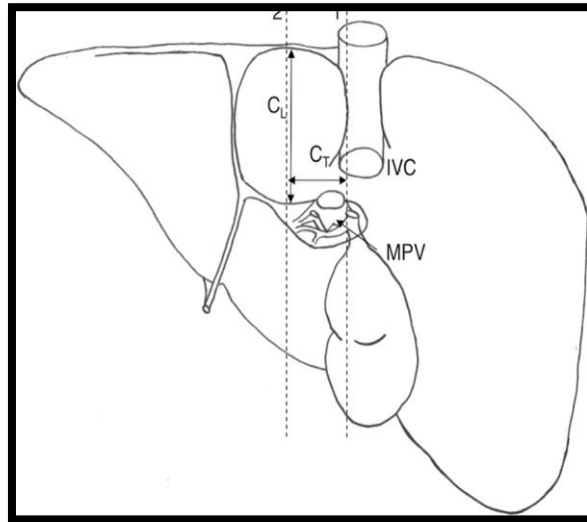
MATERIAL & METHODS

The study was conducted on 100 cadaveric livers obtained from the Department of Anatomy, Baroda Medical College, Gujarat, India. Any liver from cadavers with previous history or appearance of cirrhosis, metastatic disease or other liver pathology and any cadavers with previous history of or an appearance suggestive of any trauma disease or abdominal surgery were excluded from the study. The approval was obtained from the Institutional Ethics Committee for Human research, Medical College Baroda, Gujarat prior to the commencement of the study. The liver specimens collected were allotted numbers from 1 to 100. The numbering to the specimens were given using synthetic thread and

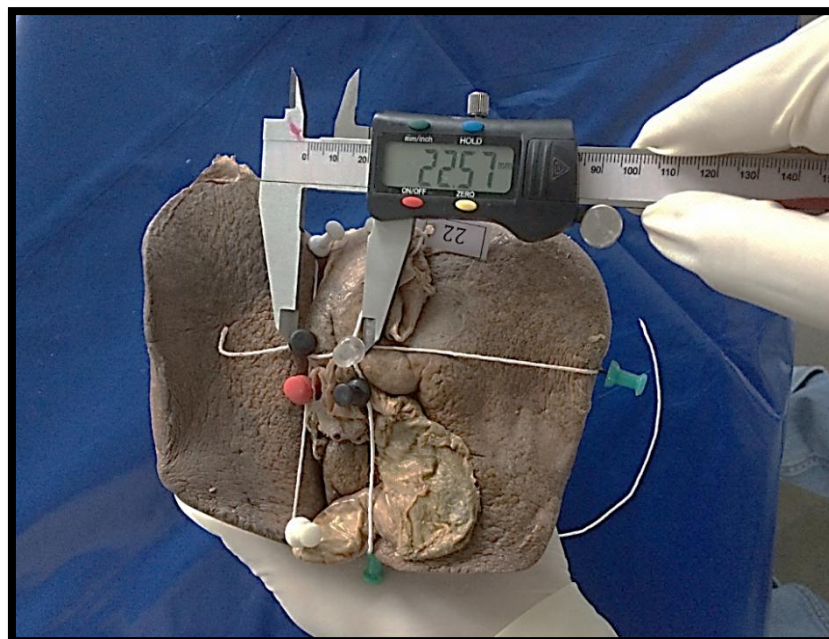
laminated tags. Anatomy of the caudate lobe was studied after defining and cleaning lesser omentum covering its two of the four margins [7].

Each liver was placed in the anatomical position to facilitate visualization of the diaphragmatic and visceral surfaces, and morphometric measurements were performed with the aid of cotton threads and digital Vernier caliper in mm. Each liver was examined on three different occasions by the examiner and the mean of the three readings was derived. A line, L1 is

drawn through the right lateral wall of the main portal vein. Another line, L2 was drawn parallel to L1 at the most medial aspect of the caudate lobe. Another line, L3 was drawn perpendicular to lines 1 and 2, midway between Main Portal Vein and the inferior vena cava, and extended out to the lateral margin of the right lobe. For consistency, in the present study the most medial aspect of the caudate lobe was considered as the medial extent of the transverse diameter of the porta hepatis in all livers [8, 9].



Visceral surface of the liver, demonstrating the greatest longitudinal diameter of the caudate lobe (CL) measured supero-inferiorly. CT transverse diameter of the caudate lobe, IVC Inferior Vena Cava, MPV Main Portal Vein
 CT – Transverse diameter of caudate lobe: Measured from the most medial margin of the caudate lobe to the right lateral wall of the portal vein.
 CL – Longitudinal diameter of caudate lobe: Measured at the level of the greatest longitudinal extension of the caudate lobe.



Transverse diameter of the caudate lobe measured on L3 between L1 and L2

The distinct morphological characteristics observed were recorded on individual data sheets in a form appropriate for posthumous analysis [3].

The data was analyzed using descriptive statistics (frequency, percentage, mean, median, standard deviation, skewness and kurtosis) and relational statistics i.e. 'Z' test. Z' test was computed to find out the association between the parameters of the present study and the studies of similar background [10].

OBSERVATIONS AND RESULTS

In the present study, a total of 100 embalmed human livers evacuated were studied, 18 livers (18%) were normal in their external appearance. However, 82 (82%) specimens showed anomalies in lobes, fissures, shape and size of lobe. On examining the caudate lobe it was found that majority of the caudate lobes in all the livers are rectangular 67 (67%) in shape followed by pyriform 21 (21%) and irregular 12 (12%) shaped.

Table-1: Shape of Caudate lobe

Shape of Caudate lobe		
Type of Shape	No. of Liver specimen	Percentage %
Rectangular	67	67
Pyriform	21	21
Irregular	12	12

The average transverse diameter of caudate was measured 28.69 ± 7.73 , while the values ranged between 14.68–50.81. The mean is more than median and $S^3 > 0$, which indicate positively skewed distribution of data because observations tend to concentrate more at the lower end of the possible values. The distribution is more spread out than normal as kurtosis is less than 3 (platykurtic). The average

longitudinal diameter of caudate lobe was measured 54.67 ± 10.73 and the values ranged between 35.41–74.24. The mean is less than median and $S^3 < 0$, which indicate negatively skewed distribution of data because observations tend to concentrate more at the higher end of the possible values. The distribution is more spread out than normal as kurtosis is less than 3 (platykurtic).

Table-2: Morphology of caudate lobe

Parameter	Mean (SD)	Median	Skewness (S ³)	Kurtosis (S ⁴)
Transverse Diameter (CT)	28.69 (7.73)	27.97	0.75	0.15
Longitudinal Diameter (CL)	54.97 (10.73)	56.23	-0.91	-1.07

Table-3: Morphology of Caudate Lobe comparing with other studies

Authors	Present study	Sahni et al., [11]	Ahidjo et al., [12]	Chavan et al., [13]	Arora et al., [14]	Sagoo et al., [15]	Reddy et al., [16]
Sample size	100	138	-	50	36	50	80
Transverse Diameter of caudate lobe	28.69±7.73	32.7± 7.6	34.1± 6.5	25.0	27.0	27.4± 12.2	25.4
Longitudinal diameter of caudate lobe	54.97± 10.73	-	-	81.5	50.3	57.4± 14.1	47.8

DISCUSSION

An attempt was made to find out the variations in the shape and size of caudate lobe to aid into clinical and surgical applications.

The findings of the present study for shape of caudate lobe are 67 (67%) rectangular, 21 (21%) pyriform and 12 (12%) irregular. Sahni et al. studied 200 specimens of liver. They observed that 189 (94.5%) were rectangular, 9 (4.5%) pyriform and 2 (1%) irregular. Sagoo et. al. also studied 50 specimens of liver for Northwestern Indian reported 45 (90%)

rectangular, 03 (6%) pyriform and 02 (4%) irregular shapes of caudate lobe. In the Present study the average transverse diameter of caudate was measured 28.69 ± 7.73 , while the values ranged between 14.68–50.81 and the average longitudinal diameter of caudate lobe was measured 54.67 ± 10.73 and the values ranged between 35.41–74.24. Such measurements were compared with the studies done in the past as shown in Table-3.

CONCLUSION

A sound knowledge of the normal and variations in liver anatomy is a prerequisite to having a

favorable clinical outcome. The commonly occurring anatomical variations in liver have even more significance in the era of diagnostic imaging and minimally invasive surgical approaches. The absence of normal fissures or the presence of additional lobes might lead to confusion on a radiological diagnosis of a liver disorder. The modern era of imaging and minimally invasive liver surgeries have started after the intrahepatic segmentary anatomy was classified. It is very important on the part of both the radiologists and surgeons to have a thorough knowledge of the normal anatomy and the commonly occurring variations of this organ. The success of liver transplantation points towards an increase in liver operations in the future.

Conflict of Interest: None

ABBREVIATIONS

IVC: inferior vena cava
 et.al: Et Alia (and others)
 CT: Transverse diameter of caudate lobe
 CL: Longitudinal diameter of caudate lobe
 SD: Standard deviation

Authors' Contributions

JBC: Concept and design of study, Collection of data, Acquisition of data, analysis & interpretation of data, literature search, BBK: Concept and design of study, analysis & interpretation of data, literature search, drafting the article and final version to be published. VHV: Concept and design of study, Collection of data, Acquisition of data, analysis & interpretation of data, literature search.

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