

Morphology and Morphometric Analysis of the Caudate Lobe of Human Liver in Eastern India- A Cross-sectional Cadaveric Study

TAPATI ROY¹, RITUPARNA BASU²

ABSTRACT

Introduction: The unique feature of caudate lobe of liver is that it has a dual blood supply. Since it is supplied both by branches of portal vein and hepatic artery, it may undergo compensatory hypertrophy in different hepatic diseases like cirrhosis of liver. In addition, excessive localised growth of the liver may be manifested as accessory lobules. Previous studies in different settings had implied an ethnic predisposition affecting the morphology of the liver. All these factors revealed an urgent need for further research regarding the surface variations and morphometry of the caudate lobe.

Aim: To study the morphological variations and morphometric measurements of the caudate lobe of the human liver in eastern India.

Materials and Methods: A descriptive cross-sectional study was undertaken on 51 formalin fixed adult human livers in Department of Anatomy, Medical College, Kolkata, West Bengal, India from March 2021 to September 2021. Vernier calliper was used to measure the Transverse Diameter (TD), Vertical

Diameter (VD) and Anteroposterior Diameter (APD) of caudate lobe. In addition, the TD and APD diameters of Porta hepatis and TD of the right lobe of liver were also measured. Morphological variations were noted. The morphometric measurements and morphological variations of caudate lobe of liver were entered in Excel sheet which were further transported to IBM Statistical Package for Social Sciences software (SPSS) version 12.0 (free version) for further analysis. Morphometric measurements were analysed by using descriptive statistics. Caudate to right lobe (CRL) ratio was calculated manually.

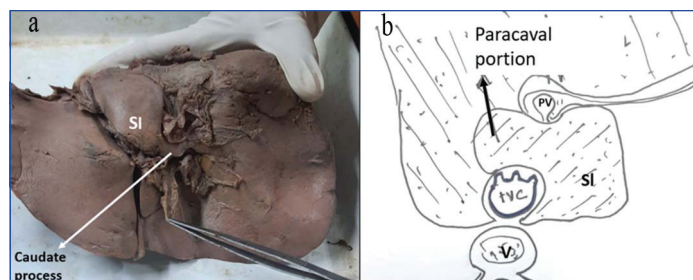
Results: Most common type of shape of caudate lobe was rectangular (37.25%). Mean values (in cm) of TD, VD, APD of caudate lobe were 2.4 ± 0.54 , 4.7 ± 0.75 , 1.9 ± 0.51 , respectively. The value of mean CRL (caudate to right lobe) ratio was 0.30.

Conclusion: A detailed anatomical knowledge of the caudate lobe would be helpful to the surgeon to suitably plan hepatic resections and may also guide the radiologist regarding correct interpretation of imaging technique.

Keywords: Couinaud's segment I, Measurements, Surface variations

INTRODUCTION

The caudate lobe or Couinaud's segment I is that segment of the liver which is bounded by the fissure for ligamentum venosum and groove for inferior vena cava on each side and the porta hepatis inferiorly [1]. As shown in [Table/Fig-1], it consists of two parts when viewed from the visceral surface, namely, the Spiegel's lobe and the paracaval portion bridged by the caudate isthmus [2]. It is a unique well-defined anatomical segment of the liver as it is supplied by both the branches of portal vein as well as the hepatic artery and hence, may be differently affected in pathologies of the liver such as liver cirrhosis [1].



[Table/Fig-1]: a) Shows Spiegel's lobe, caudate process in liver; b) Shows cross-section at the level of L1 vertebra depicting Spiegel's lobe and paracaval portion.
[†]SI: Spiegel's lobe; IVC: Inferior vena cava; PV: Portal vein; V: Vertebra

Literature review revealed the application of this anatomical fact in the diagnosis of cirrhosis of liver, where the CRL was measured and CRL ratio ≥ 0.65 was taken as a reliable indicator of liver cirrhosis [3-6]. Hence, there have been extensive morphometric studies aimed at determination of one or more diameters of the

caudate lobe and right lobe [3-5]. In addition, it has been observed that developmental defects affecting the morphology of the right and left lobes of the liver may give rise to pathologies like gastric volvulus and portal hypertension. Also, excessive development of the liver may occur in the form of accessory lobes. On the other hand, there may be agenesis or hypoplasia of lobes or absence of liver segments [6].

Therefore, it is highly important to have a thorough knowledge of the morphological variations of liver, especially its caudate lobe. However, in spite of extensive research being conducted regarding the segmentation of liver, studies of the surface variations of caudate lobe, especially in eastern India are sparse [3-6]. This is particularly relevant because a previous study of the caudate lobe carried out on the Caribbean population implied an ethnic predisposition affecting its morphology [2].

A detailed morphological and morphometric study of the caudate lobe would not only enlighten the knowledge of anatomists to facilitate anatomical teaching but also the surgeon, radiologist and clinician during diagnosis and treatment of liver diseases. Although there have been many previous studies which have observed variations in the morphology and morphometric measurements of the caudate lobe, on repeated search, no such study was found to have been based in eastern India [7-9]. Hence, the aim of the current research was to study the detailed morphology and morphometry of caudate lobe of liver specimens at tertiary medical college of eastern India. In addition, TD and APD of porta hepatis and TD of right lobe were also determined.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted on 51 formalin fixed adult liver specimens from Department of Anatomy, Medical College, Kolkata, West Bengal, India during the period between March 2021 to September 2021. Institutional Ethical Clearance as well as permission from competent authority (Ref no. MC/KOL/IEC/NON-SPON/1181/08/2021 dated 25/08/2021) was obtained before conduction of the study.

Inclusion criteria: Only well-preserved adult human livers were selected for the study.

Exclusion criteria: Diseased, surgically resected liver specimens, or those whose shape was distorted during preservation and storage or due to traumatic injury were excluded.

Sample size calculation: Assuming the population standard deviation 6.8, 95% level of confidence with margin of error 2, this study would require estimated sample size of 48 [10]. However, over a period of seven months (March 2021 to September 2021), 51 well-preserved liver specimens were collected to conduct the study.

Study Procedure

The variables of morphometric measurements under study were Transverse Diameter (TD), Anteroposterior Diameters (APD) and Vertical Diameter (VD) of caudate lobe, TD and APD of porta hepatis and TD of right lobe of liver. For determination of these morphometric measurements of caudate lobe, the method used by H.Ibrahim was adopted for the present study [8]. Before taking all measurements, portal vein and its bifurcation as well as the entire region under study was carefully dissected and cleared to determine the important anatomical landmarks. Vernier callipers, pins and cotton thread were used to measure all the parameters of liver. For each measurement, three observations were made, and their average was taken to minimise subjective error.

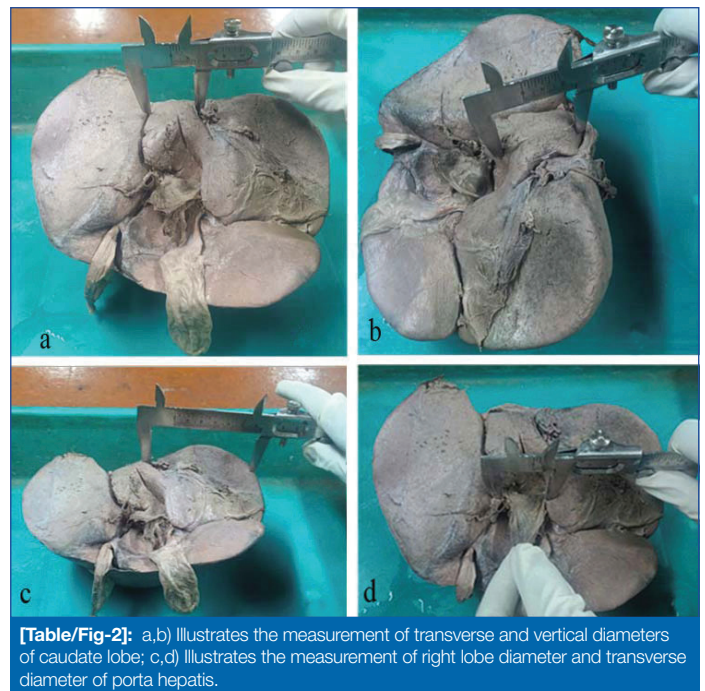
Transverse diameter: To determine the transverse diameter of caudate lobe, midpoint of hepatic part of Inferior Vena Cava (IVC) was taken as a reference point and same reference point was used to determine the TD of right lobe of liver. These two transverse diameters were used to calculate CRL. TD was measured as the distance between mid-point of fissure for ligamentum venosum to mid-point of hepatic part of IVC.

Vertical diameter: The VD was measured between mid-point of inferior border of caudate lobe to mid-point of its upper border [9].

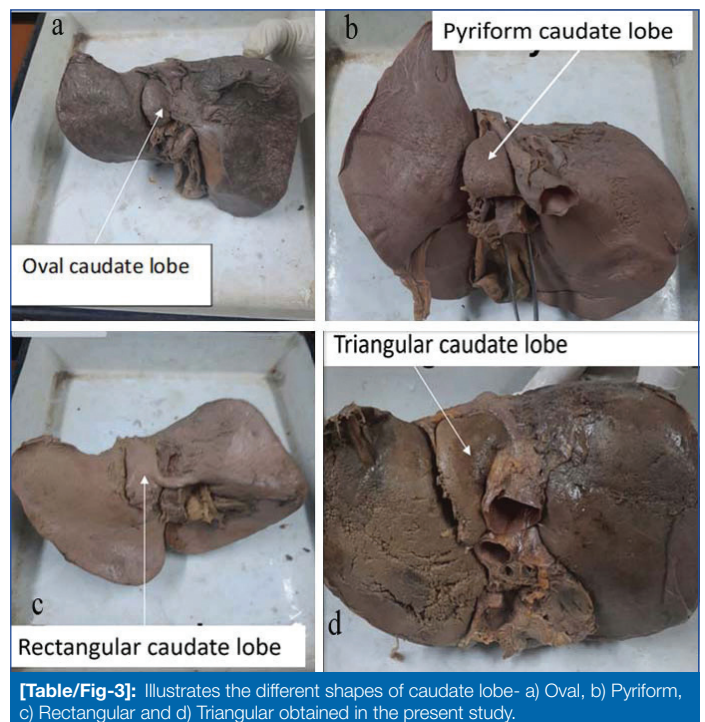
Anteroposterior diameter: The APD of caudate lobe was measured as the distance between right lateral margin of portal vein trunk at the bifurcation to its posterior most projection from liver [9]. [Table/Fig-2a,2b] illustrates the measurement of transverse and vertical diameters of caudate lobe, whereas [Table/Fig-2c,2d] shows the measurement of right lobe diameter and transverse diameter of porta hepatis.

Porta hepatis: As elaborated in the study by Sagoo MG et al., [11] the axis of measurement passing through the portal venous trunk before its bifurcation was considered for measurement of the greatest vertical diameter of porta hepatis. In addition, in order to determine the greatest TD of porta hepatis, the axis of measurement was also taken at the level of the main portal vein just before its bifurcation. The medial limit of the TD of porta hepatis was taken to correspond with most medial aspect of the caudate lobe.

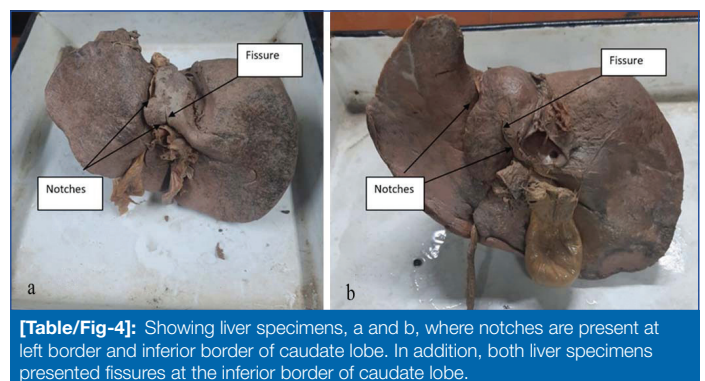
The study also included variations in morphology of caudate lobe with regard to its shape, shape of its caudate and papillary processes and presence/absence of fissures, notches. Variations in shapes of caudate lobe in the form of rectangular, pyriform, triangular, oval [Table/Fig-3a-3d] as revealed by previous studies [6,12-16] were noted in this study also. In addition, presence of caudate notch [Table/Fig-4a,4b] and a caudate fissure [Table/Fig-5a-5d] as mentioned by Auh YH et al., [15] were noted in this study.



[Table/Fig-2]: a,b) Illustrates the measurement of transverse and vertical diameters of caudate lobe; c,d) Illustrates the measurement of right lobe diameter and transverse diameter of porta hepatis.



[Table/Fig-3]: Illustrates the different shapes of caudate lobe- a) Oval, b) Pyriform, c) Rectangular and d) Triangular obtained in the present study.

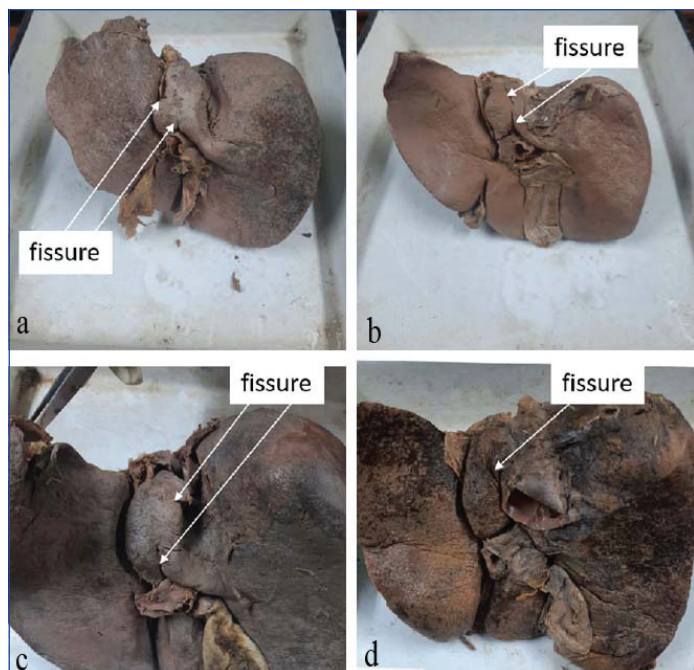


[Table/Fig-4]: Showing liver specimens, a and b, where notches are present at left border and inferior border of caudate lobe. In addition, both liver specimens presented fissures at the inferior border of caudate lobe.

After observation of morphological variations of caudate lobe of liver and determination of morphometric measurement of study variables, the results were tabulated and analysed.

STATISTICAL ANALYSIS

All the study variables were entered in excel sheet which were further transported to IBM SPSS software version 12.0 (free version) for



[Table/Fig-5]: Shows liver fissures- a) shows fissure at the inferior border; b) shows fissures extending from inferior and superior borders; c) shows presence of fissures at the inferior and right borders and d) shows presence of fissure at the right border.

further analysis. CRL ratio was calculated manually. Morphometric measurements were analysed by using descriptive statistics.

RESULTS

On examination of the morphology of 51 liver specimens, most common shape of caudate lobe was found to be rectangular 19 (37.25 %) and other shapes were triangular 5 (9.80%), pyriform 17 (33.33%), oval (7.84%), wedge shaped (11.76%) [Table/Fig-6]. [Table/Fig-3] illustrates the different shapes of caudate lobe obtained in the present study.

Shape of caudate lobe	Number (n)	Percentage (%)
Rectangular	19	37.25%
Triangular	5	9.80%
Pyriform	17	33.33%
Oval and wedge shaped	10	19.60%

[Table/Fig-6]: Variations of shapes of caudate lobe.

Notches and fissures were present in 9.8% and 23.52% cases, respectively [Table/Fig-7]. [Table/Fig-4] shows two liver specimens, A and B, where notches were found at left border and inferior border of caudate lobe, respectively. In addition, both liver specimens presented fissures at the inferior border of caudate lobe. Also, [Table/Fig-5a-5d] shows fissure at the inferior border, fissures extending from inferior and superior borders of liver, fissures at the inferior and right borders and presence of fissure at the right border, respectively.

Caudate lobe	Present n (%)	Absent n (%)	Special features n (%)
Notch	5 (9.8%)	46 (90.19%)	1 (1.96%)
Fissure	16 (31.37%)	35 (68.62%)	4 (7.84%)

[Table/Fig-7]: Presence/absence of notch and fissure in caudate lobe. n=Number of liver samples

Variations of papillary process were also observed in present study. Most common variety of shape was rounded 17 (33.33%) and least common was conical 1 (1.96%). Other variations in shape of papillary process were tongue shaped 9 (17.64%) and pointed 13 (25.49%). Papillary process was absent in 11 (21.56%) cases [Table/Fig-8].

Shape of papillary process	Number (n)	Percentage (%)
Rounded	17	33.33%
Conical	1	1.96%
Tongue	9	17.64%
Pointed	13	25.49%
Absent	11	21.56%

[Table/Fig-8]: Variations in shape of papillary process.

Present study also noted differences in shapes of caudate process. Elongated shape 31 (60.78%) was the most common type and tongue shape 1 (1.96%) was the least common type. Other shapes were pointed 11 (21.56%) and rounded 7 (13.72%). Caudate process was absent in 1 (1.96%) case [Table/Fig-9].

Shape of caudate process	Number (n)	Percentage (%)
Elongated	31	60.78%
Rounded	7	13.72%
Pointed	11	21.56%
Tongue	1	1.96%
Process absent	1	1.96%

[Table/Fig-9]: Variations of shape in caudate process.

Regarding morphometric measurements, the mean values (in cm) of following variables were observed: TD of caudate lobe 2.45±0.54, VD of caudate lobe 4.7±0.75, APD of caudate lobe 1.9±0.51, TD of right lobe of liver 8.1±0.93, TD of porta hepatis -3.2±0.44, APD of porta hepatis 1.8±0.42. Range of above mentioned variables were as follows- 1.55-3.91, 3.3-5.9, 1-2.9, 5.93-9.96, 2.26-4.04 and 0.89-2.74, respectively [Table/Fig-10].

The value of mean CRL ratio was calculated to be 0.30.

Parameters	Mean (cm)	Range (cm)	Mean CRL ratio
Caudate lobe			
Transverse diameter	2.45±0.54	1.55-3.91	0.30
Vertical diameter	4.7±0.75	3.3-5.9	
Anteroposterior diameter	1.9±0.51	1-2.9	
Transverse diameter of right lobe of liver	8.1±0.93	5.93-9.96	
Porta hepatis			
Transverse diameter	3.2±0.44	2.26-4.04	
Anteroposterior diameter	1.8±0.42	0.89-2.74	

[Table/Fig-10]: Morphometric measurement of liver (N=51). CRL ratio- caudate to right lobe ratio

DISCUSSION

The caudate lobe is an exclusive part of the liver which is supplied both by branches of hepatic artery and portal vein. Because of this special feature, it is distinctly affected in diseases of liver [11]. In fact, there are many pathologies like Budd Chiari syndrome and liver cirrhosis where the caudate lobe of the liver may undergo compensatory hypertrophy [17,18]. Although there are many advanced diagnostic imaging techniques which are available, nevertheless cadaveric studies for evaluation of liver are still held in high esteem [19,20]. Previous studies have revealed morphological variations of the caudate lobe with respect to its shape, its caudate and papillary processes and presence of notches and/or fissures as well as variations in its morphometric measurements [8,9].

Kogure K et al., noted notches in 50% of caudate lobes in patients undergoing hepatectomy [13]. In the study carried out by Joshi SD et al., [21], 18% of livers examined revealed notching along inferior border of caudate lobe and in 30% of livers, vertical fissures were noted. In addition, accessory fissures were found which were more common in the right lobe. In the study by Patil S et al., [6] also, accessory fissures were found in right lobe, quadrate lobe and

caudate lobe. As compared to these studies, in the present study, notching was seen along inferior border in five liver specimens (9.8%) whereas one liver specimen showed notching at left border of caudate lobe. Presence of fissures in the caudate lobe were documented at inferior border in 23.52% liver specimens while four liver specimens showed presence of fissures at left border, extending obliquely above and below.

Chavan NN and Wabale RN et al., [12] observed absence of papillary process in their entire study population, whereas Sahni D et al., [14] reported papillary process in 33.5%. Auh YH et al., [15] found that on Computed Tomography (CT), papillary process sometimes can be mistaken as enlarged porta hepatis. Enlarged papillary process can displace gastric antrum and duodenum anteriorly mimicking right-sided retroperitoneal mass. In their study, Sarala HS et al., [7] found prominent papillary process in 21% of the livers while Joshi SD et al., [21] also found prominent papillary process in 32% of the livers in their study. In the present study, with the exception of 21.56% liver specimens, all other liver specimens presented with a papillary process. Most common shape of papillary process was found to be round shape (33.33%) and least common shape was conical (1.96%).

Variations of shape of caudate lobe in the form of rectangular, triangular, square, inverted flask shaped, oval and pear shaped was seen by Chavan NN and Wabale RN, [12] in their study. The most common shape observed by Ibrahim H [8]. in his study was rectangular. One case of dumbbell-shaped caudate lobe was found by Mamatha Y et al., [22] as also in Nayak SB et al., study [23]. Joshi SD et al., [21] reported 58% rectangular, 20% bicornuate, and an assortment of pear shaped, quadrangle, oblong, heart shaped, square, and inverted pear-shaped caudate lobes in the remaining 22% of liver specimens in their study. Rectangular, pyriform and irregular shaped caudate lobes were seen in the study by Sagoo MG et al., [11] also. Rectangular shape (46%), columnar or elongated caudate lobes and triangular caudate lobes in equal proportion (16%) and dumbbell-shaped lobes were observed in 14% liver specimens studied by Syamala G et al., [10]. In the present study also, we found five different shapes of caudate lobes, namely, rectangular, pyriform, triangular, oval and wedge shaped. Most common shape of caudate lobe observed was rectangular (37.25 %) followed by pyriform shape (33.33%). Elongated shape of caudate process was the most common type (60.78%). Thus, findings of the morphological variations of the liver in the present study are congruent to previous studies [10,11,12,24].

Regarding morphometric measurement of the liver specimens in the present study, we noted that the mean values in cm of TD, VD and APD of caudate lobe were 2.45, 4.6, and 1.9, respectively. Chavan NN and Wabale RN [12] observed TD to be 2.5 cm which was almost similar to present study. The CRL ratio (mean) of our study was 0.30. This ratio was slightly lower than that found by Gardner MT et al., [2] in their study where they documented the mean CRL ratio to be 0.34. Arora NK et al., [16] noted a CRL ratio of 0.36 which was higher than the present study. Syamala G et al., [10] have measured 50 formalin fixed adult liver in south Indian population where they found the mean CRL ratio to be 0.17 which is lower than the present study. This regional variation might be due to small sample size. Further evaluation is required to obtain the exact knowledge of regional variation among Indian population. In their study, Ilione T et al., [25] suggested the use of CRL ratio as a trusted parameter for the diagnosis of liver cirrhosis even in the early asymptomatic stages. Literature review revealed many studies where this ratio ($CRL \geq 0.65$) was utilised to diagnose cirrhosis of liver [2,15,23,24,25]. In their study, Syamala G et al., [10] mentioned that cirrhotic livers may show ratio over 0.65 and noted that the mean length and breadth of the caudate lobes they examined were 5.3 cm and 2.58 cm, respectively. Although these values were more than the present study but mean breadth (7.39 cm) for right lobe

of their study was less than the present study. Ibrahim H [8] stated in his study that CRL ratio was 0.30 which was exactly similar to the present study. But mean values of other parameters like VT (57.45 ± 4.74 mm), TD (27.49 ± 2.82 mm) and diameter of right lobe (90.58 ± 7.76 mm) were slightly higher than the present study. Findings of the current study were compared with similar studies conducted in other settings and regions [10-12,24] [Table/Fig-11].

Parameters	Present study (West Bengal, 2021)	Sagoo MG et al., [11] (Punjab, 2018)	Jaikumar BC et al., [24] (Gujarat, 2019)	Chavan NN, Wabale RN [12] (Maharashtra, 2014)	Syamala G et al., [10] (Andhra Pradesh, 2019)
Sample size	51	50	100	50	50
Mean TD, (Caudate lobe)	2.45 cm (1.55-3.91)	2.74 cm	28.69 ± 7.73	3.4 cm (2.5-4.2)	2.58 cm (1.5-4.5)
Mean VD (Caudate lobe)	4.6 cm (3.3-5.9)	5.74 cm	54.97 ± 10.73	6 cm (4-9.3)	5.3 cm (3.3-8)
Mean APD (Caudate lobe)	1.9 cm (1-2.9)	4.36 cm	-	-	-
CRL ratio	0.30	0.34	-	0.33 (0.28-0.46)	0.17 (0.06-0.41)

[Table/Fig-11]: Comparison of morphometric measurements of caudate lobe of liver obtained in present study with that of different studies from other regions of India [10-12,24].

†TD: Transverse diameter; VD: Vertical diameter; APD: Anteroposterior diameter; CRL ratio: Caudate to right lobe ratio

Limitation(s)

The cadaver samples were predominantly received from the state of West Bengal and limited samples were received from other states of eastern India. This might affect the representation of eastern India. It would be relevant to study with bigger sample size with less margin of error.

CONCLUSION(S)

The present study of caudate lobe of liver in eastern India would enhance the knowledge of the anatomists, radiologists and surgeons regarding its probable morphological and morphometric variations in this region. In addition, since morphometric measurements revealed certain points of similarities as well as differences with other similar studies conducted in different regions and settings, it is recommended that observations of the regional variations of morphometric measurements should further be analysed by extensive studies and meta-analysis in order to obtain a standardised national value.

Acknowledgement

The authors would like to extend their heartfelt thanks to the Head of Department of Anatomy, Medical College, Kolkata, for his support during conduction of their research and acknowledge their deep gratitude to all the persons whose body donations made the research possible.

REFERENCES

- [1] Standring S. Gray's Anatomy. 41st edition. Philadelphia: Elsevier-Churchill Livingstone. 2016; pp. 1162-64.
- [2] Gardner MT, Cawich SO, Zheng Y, Shetty R, Gardner DE, Naraynsingh V, et al. Morphology of the caudate lobe of the liver in a Caribbean population. Italian Journal of Anatomy and Embryology. 2019;124(3):364-76.
- [3] Harbin WP, Robert NJ, Ferrucci JT. Diagnosis of cirrhosis based on regional changes in hepatic morphology: A radiological and pathological analysis. Radiology. 1980;135(2):273-83. Doi: 10.1148/radiology.135.2.7367613.
- [4] Hess CF, Schmiedl U, Koelbel G, Knecht R, Kurtz B. Diagnosis of liver cirrhosis with US: Receiver-operating characteristic analysis of multidimensional caudate lobe indexes. Radiology. 1989;171(2):349-51. Doi: 10.1148/radiology.171.2.2649915.
- [5] Giorgio A, Amoroso P, Lettieri G, Fico P, de Stefano G, Finelli L, et al. Cirrhosis: Value of caudate to right lobe ratio in diagnosis with US. Radiology. 1986;161(2):443-45. Doi: 10.1148/radiology.161.2.3532188.
- [6] Patil S, Sethi M, Kakar S. Morphological study of human liver and its surgical importance. Int J Anat Res. 2014;2(2):310-14.

- [7] Sarala HS, Jyothilakshmi TK, Shubha R. Morphological variations of caudate lobe of the liver and their clinical implications. *Int J Anat Res.* 2015;3(2):980-83.
- [8] Ibrahim H. Morphological variations and measurements of the caudate lobe of the human liver: A cadaveric study. *The Medical Journal of Cairo University.* 2020;88(1):155-60.
- [9] Webb M, Yeshua H, Zelber-Sagi S, Santo E, Brazowski E, Halpern Z, et al. Diagnostic value of a computerized hepatorenal index for sonographic quantification of liver steatosis. *AJR Am J Roentgenol.* 2009;192(4):909-14. Doi: 10.2214/AJR.07.4016.
- [10] Syamala G, Veernala P, Shravya EC. A Descriptive study of morphology of caudate lobe of liver in adult human cadavers in Siddhartha Medical College, Vijayawada. *IOSR-JDMS.* 2019;18(8):48-53. Doi: 10.9790/0853-1808124853.
- [11] Sagoo MG, Aland RC, Gosden E. Morphology and morphometric of the caudate lobe of the liver in two populations. *Anat Sci Int.* 2018;93(1):48-57. <https://doi.org/10.1007/s12565-016-0365-67>.
- [12] Chavan NN, Wabale RN. Morphological study of caudate lobe of liver. *Indian J Basic Appl Med Res.* 2014;3(3):204-11.
- [13] Kogure K, Kuwano H, Fujimaki N, Makuuchi M. Relation among portal segmentation, proper hepatic vein, and external notch of the caudate lobe in the human liver. *Ann Surg.* 2000;231(2):223.
- [14] Sahni D, Jit I, Sodhi L. Weight and surface area of the liver in northwest Indian adults. *J Anat Soc India.* 1997;46:67-76.
- [15] Auh YH, Rosen A, Rubenstein WA, Engel IA, Whalen JP, Kazam E. CT of the papillary process of the caudate lobe of the liver. *AJR Am J Roentgenol.* 1984;142(3):535-38. Doi: 10.2214/ajr.142.3.535.
- [16] Arora NK, Srivastava S, Haque M, Khan AZ, Singh K. Morphometric study of caudate lobe of liver. *Ann Int Med Dent Res.* 2016;2(1):275-79.
- [17] Filippini F, Romagnoli P, Mosca F, Couinaud C. The dorsal sector of human liver: Embryological, anatomical and clinical relevance. *Hepatogastroenterology.* 2000;47(36):1726-31.
- [18] Mullane JF, Gliedman ML. Elevation of the pressure in the abdominal inferior vena cava as a cause of a hepatorenal syndrome in cirrhosis. *Surgery.* 1966;59(6):1135-46.
- [19] Meirelles GD, Tiferes DA, D'ippolito G. Pseudolesões hepáticas na ressonância magnética: Ensaio iconográfico. *Radiologia Brasileira.* 2003;36(5):305-09.
- [20] Nagato A, Silva MA, Trajano ET, Alves JN, Bandeira ACB, Ferreira TA, et al. Quantitative and morphological analyses of different types of human liver. *J Morphol Sci.* 2011;28(4):275-279.
- [21] Joshi SD, Joshi SS, Athavale SA. Some interesting observations on the surface features of the liver and their clinical implications. *Singapore Med J.* 2009;50(7):715.
- [22] Mamatha Y, Murthy CK, Prakash BS. Study on morphological surface *Int J Health Sci Res.* 2014;4(11):97-102.
- [23] Nayak Satheesha B, Reghunathan D, George BM, Mishra S. Accessory lobe of liver associated with a "bean shaped" gall bladder. *Kathmandu Univ Med J (KUMJ).* 2016;14(55):292-93.
- [24] Jaikumar BC, Bhavin BK, Vaniya VH. A morphological study of caudate lobe in human cadaveric liver. *Sch Int J Anat Physiol.* 2019;2(3):128-31.
- [25] Ilione T, Ohagwu CC, Ogolodo MP. Computed tomography evaluation of the caudate-to-right lobe ratio in patients with liver cirrhosis and subjects with normal liver in Benin City, Edo State, Nigeria. *Health Science Journal.* 2019;13(5):672. Doi: 10.36648/1791-809X.13.5.672.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Anatomy, Medical College, Kolkata, West Bengal, India.
2. Associate Professor, Department of Anatomy, Medical College, Kolkata, West Bengal, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Rituparna Basu,
142, Bagmari Road, Flat No. 3, Mass Cooperative Housing Society Ltd,
Kolkata-700054, West Bengal, India.
E-mail: rituparnabasu2016@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Mar 01, 2022
- Manual Googling: May 09, 2022
- iThenticate Software: Jun 23, 2022 (6%)

ETYMOLOGY: Author Origin**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **Feb 23, 2022**Date of Peer Review: **Mar 12, 2022**Date of Acceptance: **May 10, 2022**Date of Publishing: **Oct 01, 2022**