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# Morphological variations of the caudate lobe of the liver in the Department of Anatomy, JNIMS, Manipur.

Soram M[1],Gurumayum T[2],KaramR[3], Thounaojam K[4], Pfoze AK[5], Huidrom R[6], Remei E[7], Yaikhom M[8], Laishram B[9], Ningombam T[10]

*[1]Post graduate trainee,[2]Assistant Professor, [3]Associate Professor,[4]Associate Professor[5]Professor and HOD, [6]Associate Professor,[7]*Demonstrator, *[8]Post graduate trainee, [9]Post graduate trainee, [10]Post graduate trainee*
*Department of Anatomy, Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Imphal, Manipur, India.*
*Corresponding author: *Dr. Soram Malasana Devi*

***Abstract***
***Background:*** *Knowledge of variations in the external morphology of liver is essential during radiological investigationsand surgeries.*
***Objective:*** *The objective of the study is to estimate the morphological variations of caudate lobe of liver.*
***Materials& Methods:*** *For the present study, 50 formalin fixed adult cadaveric livers of unknown age and sex were obtained from Department of Anatomy, JNIMS, Imphal, Manipur. Liver specimens which werecut and distorted during dissection were excluded. The caudate lobe of the liver specimens were studied and their shapes (whether it was rectangular, pear, triangular and irregular)were recorded and photographed. Further inspection and observation was done to ascertain whether there were presence of prominent caudate processes, papillary processes and vertical accessory fissure in the study specimens. When prominent processes and vertical accessory fissure were present, they were recorded and photographed. Percentage incidence of the different shapes of caudate lobe, prominent caudate processes, papillary processes andvertical accessory fissure were calculated.*
***Results:*** *Rectangular shaped caudate processes were seen in 44%, pear shaped in 24%, triangular in 8% and irregular in 24% of the total specimens. Vertical fissure extending upwards from the lower border was seen in 12% of the total specimens. Prominent papillary process was seen in 14% of the total specimens. Prominent caudate process was seen in 10% of the total specimens. In one of the specimens (2%), the papillary process was separated by a deep oblique parasagittal fissure.*
***Conclusion:*** *Incidence of morphological variations of caudate lobe as obtained from the study is high. The papillaryprocess of caudate lobe is a potential source of pitfalls in interpretation of CT images. Knowledge of these variations is important for radiologists to achieve correct diagnosis and for surgeons to plan for surgery and to achieve good surgical outcome.*

***Keywords:*** *Caudate lobe, caudate process, papillary process, accessory fissure.*

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## I. Introduction

The caudate lobe is a prominence on the posterior surface, bounded on the leftby the fissure for theligamentum venosum, below by the porta hepatis and to its right is the groove for the inferior vena cava. Above, it continues into the superior surface on the right of the upper end of the fissure for the ligamentum venosum. Below and to the right, it is connected to the right lobe by a narrow caudate process, which is immediately behind the porta hepatis and above the epiploic foramen. Below and to the left, the caudate lobe has a small rounded papillary process[1].The caudate lobewas so-named not because it is caudal in position (it is not) but because it often gives rise to a "tail" in the form of an elongated papillary process. The caudate lobe may in fact be considered a third liver; its vascularization is independent of the bifurcation of the portal triad (it receives vessels from both bundles) and is drained by one or two small hepatic veins, which enter directly into the IVC distal to the main hepatic veins[2].

A normal-sized or small papillary process on computed tomography may be mistaken for enlarged portahepatis nodes. When enlarged papillary process extends on to left side it can mimic pancreatic body mass[3]. Normal-sized papillary processes which extend anterior and to the left are easily mistaken for enlarged nodes, particularly if they appear separately from the caudate lobe on inferior CT sections. A rudimentary papillary process may mimic lymphadenopathy, a liver nodule or an extrahepatic lesion[4].

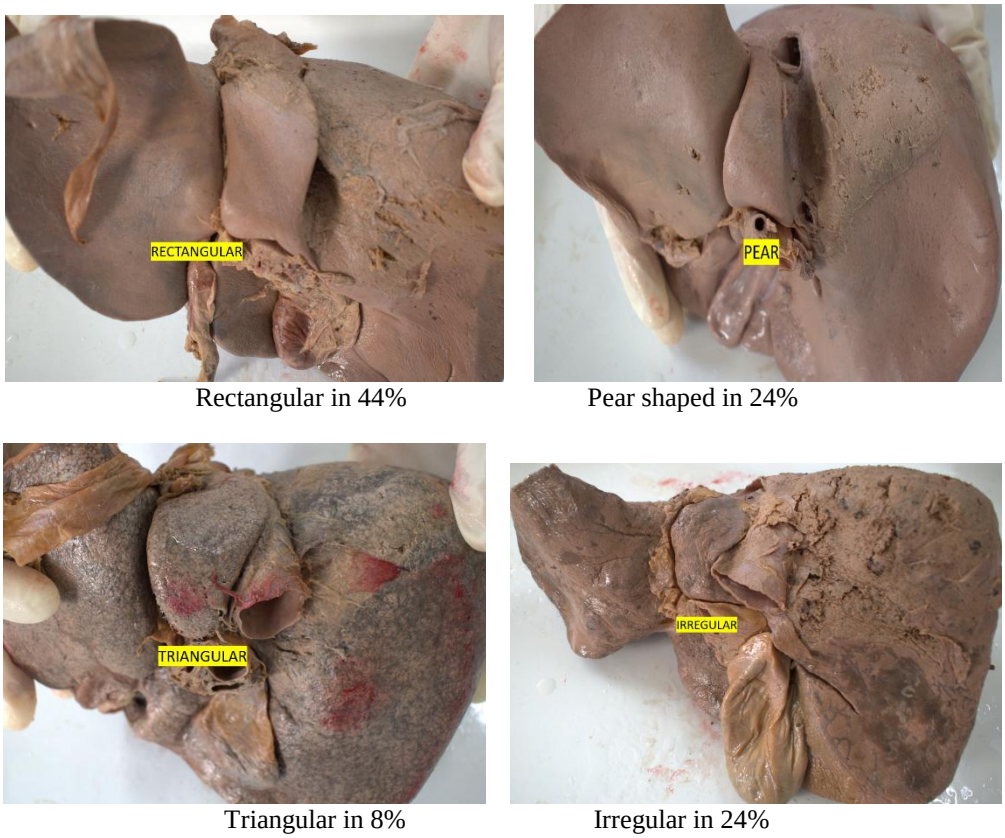
Prevalence of morphological variations of caudate lobe of the liver is high. Knowledge of these variations is important to radiologists and surgeons.Considering high prevalence of variations and its clinical importance, the present study was conducted to estimate the prevalence of morphological variations of caudate lobe of the liver in the Department of Anatomy, JNIMS, Manipur.

## II. Materials And Methods

Formalin fixed 50 adult cadaveric livers of unknown age and sex in the Department of Anatomy, JNIMS, Imphal, Manipur.Liver specimens with gross anomalies,torn or lacerated liver specimens during routine dissections were excluded from the study. The livers were then inspected for the study of shapes of caudate lobe and presence or absence of prominent:a)Caudate process, b)Papillary process and c)Vertical accessory fissure. Photographs were taken.The percentage of incidence of the different shapes of above mentioned of caudate lobe, prominent caudate processes, papillary processes and vertical accessory fissure were calculated.

## III. Results And Observations

Various shapes of the caudate lobe were observed (shown in fig.1). It was rectangular in 44%, pear shaped in 24%, triangular in 8% and irregular in 24%. Vertical accessory fissure extending upwards from lower border was seen in 12% (shown in fig.2). Prominent papillary process was seen in 14%( shown in fig.3). Prominent caudate process was seen in 10%(shown in fig.4).A completely separated papillary process was seen in 4% (shown in fig.5).




Rectangular in 44% Pear shaped in 24%

Triangular in 8% Irregular in 24%

**Fig.1. Various shapes of the caudate lobe**

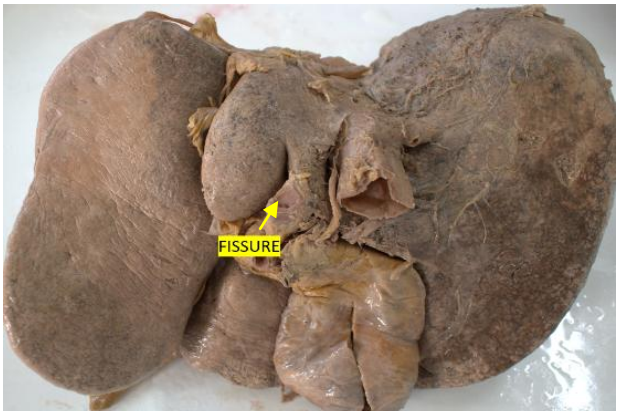
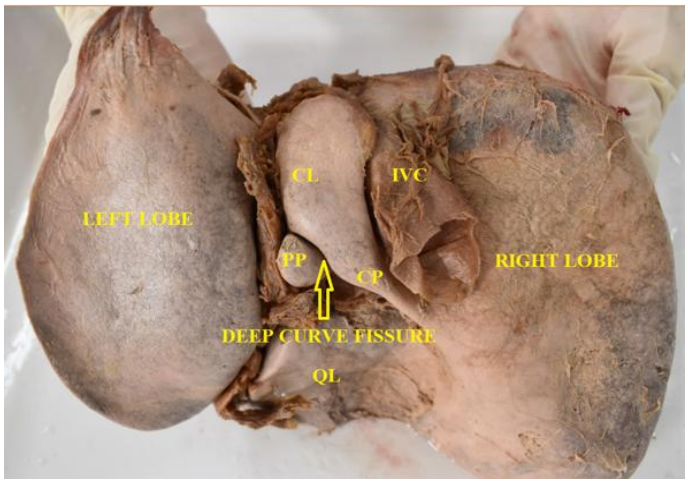



**Fig.2. Vertical accessory fissure 12%**


**Fig.3.Prominent papillary process(PP) 14%**


**Fig.4. Prominent caudate process(CP)10%**




**CL: Caudate lobe**

**QL: Quadrate lobe**

**PP: Papillary process**

**CP: Caudate process**

**IVC: Inferior vena cava**

**Fig.5. A completely separated papillary process 4%**

## IV. Discussion

| Shapes of Caudate lobe | Joshi et al | Sarala HSet al | Abraham J et al | Arora NK et al | Jaikumar BC et al | Ibrahim IH | Seye C et al | Present study |
|---|---|---|---|---|---|---|---|---|
| **Number of livers** | **90** | **100** | **59** | **36** | **100** | **56** | **39** | **50** |
| a.Rectangular | **58%** | **48%** | **57.6%** | **91.66%** | **67%** | **73.21%** | **33.33%** | **44%** |
| b.Pear | **10%** | **18%** | **18.6%** | **-** | **21%** | **-** | **30.77%** | **24%** |
| c.Triangular | **8%** | **12%** | **-** | **5.55%** | **-** | **21.43%** | **23.07%** | **8%** |
| d.Irregular | **20%** | **16%** | **-** | **-** | **12%** | **5.36%** | **7.7%** | **24%** |
| e.Others | **4%** | **6%** | **25.6%** | **2.77%** | **-** | **-** | **5.12%** | **-** |

**Table 1:** Comparison of variation in shapes of caudate lobe with other authors.

| Morphological features | Joshi SD et al | Phad VV et al | Sarala HSet al | Abraham J et al | Singh HR, Rabi S | Ibrahim IH | Seye C et al | Dawani P et al | Kaur J et al | Present study |
|---|---|---|---|---|---|---|---|---|---|---|
| **1.Number of livers** | **90** | **80** | **50** | **59** | **70** | **56** | **39** | **50** | **32** | **50** |
| **2. Accessory fissure (vertical)** | **30%** | **2.5%** | **30%** | **5.1%** | **27.14%** | **26.79%** | **46%** | **12%** | **37.5%** | **12%** |
| **3.Prominent papillary process** | **32%** | **5%** | **21%** | **1.81%** | **4.29%** | **42.86%** | **38.46%** | **12%** | **-** | **14%** |
| **4.Prominent caudate process** | **-** | **10%** | **9%** | **-** | **2.86%** | **-** | **-** | **-** | **3.125** | **10%** |
| **5.Completely separated papillary process** | **-** | **2.5%** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **4%** |

**Table 2:** Comparison of variations in accessory fissure and processes of caudate lobe with other authors.

Various shapes of the caudate lobe wereobserved according to different authors. Joshi SD et alstudied 90 specimens of liver and reported 58% as rectangular, 10%as pyriform, 8% as triangular, 20%as irregular and 4% as belonging to other shapes of caudate lobe[5]. Sarala HS et al, out of 100 liver specimens reported 48% as ractangular, 18% as pear shape, 12% as triangular, 16% as irregular and 6% as other shapes of caudate lobe[6]. Abraham J et al also found that out of 59 liver specimens, 57.6%as rectangular, 18.6%as pear and 25.6%as others shapes of caudate lobe of liver[7].Arora NK et al observed that out of 36 liver specimens, rectangular in 91.66% ,triangular in 5.55% and 2.77% belonging to other shapes of caudate lobe[8]. Jaikumar BC et al mentioned that 67% as rectangular, 21% as pear and 12% as irregular shapes of caudate lobe were seen from 100 liver specimens[9]. Ibrahim IH observed rectangular in 73.21%, triangular in 21.43% and irregular shapes in 5.36% of caudate lobe out of 56 liver specimens[10]. Seye C et al reported that out of 39 liver specimens rectangular in 33.33%,pyriform in 30.77%, triangular in 23.0%, irregular in 7.7% and others shapes belonging to 5.12% of caudate lobe were seen[11].Whereas, in the present study, rectangular in 44%, pear shaped in 24%,

triangular in 8% and irregular in 24 % of various shapes of caudate lobes of liver were seen (comparison as shown in Table.1).

Joshi SD et al reported out of 90 liver specimens 30% accessory fissure extending vertically and 32% prominent process were seen[5]. Phad VV et al reported morphological variations of caudate lobe in 30% of the 80 livers studied. They found accessory fissure 2.5 %, enlargement of caudate process in 10% and enlargement of papillary process was seen in 5% of the specimens studied[12]. Sarala HS et al observed accessory fissure 30 %, prominent caudate process in 9% and prominent papillary process was seen in 21% out of 50 liver specimens[6]. Abraham J et alobserved vertical fissure extending upwards from lower border of caudate lobe in 5.1% and also oblique fissures in caudate lobe. In addition, they also reported prominent papillary process in 1.81% cases and absence of papillary process in 33%[7]. Singh HR and Rabi Salso noted fissures in the caudate lobe in 27.14% which ended in a notch at the inferior border. In addition, accessory lobes were seen 2 specimens[13]. Arora NK et alobserved vertical fissure extending upwards from the inferior border of the caudate lobe was seen in 7 specimens (19.44%)[8]. Ibrahim IH observed that out of 56 liver specimens, 26.79% vertical accessory fissure and 42.86% prominent papillary process were seen[10]. Seye C et al reported that 46% vertical fissure and 38.46% prominent papillary process were observed out of 39 liver specimens[11].Dawani P et al noted that out of 50 liver specimens, both accessory fissure and prominent papillary process were seen in 12%[14]. Kaur J et al observed the accessory fissures related to caudate lobe were present in 12(37.5%) out of 32 specimens. They also observed enlarged caudate lobe with hypertrophied caudate process was present in one (3.125%) specimen. A kidney shaped accessory lobe projecting from the lower part of caudate lobe was observed in one (3.125%) of them[15]. Whereas in the present study, vertical fissure extending upwards from lower border was seen in 12%, prominent papillary process was seen in 14% and prominent caudate process was seen in 10%and no accessory lobes were seen from the caudate process (as shown in Table.2).

Phad VV et al reported notch or fissure separating papillary process from rest of the caudate lobe was seen in 2.5%. Similarly, in the present study such a separate papillary process was seen in 4% out of the total specimens (as shown in Table.2). ear separate from the caudate lobe on inferior CT sections.

## V. Conclusion

The caudate lobe is considered as an independent segment according to Couinaud classification. Isolated resection of caudate lobe and resection of caudate lobe combined with major hepatecomy procedures for hepatocellular carcinoma or hilar bile duct carcinoma has increased in number. Therefore the knowledge of the morphological variations of the caudate lobe is essential for the surgeons. The papillary process is a possible source of pitfalls in interpretation of CT images. A small papillary process may be seen for an enlarged porta hepatis lymph nodes. An enlarged papillary process may be mistakenfor a pancreatic body mass or cirrhosis of liver. The accessory hepatic fissures are potential sources of diagnostic errors during imaging. Any collection of fluid in these fissures may be mistaken for a liver cyst, intrahepatic haematoma or liver abscess. Procedures like laparoscopic hepatectomy, laparoscopic thermal ablation and liver transplantation for patients with hepatic tumour, have been increasing recently.It is therefore important for radiologists to achieve correct diagnosis and for surgeons to plan for surgery and to achieve good surgical outcome by minimising unnecessary tissue dissections and traumatic surgical manoeuvres.

**CONFLICT OF INTEREST:** None.

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