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Anatomical Diversity of the Caudate - Lobe of the Liver A Comprehensive Study of Liver Specimens

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ABSTRACT

Aim - the study is aimed at in finding the morphological variations of the caudate lobe of the liver in 108 formalin fixed adult livers.

The caudate is an additional lobe present on the posterior surface of liver. The caudate lobe has aquired considerable importance because of its own vascularisation & biliary drainge. The lobe is bounded on the right by vena caval groove, on the left side by fissure for ligamentum venosum, above by posterior- Superior border and below by the porta hepatis of the liver. It consists of anterior and posterior surface. The former is formed by the posterior wall of the ligamentum venosum and the latter occupies the floor of the vertebral groove. The caudate lobe is the only part of liver which is covered with the peritoneum of lesser sac. The lower part of the caudate lobe presents 2 processes. Caudate and papillary processes. The caudate processes is a tail like projection which arises from the junction of the lower end and right margin of the caudate lobe and extend transversly to the right between the portahepatis & IVC (inferior vena cava), it forms the roof of the epiploic formamen. The papilary process is a conical projection which arises from the junction of the lower end & left margin of the caudate lobe. It is directed downwards and related with the orgin of the coeliac artery.

In this study morphological variation of caudate lobe regarding its shape , vertical fissures,and processes were clearly observed and photographed from 108 consecutive adult liver specimens, Bar graph were made by studing the collected samples in order to achieve the percentage of variations in the liver specimens.

The liver presents anatomical and physiological right and left lobes, caudate and quadrate lobes and occationally riedel's lobe. The right lobe of the liver is much greater in volume than the left lobe and contributes all the surfaces of the organ. The caudate lobe is situated on the posterior surface. It is bounded on the left side by fissure for ligamentum venosum, on the right side by grove for the IVC below by porta hepatis and above it is continuous with the superior surface. In additional the caudate lobe below and to the right connected to the main mass of right lobe by a narrow tongue of liver substance called as the caudate process. This process is sometimes elevated below and to the left caudate lobe forms another process called papillary process. These two process are sometimes sepated from the reminder of liver by grooves of fissures.

Anatomically the caudate lobe consists of spiegel's lobe, paracaval part caudate process. Most of the blood supply to the
lobe is provided by the posterior segmentals branches of the portal vein and left & right hepatic artery.

Keywords*: Anatomical Diversity, Liver, morphological, vascularization.*

INTRODUCTION

The liver is the largest gland in the body and consists of both exocrine and endocrine parts. It is wedge shaped with broad base directed to the right. It occupies whole of the Rt.hypochondrium, upper part of the epigastric and part of the left hypochondrium up to left lateral plane. In male it is usually weighs from 1.4 to 1.8 kg and in female it weighs from 1.2 to 1.4 kg. Owing to great vascularity, wounds of liver cause considerable haemorrhage. In spite of its great weight it is maintained in position by falciform ligeament, which is a fold of peritoneum streching from posterior aspect of anterior abdominal wall and goes under surface of the diaphragm the comes down and attach to the antero - superior surface of the liver and secondly the three main hepatic veins which drains blood from the liver to interior venacava and lastly supported by intra - abdominal pressure to keep the liver in its position.

Biliary drainage of liver flows into the right and left hepatic ducts, which joins to form the common hepatic duct (CBD) located near the portal vein. The hepatic venous drainage consists of a few sizable and several smaller branches that flow directly into the inferior venacava. The posterior edge of caudate lobe on the left side commonly exhibits a fibrous attachment expanding behind the venacava towards 7^{th} segment. In a substantial number of individuals the filrons band is replacd by liver paren - chyma thay can circumferentially envelope the inferior vena - cava.

Knowledge of normal and variant anatomy of caudate lobe is prerequisite for better surgical outcome. Morphology of caudate has significance in diagnostic imaging and also minimally invasive surgical approaches.

REVIEW OF LITERATURE

1. Kupffer (1898) The hepatic sinusoids are lined by endothelium instead of the endothelium macrophages. They are present called as stellate cells of Vankupffer.
2. Regarding the hepatic lobes, the classical studies of Hjortsjo (1948, 1951, and 1956) upon the segmental branching of bile ducts, hepatic artery and portal vein within the liver have emphasized that the primary anatomical and functional lobation is better defined by the distribution of the right and left hepatic ducts
3. Hilliard J Catz , A Justin Williams (1952) investigated on Accessory lobes of liver and their significance in roentgen diagnosis.
4. Glancer (1953) There is no anastomosis between hepatic arterial territories and hence each branch is an end artery.
5. The hepatic artery, portal vein and common bile duct divide and sub divide upon a common pattern as is implied in the classical observation of Glission (1954)
6. Doljansky(1960) The nucleus present in the hepatocytes is spheroid and euchromatic, polyploidy or multiples within each cell.
7. Sutherland (1965) Nerve fiber both myelinated and non myelinated also reach the liver parenchyma from nerves in the various peritoneal folds of the organ.
8. Rapport (1969) has also proposed multiple units (compound portal acini) for more complex groups of hepatic units
9. Nidden et.aI (1973) The importance of the trans diaphragmatic lymph drainage of the liver into the internal mammary and diaphragmatic lymph nodes.
10. Dawson (1974) and others considered resection of less than a lobe as hazardous while others such as Ryncki (1974) have recorded succesfull segmental resection.
11. Yong Ho Auh et al. (1983) conducted a detailed study on CT of papillary process of the caudate lobe of liver. For the purpose abdominal CT scans of 50 consecutive patients were reviewed. For each examination, the appearance of papillary process was noted as well as its relation to the adjacent liver, portal vein, inferior venacava, pancreatic body and gastric antrum. Along with this frequency and morphology of papillary — caudate process separation were analyzed.
12. P P Anthony and P U Telesinghe (1986) studied Inflammatory Pseudo tumour of liver
13. Ryuji Mizumoto et al. (1988) investigated the portal triad around the hepatic hilum including the caudate lobe using 106 adult cadavers. Branching pattern of portal vein at hepatic hilum, hepatic artery, cystic artery, accessory bile duct and attachments of round ligament were encountered in this study.
14. 1Wylie J Dodds et al. (1990) deals with the anatomy, embryology and pathology of caudate lobe. The pitfalls in clinical imaging were also noted.
15. Fosterin (1995) in his review of liver surgery in 1991, total hepatectomy with liver transplantations said that it may be most difficult operations ever divised technically and physiologically.
16. Ernerst E More , Thomas H Cogbill , Grigory J Jurkovich et.all (1995) analysed Organ injury Scaling (OIS) , Spleen and Liver in order to devise injury severity scores for individual organs to facilitate clinical investigation.
17. K Kogure et al (2000) performed a study to clarify the interrelations among portal segmentation, hepatic venous system and external notch of caudate lobe. A total of 88 formalin fixed human livers were dissected to

visualize the same. The patterns of portal branches were also classified. In this study Kumon's segmentation was applied to the anatomical description of caudate lobe.

18. G. Murakami and F Hata (2002) give special emphasis on parts of caudate lobe and its surgical importance in their study on human liver caudate lobe and segment. They had also described the margins of the lobe, border branches of portal vein, and other topics closely relating to the surgery within these contexts.
19. Eddie K Abdulla et al. (2002) describes the implications of embryology and anatomy for surgery in the caudate lobe. To enhance the knowledge base of relevant surgical anatomy and to support the indications for partial or total caudate lobe resection, this article presents a synthesis of the existing anatomic, embryologic and clinical data about caudate lobe.
20. Arne Jorn Lemke , Martin Julius Brinkman , Thomas schott and Stefan Markus Niehues (2006) worked on Preoperative CT Volumetric Measurement for Calculation of Intraoperative Weight and Volume of a living donors right liver lobe.
21. Nagato et al. (2011) carried out a medical investigation in anatomical variations exhibited by 61 formalinised and glycerinated adult human liver. They classified the vast majority into 7 morphological liver types and also two additional liver types were identified and described. Parameters associated with the normal morphological aspects of organ surfaces were also assessed.
22. Dr. Ghanshyam Dev, Reshmi Sharma and Bhawna Sharma (2014) reported variations in hepatic papillary process using CT scans in patients undergone cholecystectomy and some other surgical procedures. Hepatic mass lesion, hepatosplenomegaly and other clinical conditions along with chances of misinterpretations in CT scans were also considered in this study.
23. Dr. Sarala HS, Jyothilakshmi TK and Subha R (2015) taken up a study on morphological variations of caudate lobe of liver and their clinical implications. For the purpose 100 formalin fixed adult livers were taken into consideration. Morphological variations such as various shapes, prominent processes, presence of fissures etc were encountered.
24. Mandeep Gill Sagoo, R. Claire and Edward Gosden (2015) had done a detailed study on caudate lobe of liver by considering its morphology and morphometry in two different populations, North West and UK. This study shows that significant population differences exist in several metrics and morphological features of liver and how it affects the calculation of hepatic indices resulting in a greater percentage of false positives of cirrhosis in northwest population.
25. S. D . Kemp , Kurt L Zimmerman , D L Panceira , W E Monorie and M S Leib (2015) Histopathologic variations between liver lobes in dogs .

METHODOLOGY

The present study deals with morphological variations of caudate lobe of liver in 108 formaline fixed adult livers. The study started from the department of anatomy, Kanyakumari medical mission college and research, Muttom, Tamilnadu. By collecting and analysing the samples and collected detail data of caudate lobe and its morphology. Since my medical college 2 year old. I have collected only the 8 samples from the college. The remaining samples from various medical colleges of South India. In which 30 samples collected from JSS medical college Mysore, Karnataka and analysed the data, another 20 from Alazar medical college and super speciality hospital, Thodapuzha, Kerala under the supervision of H.O.D anatomy and again took help from sree - gokulam medical college and research foundation, vanjaramood, Trivendrum Kerala under the guidence and supervision of prof, Anilkumar K V helped to provide 20 specimans.

To conclude my sample collection, finally I went to srinivasa institute of medical sciences under the supervision by Dr. Sathiskumar prof of anatomy and vivekananda institute of medical college Tiruchengud, Tamil nadu, Narayana medical college and hospitals, Nellore and under the guidence of my proffessor lastly, the entire my sample collection helped by Dr. Parikanksh S V and which is more useful for carry out my research work from above said colleges collected 10 samples under the supervision by their H O D of anatomy. Each sample is analysed throughtly and find out variations in shapes of caudate lobe, prominence of vertical fissure, presence and absence of processes etc were noted clear photographs of caudate lobe of all the 108 samples were taken and added to my data.

DISCUSSION

In classic description, the caudate lobe is a projection from the posterior hepatic surface that is elongated vertically. It is bounded on the left by the fissure for ligamentum venosum, anteriorly by porta - hepatis and on the right by the groove for inferior venacava. With recent progress in hepato - billary surgery, the importance of caudate lobe in human liver has been increasingly recognised and anatomical peculiarities of caudate lobe resection have been reported. Caudate lobectomy, either as an isolated procedure or more frequently as a component of major hepatectomy is frequently indispensible in radial tumous elimination. The papillary process of caudate lobe is a potential source of pitfalls in interpretation of CT images. These errors can be avoided if the CT images are analysed carefully with reference of morpholgical variations of caudate lobe of liver. Many authors have previously described variations in the morphology of

caudate lobe as it is important information for any clinical practioners treating liver disorders. The incidence of morphological variation of caudate lobe is very high in this study. These variations should be kept mind in order to achieve correct pre - operative diagnosis.

The variations are clinically important for hepato - biliary surgery, liver transplantation and radiological interpretation understanding the anatomical diversity of the caudate lobe can help surgeons and clinicians to avoid complications during hepatic procedure.

RESULTS

Hense by analysing the variation in shape of caudate lobe of the liver concluded that the most common shape was recangular which was founded to be 35% in the study population followed by the analysis of presence and absence of vertical fissures concluded that when 50% showed prominent vertical fissures while in the other 50% it was absent. The study of caudate and papillary processes concluded that the caudate processes was prominent in 44% of liver specimens while 42% showed prominent papillary process.

CONCLUSION

The caudate lobe demonstrates significant anatomical diversity due to its unique anatomical location in the liver and its characterstic configuration which resembly a joining pin of a fan. Knowledge of these variations is important for all Anatomists, radiologists and hepato billiary surgeons particularly in liver resection and transplantation procedures and

also combined with major hepatectomy procedure, so treat hepato - cellular carcinoma and hepatic hilar bile duct cancer. So this study has been taken up to briefly review the morphology of caudate lobe resection and combined with major hepatectomy procedures, so treat hepato cellular carcinoma and hepatic hilar bileduct cancer.Hence I have taken up this study to brief and review the morphology of the caudate lobe of the liver.

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