

Original Research Article**Comparative Histology of Human and Cow, Goat and Sheep Liver**Madhan KE¹, Raju S² (✉)¹Department of Anatomy, Fathima Institute of Medical Sciences, Kadapa- 516001, A.P. India.²Department of Anatomy, RIMS Medical College, Rajiv Gandhi Institute of Medical Sciences, Kadapa- 516002, A.P. India.**Abstract**

Comparative histology deals with the comparison of microscopic structural relations of the various animals with in the ecosystem. Here, we compare the microscopic structure of the human liver with domestic animals like cow, sheep and goat. Human and cow, goat and sheep's liver were taken and divided in to 3 groups. We kept liver specimen in formalin for fixation. Thin cut sections of specimen were taken after paraffin embedding. Slides were stained by Haematoxyline and Eosin, later observed the histological features under light microscope. The study was undertaken to compare the histological differences like hepatic lobule, connective tissue septa, portal triad, hepatocytes of liver between human and cow, goat and sheep. It plays a useful tool for morphological studies based on the evolution. Hepatic lobule was hexagonal in shape in cow, goat and sheep, but it was not clearly seen in human liver. Hepatocytes were larger in human beings but smaller and polygonal in cow, goat and sheep. Connective tissue septa were scanty in human liver, in comparison to other animals. Central vein was closer to the hepatic lobule in human and goat's liver, while in case of cow and sheep, it was found to be close to the portal triad. This comparative histological study may be useful to all the research scholars who undertaken similar studies, veterinary scientists and the field of liver transplantation.

Keywords: Human liver, hepatocyte, comparative histology, portal triad

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Introduction

Liver is the largest organ of the body, its size is varies in different species. The weight of the liver in carnivores is 3%-4% of its body weight, and it is about 2% in omnivores and about 1%-1.5% in herbivores. The liver parenchyma is made up of a complex network of epithelial cells, supported by connective tissue and supplied by portal vein and hepatic artery. The hepatic lobule is the structural unit of liver. A roughly hexagonal arrangement of plates of Hepatocytes separated by intervening sinusoids which radiate outward from a central vein, with portal triads at vertices of each hexagon (1). In mammals initial hematopoiesis takes place in foetal liver (2). The connective tissue septa between individual hepatic lobule are scanty or less and the liver sinusoids are

continuous between the lobules. The central vein appears in the center of each hepatic lobule and the hepatic sinusoids emerge between the plates of hepatocytes (3). This study was undertaken to observe, compare and differentiate the nature of human liver with that of cow, goat and sheep.

Materials and Methods

Total number of five liver specimens of cow, goat and sheep, were brought from local slaughter house. Human liver specimens were collected from fresh autopsied body of forensic department after taken appropriate permission. For this comparative study, the selected specimens were free from liver diseases that were confirmed by the case history of autopsied body. Liver specimens were divided into 4 groups.

Then, infused with neutralized buffered formalin via hepatic vessels and then fixed in 10% formalin over night. Liver specimens were cut into small bits without damaged by knife. Later embedded in paraffin, then sections of five microns were taken by rotary microtome and mounted on glass slides. Slides were stained by normal Hematoxylin and Eosin (H&E) stain. The histological differences were observed under light microscope under different magnifications.

Results

In the present study we compared the histological differences like, position of central vein, shape of hepatic lobule, shape of hepatocyte, sinusoids, connective tissue septa between portal triad, structures in portal triad, capsules with the portal triad of liver between the human and cow, goat and sheep.

Human liver histological observations

The central veins of liver forms approximately centre of the hepatic lobule. The hepatic lobule was roughly hexagonal in shape and mingled with the adjacent hepatic lobule because, of the absence of the tissue septum in between. The shape of hepatocyte was hexagonal and appearance of the nuclei of hepatocyte was little larger. Hepatic sinusoids were clear and were present among the radiating cords of liver cells. Connective tissue septum between portal triad in human liver was scanty or less. Branches of portal vein, hepatic artery and bile duct were present in connective tissue (Fig. 1a, 1b).

Goat's liver histological observations

The central vein formed approximately centre of hepatic lobule and margin was collapsed. Endothelium was visible and fenestrations of margins were more by sinusoids. The hepatic lobule was roughly hexagonal in shape. The shape of the hepatocyte was polygonal in shape and nuclei of hepatocyte were small in size. Hepatic sinusoids were present among radiating cords of liver cells. Connective tissue septum between portal triad in goat's liver was present but merged with hepatic lobule. Branches of portal vein, hepatic artery and bile duct were present in the connective tissue (Fig. 2a, 2b).

Cow's liver histological observations

The central veins in cow's liver formed approximately closer to portal triad and margin of lumen was collapsed. Endothelium was visible, and fenestrations of margins were more by sinusoids. The hepatic lobule was hexagonal approximately in the cow's liver. The

shape of hepatocyte was polygonal and was arranged in radiating cords and nuclei of hepatocytes were smaller. Hepatic sinusoids were present with radiating cords of liver cells. Connective tissue septum between portal triad in cow's liver was well observed and merged with hepatic lobule. Branches of portal vein, hepatic artery and bile duct were present in the connective tissue (Fig. 3).

Sheep's liver histological observations

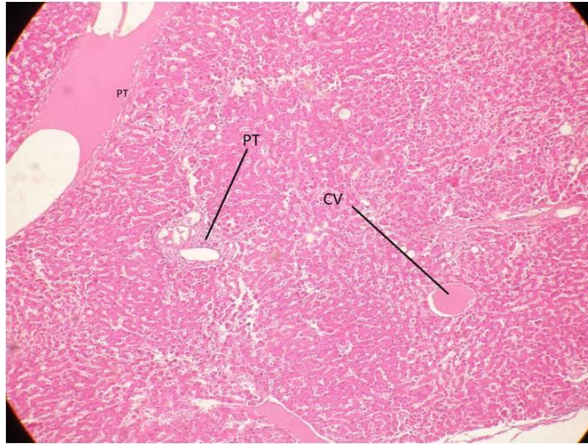
The central vein in sheep's liver was seen closer to the portal triad. The margin of lumen was collapsed. Endothelium was visible, and fenestrations of margins were minimal. The hepatic lobule was roughly hexagonal. The shape of hepatocyte was hexagonal and nuclei of hepatocytes was little larger than goat and cow. Hepatic sinusoids were present among radiating cords of liver cells. Connective tissue septum between portal triad in sheep's liver was prominently present which merged with hepatic lobule. Branches of portal vein, hepatic artery and bile duct were present in connective tissue (Fig. 4).

Discussion

The liver consists of multiple lobes in animals, the number and arrangement is varies, considerably among domestic animal species and 70%-80% of the liver mass is composed of hepatocytes (4). The traditional functional subunit of the liver is hepatic lobule, a hexagonal structure; 1-2mm wide. The limiting plate, a discontinuous border of hepatocytes, forms the outer boundary of the portal area (5). Hepatic lobules are roughly hexagonal in shape and are centered on a terminal hepatic venule and portal tracts are positioned at an angle of the hexagon (6). Hepatocytes are intimately contacted with sinusoidal capillaries that form a thick network in mammalian livers (7). In foetal stage, the mammalian liver develops as a hematopoietic organ earlier to the bone marrow development (8). According to Banks, morphological units of the liver is hepatic lobule. These prismatic, polygonal masses have plates of hepatocytes placed between anastomotic hepatic sinusoids. The plates appear to radiate from centrally placed vessel, the central vein (9).

Conclusion

The comparative histological study among human, cow, sheep and goat's liver showed that hepatic lobules were not distinct in case of human liver. Hepatocytes were consistently found to be hexagonal in shape, larger in size in human liver in comparison to other animals taken in this study. The shape of the

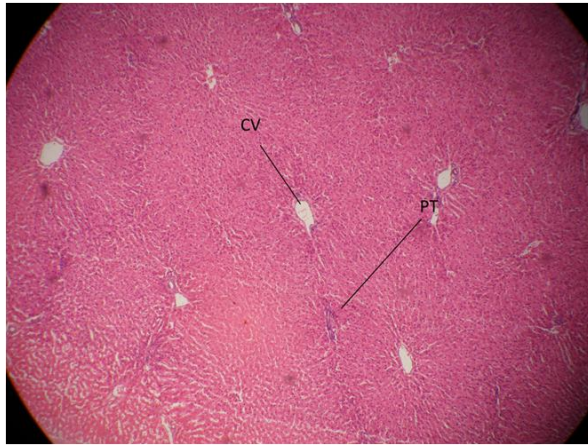


(a)

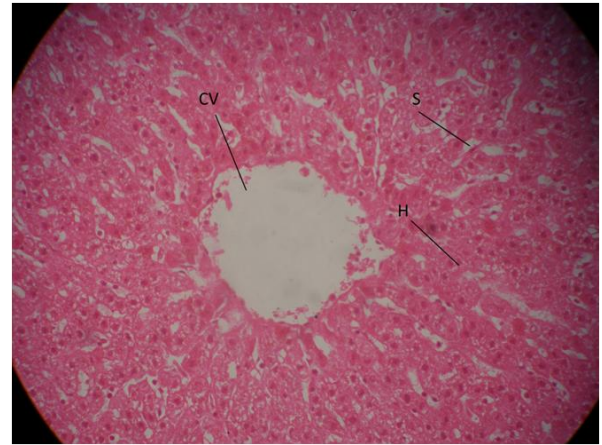


(b)

Figure 1: (a) Human liver H & E stain. 100 × showing CV: central vein, PT: portal triad. (b) Human liver H & E stain. 400 × showing CV: central vein, H: Hepatocyte, S: Sinusoid.



(a)



(b)

Figure 2: (a) Goat's liver H & E stain. 100 × showing CV: central vein, PT: portal triad. (b) Goat's liver H & E stain. 400 × showing CV: central vein, H: Hepatocyte, S: Sinusoid.

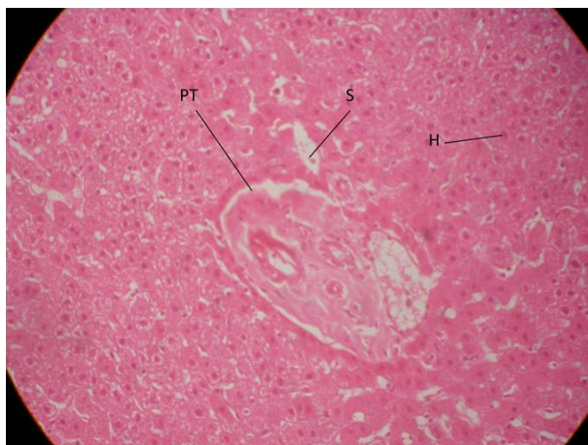


Figure 3: Cow's liver H & E stain. 400 × showing CV: central vein, PT: portal triad, S: Sinusoid

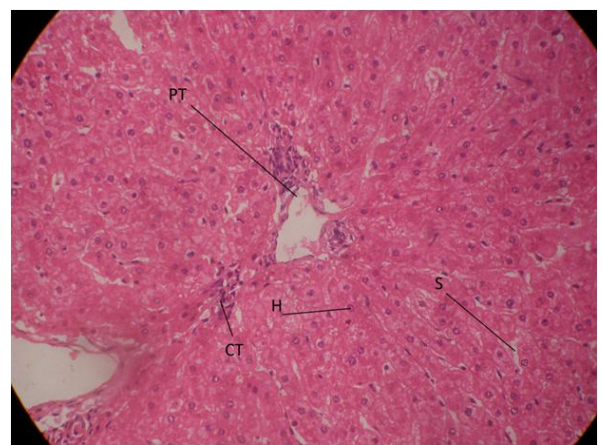


Figure 4: Sheep's liver H & E stain. 400 × showing PT: Portal triad, S: Sinusoid, H: Hepatocyte.

hepatocytes in case of cow, goat, sheep, consistently was found to be polygonal in appearance. Rests of the histological structures were more or less similar. The significance of the comparative study of liver of animal and human was different in terms of cytoarchitecture. These differences may be due to the phylogenical or evolutionary or developmental.

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