



MORPHOLOGICAL STUDY OF LIVER AMONG HUMAN, COW, GOAT, AND SHEEP: A COMPARATIVE STUDY

Anatomy

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ABSTRACT

Liver is the largest abdominal viscera. In mammals it is an important organ which performs a wide range of vital functions such as metabolic activities, immune defense as well as important for nutritional value. Liver performs all above function in animals also but the morphology of this organ is slightly deferent in animals which can have idea about evolutionary steps from cattle to human. The present study is focused on Morphology of liver of Human, cow, goat and sheep manually because of expensiveness and unavailability of different technique like MRI, CT scan etc. The study was carried out in Dept. of Anatomy, Hi-Tech Medical College and Hospital, Health Park, Rasulgarh, Bhubaneswar. Total twenty liver specimens have been taken for study out of those five of each of Human, Cow, Goat and Sheep were included in study. All specimens were of deferent age groups and sexes. All the specimens were fixed in formalin and finally analyzed morphologically. The results show variability in organ's position and it's presenting parts. There was variation in morphological structure between human and animals. The study will helpful to explore the evolutionary changes and will also enlighten the knowledge of veterinary doctors.

KEYWORDS

liver, Comparative morphology, Cow, Goat, Sheep

INTRODUCTION:

Liver is the largest abdominal viscera. In mammals it is an important organ which performs a wide range of vital functions, as well as important for nutritional value. The extent of functionality can be visualized by its weight as in carnivores 3-4 % of body weight, 2 % in Omnivores and 1-1.5 % in herbivores⁽¹⁾. It serves mainly in the formation and secretion of bile with a special blood circulation as Portal system. This function is fulfilled by hexagonal arrangements of cords of Hepatocytes separated by sinusoids called as Hepatic lobule with portal triad at each corner of Hexagon⁽²⁾. It helps in Phagocytosis of foreign particles; detoxification of lipid soluble drugs and poisonous substances; esterification of free fatty acids to triglyceride; metabolism of proteins, carbohydrates, fats, hemoglobin and drugs. It is an important site for haemopoiesis in Fetus⁽³⁾. Because of these functions, liver is an important organ in mammals. The study is undertaken to appreciate the gross anatomical features of the liver in human, cow, goat & sheep, to compare and highlight significant and salient differences among them.

AIMS & OBJECTIVES

Though, there are advanced and modern technologies like MRI, CT scan, which are used for morphometric studies of different comparative research to get appropriate results but these are expensive, not easily available and they are still controversial in results. The aim of this comparative study is to get morphological variation of liver in cheap and easily available infrastructure. Objective for this study of comparative anatomy of liver among Human, Cow, goat & sheep are as following;

- To compare Shape, Size, Situation and presenting features of liver in human, cow, goat and sheep.
- To compare the position of Gall bladder, lobes and supports of liver in human, cow, goat and sheep.

MATERIAL

- The study is planned in Anatomy Dept. Hi-Tech Medical College and Hospital, Health Park, Rasulgarh, Bhubaneswar. Twenty liver specimens have been taken for study, five of each of Human, Cow, Goat and Sheep were included which were of various age groups and sexes.
- Plastic bucket were used for storage and collection of specimens and Separate plastic trays used for the purpose of cleaning, tracing, and painting.
- The dissection kit containing instruments
 - Scalpel
 - Pointed forceps
 - Toothed forceps
 - Blunt forceps
 - Normal forceps
 - Scissors
 - Needles
- The high resolution mega pixel camera to take photo in different views.

METHOD:

- The specimens were being cleaned properly by removal of fat from portahepatis, ligaments and blood vessels then specimens were kept to dry.
- In human liver the red colored enamel paint is used for hepatic artery, & the blue colored is for inferior venacava. Green colored enamel is used to paint gallbladder, cystic duct, hepatic duct and White color is for ligaments. In animal's liver, every colour code was same as Human but Blue colour is used for Posterior venacava at the place of inferior venacava. Liver specimen was kept for drying after painting and then glycerin was applied on painted area.
- The photographs were taken from various angles by digital camera to identify the different structure.

RESULTS

Table-1: Table showing comparison of gross features of liver specimen among human, cow, goat & sheep.

	HUMAN	COW	GOAT	SHEEP
SHAPE	Wedge	Wedge	Wedge	Wedge
SIZE	Larger	Larger	Medium	Small
SITUATION	Upper abdominal cavity with right hypochondrium	Almost entirely right of median plane	Almost entirely right of median plane	Almost entirely right of median plane
COLOUR	Dark brown	Reddish brown	Reddish brown	Reddish brown
LOBES	Right, Left, Caudate, Quadrate	Right, Left, Caudate, Papillary	Right, Left, Caudate	Right, Left, Caudate
LIGAMENTS	Falciform, Coronary, Round, Right & left triangular, Lesser omentum, Ligamentum venosum.	Falciform, Coronary, Round, Caudate, Right lateral.	Falciform, Coronary, Round, Caudate, Right lateral.	Falciform, Coronary, Round, Caudate, Right lateral.
SURFACES	Superior, Anterior, Posterior, Inferior, Right lateral	Superior, Anterior, Posterior, Inferior, Right lateral	Superior, Anterior, Posterior, Inferior, Right lateral	Superior, Anterior, Posterior, Inferior, Right lateral
BORDERS	Inferior	Inferior	Inferior	Inferior
GALLBLADDER	Present	Present	Present	Present

Anterior surfaces of liver of Human, Cow, Goat and Sheep

Fig. 1

Fig. 2

Fig. 3

Fig. 4

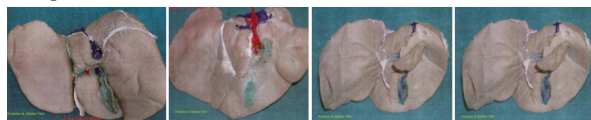
Posterior and Inferior surfaces of Liver of Human, Cow, Goat and Sheep

Fig. 5

Fig. 6

Fig. 7

Fig. 8

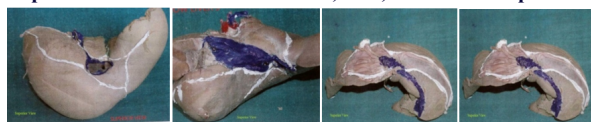
Superior surfaces of Liver of Human, Cow, Goat and Sheep

Fig. 9

Fig. 10

Fig. 11

Fig. 12

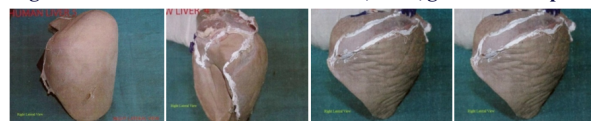
Right lateral surfaces of Liver of Human, Cow, goat and Sheep

Fig. 13

Fig. 14

Fig. 15

Fig. 16

On observation it was found that the livers had similarities and differences in shape, size, weight, situation, lobes, surfaces, borders & ligaments. All the liver specimens were wedge shaped, different in sizes and reddish brown except human which was dark brown. The Position of liver in human was in right hypochondrium and epigastric region with slightly in left hypochondrium. Liver was situated almost entirely right of the median plane in other animals. (Table 1)

Surfaces and borders were approximately similar in all specimens which represent five surfaces such as anterior, posterior, superior, inferior and right lateral. One prominent border was found as inferior border. In Human, the anterior surface was smooth, triangular with right and left lobe separated by falciform ligament and in Cow all features is same except left lobe which was thin, elongated and markedly cirrhotic (Fig 1&2) whereas in Goat and Sheep left lobe was appeared irregular and thinner towards lower edge (Fig 3&4).

The posterior surface is deeply concave in middle in Human, Goat and sheep (Fig 5, 7 & 8) and in cow it was convex in middle (Fig 6). In human, Inferior venacava & Ligamentum Venosum was additional feature along with caudate lobe and groove for esophagus (Fig 9). In Goat and Sheep the caudate lobe is like Pyramidal projection and papillary lobe was absent (Fig 7 & 8)

The inferior surface of human's liver shows Quadrate lobe, Portahepatis, ligamentum teres, gastric impression, caudate and papillary process, fossa for Gall bladder and duodenal impression. (Fig 5). In animals there was no quadrate lobe but other features were same as human. (Fig. 6, 7 & 8).

The superior surface doesn't show much variation as all have cardiac depression but in animals the Posterior vanacava located on this surface. (Fig 10, 11, 12). The right lateral surface was smooth, dome shaped and covered with peritoneum in all individuals. (Fig 13 to 16)

Ligaments present in relation to liver, the falciform, coronary, round and right lateral ligaments were common to all specimens. In humans the lateral ligament is called as the right triangular ligament. The left triangular ligament, lesser omentum and ligamentum venosum are extra in human liver and they were absent in animal's liver. The lesser omentum in human shows advance development of peritoneal coverings and ligamentum venosum demonstrates the higher level of Blood circulation change from fetus to adult which was not found in animal. The caudate ligament was absent in humans and present in livers of all the other animals. (Table 1)

DISCUSSION:

Liver is largest gland in the body, grows from infancy to adulthood rapidly and reaches at plateau around 18 years gradually decreases

from middle age. The liver has right, left, caudate and quadrate lobes but there are four portal sectors according to distribution of portal venous branches and location of hepatic veins as Right lateral, Right medial, and Left medial and Left lateral⁽⁴⁾. The caudate lobe is part of right lobe but supplied by left lobe vessels⁽⁵⁾. The liver is largest single organ after skin about 2.5 % of Adult body weight⁽⁶⁾. Liver of animal such as cow, goat and sheep is rich source of Vitamin A⁽⁷⁾. In cow, Superior border of liver is lined by posterior venacava and posterior surface shows root of omentum, gall bladder, portal vein and portal lymph nodes and in goat and sheep the caudate lobe is more like projection⁽⁸⁾. The ductus venosus which is remnants as ligamentum venosum of adult life, connects the left branch of portal vein to Inferior venacava and shunt of blood of left umbilical vein in foetal life directly to Inferior vanacava which shows special blood circulation in human⁽⁹⁾.

CONCLUSION

In this study it was found that, livers of all animals as well as human have approximately similar characteristics except few variation. In case of human liver, posterior surface was related to inferior vena cava but in animals, superior surface was related to posterior vena cava. The presence of lesser omentum and ligamentum venosum in human also gives area of attraction for more study. Papillary lobe was seen only in cows and caudate lobe was present as projection in goat and sheep. Caudate ligament was absent in human beings. As there is not much information regarding differences of cattle livers and human liver so this study could help to explore about evolutionary changes which can be used by other researcher who are working with evolutionary and anthropological sciences. It will be also useful for specialists in veterinary sciences & animal husbandry.

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