

DEVELOPMENTAL ANATOMY OF THE LIVER, GALL BLADDER AND PANCREAS IN GUINEA PIGS

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ABSTRACT

The developmental gross anatomy study was conducted on the hepato-pancreatic organ of guinea pig, which were procured from the Department of Laboratory Animal Medicine, Madhavaram Milk Colony, Chennai. Gross anatomical observations of the liver, gall bladder and pancreas were recorded in all the prenatal age groups. The liver occupied the whole of the cranial and middle part of the abdominal cavity in 30 days and 45 days of gestational age in guinea pigs. The liver was at the right side of the abdominal cavity with larger left lobe and smaller right lobes at 62 days of gestation. The liver of all the prenatal groups of animals were dark reddish brown in colour. The prenatal liver also showed six lobes as like pre-weaning and adult animals. Lobe differentiation was evident at 30 days of gestation without deep fissures. Caudate lobe and falciform ligaments were well developed at 62 days of gestation. Gall bladder was thin walled and pear shaped in all the prenatal groups of animal studied and were embedded in the right lobe of the liver as intrahepatic position. Pancreas was seen as diffuse ill-defined tissue within the mesenchymal tissue between the developing stomach, duodenum and kidney in 30 days and 45 day-old foetus in the prenatal group of present study.

Keywords: Developmental anatomy, Gall bladder, Guinea pigs, Liver, Pancreas

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The liver is the accessory digestive organ and the largest gland in the body and produces bile which helps in fat digestion. Gall bladder is a small pouch found attached to the liver and stores bile (Tortora and Derrickson, 2008). The pancreas is an accessory organ of the digestive system and also an important endocrine organ of vertebrates. The pancreas has both endocrine and exocrine function. Its function is to regulate blood sugar levels by secretion of hormones like insulin, glucagon, somatostatin and pancreatic polypeptide. As an exocrine gland, it produces pancreatic juice for digestion (Sisson *et al.*, 1975). Morphological development of the prenatal liver was studied in goats by Gajendra *et al.* (2012). Morphological development of the prenatal gall bladder was studied in Gaddi sheep by Razvi and Rajput (2016). Since, there is paucity of literature in the structure of hepato-pancreatic organ of guinea pig, the present research work was aimed to study the morphogenesis of the liver, gall bladder and pancreas in guinea pig.

MATERIALS AND METHODS

The developmental gross anatomy of the hepatopancreatic organ of guinea pig from prenatal age groups (Table 1) were conducted at the Department of Veterinary Anatomy, Madras Veterinary College, Chennai. Guinea pigs were procured the pregnant mother animals from the Department of Laboratory Animal Medicine, Madhavaram Milk Colony, TANUVAS, Chennai-51 as per the ethical committee approval (Lr. No. 1467/DFAB/

IAEC/2018 dated 13.07.2018). Then pregnant animals were subjected for ultrasonographic examination for assessing the age of the foetus per Santos *et al.* (2014).

Table 1. Details of prenatal age groups of guinea pigs used for research work

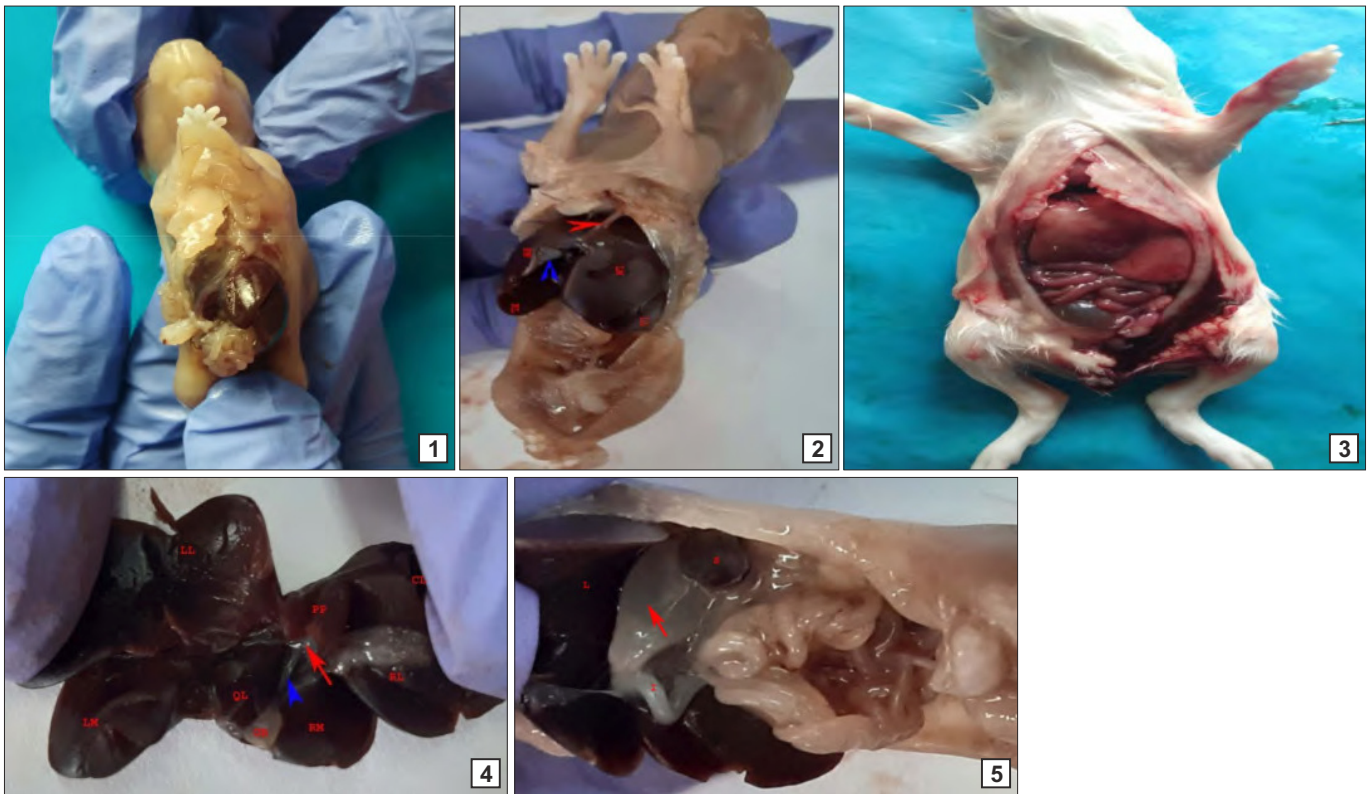
Age groups	No. of foetuses (0-30 days) from 3 pregnant mom	No. of foetuses (30 days to birth) from 3 pregnant mom
No. of animals	30 day-old-3 Embryonal mass-4	45 day-old-3 62 day-old-2

After careful dissection of the animals, hepato-pancreatic organ namely liver, gall bladder and pancreas were dissected out and gross anatomical observations like colour, shape, surface, lobulation and ligaments of the liver, gall bladder and pancreas were recorded in all the prenatal age groups.

RESULTS AND DISCUSSION

Liver: The liver occupied the whole of the cranial and middle part of the abdominal cavity in 30 days and 45 days of gestational age in guinea pigs (Fig. 1 and 2). Similar findings were occurred in goat at 47 days of gestation (Gajendra *et al.*, 2012). The liver was at the right side of the abdominal cavity with larger left lobe and smaller right lobes at 62 days of gestation as like pre-weaning animals, while in goats at 126th day of gestation, the right lobe was larger than the left lobe (Gajendra *et al.*, 2012). But in adult guinea pigs, it was found on the right side of the cranial and middle part of the abdominal cavity. The liver was covered

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Figs. 1-5. (1) Photograph showing the liver (arrow) in the abdominal cavity of 30 day-old foetus; (2) Photograph showing the liver of 45 day-old foetus with left lateral (LL), left medial (LM), right medial (RL), right lateral (RL) lobes and Gall bladder (blue arrow). Falciform ligament is depicted in the photograph as red arrow; (3) Photograph showing the liver (arrow) in the abdominal cavity of 62 day-old foetus.; (4) Photograph showing the visceral surface of the liver in 45 day-old foetus. LL-Left lateral lobe LM-Left medial lobe RL-Right lateral lobe RM-Right medial lobe, QL-Quadrante lobe CL-Caudate lobe GB-Gall bladder Red arrow- Hilus Blue arrow-Cystic duct; (5) Photograph showing the location of pancreas (arrow) in the mesentery. L - Liver, S - Spleen and I - Intestine

by last four ribs and had little costal impression on the diaphragmatic surface of the liver in the 62 day-old guinea pigs. Similar findings were observed by Gupta *et al.* (2017) in neonatal rabbit liver. The liver was related to the gall bladder, septum transversum, stomach and intestines in 45 day-old and 62 day-old guinea pig foetus studied (Fig. 2).

The liver of the prenatal groups of animals from 30 to 45 days of age were dark reddish brown in colour (Fig. 2) whereas in goats at 27 days of gestation, it was brownish in colour (Gajendra *et al.*, 2012). In 62 day-old guinea pig foetus, the colour of the liver changed from dark to light reddish brown (Fig. 3). In adult guinea pigs, the colour of the liver was pale reddish brown. These differences may be due to the structural alterations related to growth of the organ.

The prenatal liver also showed six lobes namely the right lateral lobe, the right medial lobe, quadrate lobe, left medial lobe, left lateral lobe and caudate lobe as like preweaning and adult animals (Fig. 4). Lobe differentiation was evident at 30 days of gestation without deep fissures (Fig. 1). In all the prenatal age groups, the liver showed two surfaces namely parietal and visceral surface. The parietal surface was convex, smooth and adapted to the contour of

the abdominal wall (Fig. 2). The area nuda in which the liver surface was observed to be in direct contact with the diaphragm without any peritoneal covering was not clearly seen in the prenatal age groups. The visceral surface was concave and was found related to the stomach and intestines (Fig. 4). The hilus or portal fissure of the liver was noticed in the transverse groove formed between the dorsal and ventral parts of the liver on the visceral surface in all the prenatal age groups of guinea pigs of present study (Fig. 4).

Caudate lobe and falciform ligaments were well developed at 45 and 62 days of gestation (Fig. 2) and was similar to the observations of Gajendra *et al.* (2012) in goats at 49 days of gestation. The liver of adult guinea pig showed six ligaments namely falciform ligament, coronary ligament, round ligament, triangular ligament, hepatorenal ligament and hepatogastric ligament which was not found clearly demarcated in the prenatal age groups.

Gall bladder: Gall bladder was thin walled and pear shaped in all the prenatal groups of animal studied and were embedded in the right lobe of the liver (Fig. 2) as intrahepatic position whereas in Gaddi sheep, it was found

to be located in the visceral surface of right lobe of liver at 46 days of gestational age (Razvi and Rajput, 2018). This may be due to species differences. It was found in the gall bladder fossa located between the right medial lobe and quadrate lobe of the liver (Fig. 4). Swelling present on the neck region of gall bladder in adults (Fig. 4) as stated by Rajathi *et al.* (2020) in guinea pigs was not found in the present study. Gall bladder was elongated in 30 day-old foetus and become round to pear shaped in 45 to 62 day-old foetus. It was transparent and was empty from 30 to 45 day-old foetus and filled with serosanguinous fluid in 62 day-old foetus.

Pancreas: Pancreas was seen as diffuse ill-defined tissue within the mesenchymal tissue between the developing stomach, duodenum and kidney in 30 days and 45 day-old foetus in the prenatal group of present study (Fig. 5). Similar observation was recorded in 16 weeks and 20 weeks of gestational age in human foetus (Manupati *et al.*, 2012). In adult guinea pigs, pancreatic lobes were differentiated into splenic, ventricular and intestinal lobe. But such lobular pattern was not observed in the present study. Shape, lobulation, colour and location of the pancreas was not demonstrable in the present study.

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