

Gross Anatomical and Biometric Studies on the Gall bladder of Adult Pigs of Jammu Region

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ABSTRACT

The present investigation was carried out to study the gross morphology and biometry of the gall bladder in pigs of the Jammu region. Gross anatomical examination showed that the gall bladder in pigs was typically pear-shaped structure placed in a deep fossa on the visceral surface of the liver, between the quadrate and right medial lobes. Structurally, the gall bladder comprised a narrow neck and a relatively larger fundus. The fundus did not extend up to the ventral border of the liver, however, it was seen from the parietal surface through a distinct V-shaped notch. The neck continued as a long cystic duct, which joined the common hepatic duct at the portal fissure to form the bile duct. Biometrical parameters were recorded. A significant difference in width was observed, with the middle of the body being the widest region. Overall, the present study provided baseline information on the gross anatomical features and biometric parameters of the porcine gall bladder.

Keywords: Biometry, Gall bladder, Liver, Morphology, Pig

INTRODUCTION

Swine belongs to the genus *Sus* and family Suidae that are raised for food around the world. These animals are Artiodactyla, which means they have even-toed hooves. Pigs belong to the suborder Bunodontia with 44 teeth. In our country, the total number of livestock is 535.78 million, with pigs accounting for 9.06 million (01.70%) (Livestock Census, 2019). Pigs have great potential to provide quick economic benefits to farmers because of their efficient feeding, early maturity, and short generation time (Banerjee, 1998). Pig farming requires less investment in buildings and equipment and can offer nutritional and economic stability to the poorer communities. Moreover, pigs are also of interest in biomedical research because they are similar to humans in their body structure, function, and disease processes and are widely used in various scientific fields, such as immunology, organ transplantation, heart disease, and wound healing (Wang *et al.*, 2023).

MATERIALS AND METHODS

The present study was conducted on the gall bladder (N=10) of apparently healthy adult (1-1.5 years) pigs (irrespective of sex) collected from slaughter houses in and around Jammu City of union territory of Jammu & Kashmir. Age was estimated by examining the dentition. Immediately after collection, the samples were cleaned with running water and brought to the laboratory for recording the gross morphological and biometrical studies. Following biometrical parameters for gall bladder were recorded:

- i. **Empty weight (gm) of gall bladder:** Empty weight (gm) of gall bladder was recorded with help of Monopan balance.
- ii. **Total volume (ml) of gall bladder:** It was measured by water displacement method (Barnwal and Sinha, 1981).
- iii. **Density of gall bladder (gm/ml):** It was calculated as Weight of liver (gm)/Total volume (ml) (Niehues *et al.*, 2010)
- iv. **Length (cm) of gall bladder:** It was measured as the distance between starting of neck to apex of fundus.
- v. **Width (cm) of gall bladder:** It was

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measured as the distance between medial and lateral border at three sites, namely proximal, middle and distal.

- vi. **Thickness (cm) of gall bladder:** It was measured as the distance between parietal and visceral surface at the fundus of gall bladder (Mandal *et al.*, 2001).
- vii. Thickness (cm) of wall of gall bladder in the middle portion of gall bladder
- viii. Shape index

RESULTS AND DISCUSSION

Gross morphology

In present study, pig possessed a well-developed pear-shaped gall bladder (Fig. 1) which function to store and concentrate bile. Sethi (2020) also reported pear shaped gall bladder in Bakerwali and non-descript goats of Jammu region. Dyce *et al.* (2010) mentioned that in small ruminants, the gall bladder was more elongated while Cortez and Maala (2010) observed pear shaped gall bladder in the Philippine water buffalo. It was embedded in a deep fossa on the visceral surface of the liver between the quadrate and right medial lobe (Fig. 2). Similar observations were also reported by Carvalho-de-Souza *et al.* (2005) in wild boar. Vishwanath (1967) in pig described that the gall bladder was a dark green elongated structure located in a depression on the posterior face on the right central lobe of the liver. Sisson (1975) reported that in pig, fossa for gall bladder was mainly located on the right central lobe with some part on the adjacent surface of the left central lobe. In present study, gall bladder consisted of a narrow part known as neck and a larger part known as fundus which did not reach to the ventral border as reported earlier by Carvalho-de-Souza *et al.* (2005) in wild boar; however, it was visible from the parietal surface through a 'V' shaped notch along the ventral border (Fig. 3). The neck was continued by a long cystic duct that passed to the portal fissure, where it unites with the common hepatic duct to form the bile duct.

Biometry

Quantitative measurements of the porcine gall bladder were recorded and summarized in Table 1. The average empty weight of gall bladder was 12.62 ± 0.16 g which ranges from 12.22 to 13.17 g. The average volume was 13.58 ± 0.20 ml (13.00 -14.50 ml). The density of gall bladder was 0.93 ± 0.01 g/ml with a range of 0.89-0.96. The wall thickness was 0.16 ± 0.01 cm which varied between 0.13 to 0.18 cm. The total length of gall bladder was 8.58 ± 0.03 cm (8.47 -8.66 cm). The width was recorded at neck, middle of the body and distal end. Gall bladder was significantly ($p < 0.05$) widest at the middle of the body (4.21 ± 0.23 cm) followed by width at neck (2.27 ± 0.05 cm) and least at the distal end (1.59 ± 0.05 cm). The width increased by 85.46% from neck towards the middle of the body and thereafter showed a decreasing trend. From middle of the body towards the distal end, the width decreased by 62.23%. Khalil *et al.* (2004) recorded morphometry of gall bladder in human and cat. Gall bladder of ox measured 11.3 ± 0.87 cm in length and 4.7 ± 0.57 cm in width whereas in cat, the same was 2.5 ± 0.57 cm and 1.3 ± 0.51 cm, respectively. Sethi (2020) recorded mean length of gall bladder of adult Bakerwali goat (14.04 ± 1.02 cm) and non-descript goats (7.56 ± 2.40 cm) of Jammu region.

From the study, it was concluded that the gall bladder of the pig was pear shaped structure situated in a distinct fossa between the quadrate and right medial lobes of the liver, similar to that reported in other domestic and wild species. It was composed of a narrow neck, a broader fundus, and a long cystic duct that joined the bile duct. Biometric observations showed the greatest width at the middle of the gall bladder and a gradual tapering toward both the neck and the distal end. These observations provided important baseline anatomical and morphometric information for comparative and clinical studies in pigs. 3



Fig.01

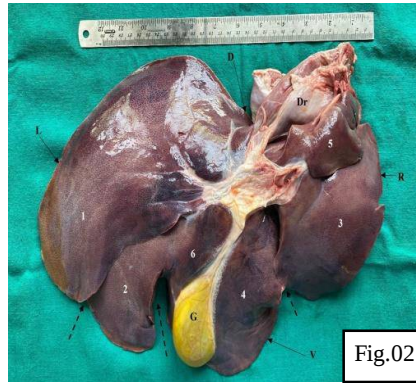


Fig.02

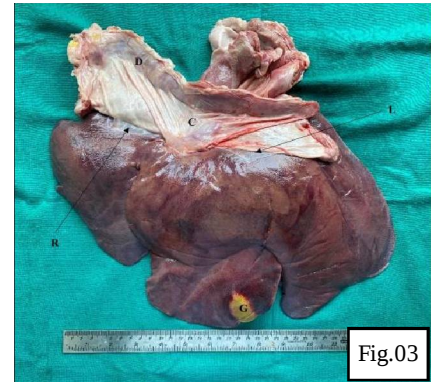


Fig.03

Fig. 1 Photograph showing pear shaped gall bladder of pig. **Fig. 2** Photograph of visceral surface of liver of pig showing its rectangular shape and cherry brown colour. Different lobes are left lateral (1), left medial (2), right lateral (3), right medial (4), caudate (5) and quadrate (6). Gall bladder (G) is also evident. Four borders are dorsal (D), ventral (V), right lateral (R) and left lateral (L). Dorsal border is connected to the diaphragm (Dr). Three deep interlobar fissure were prominent (dotted arrow). Middle fissure was the deepest. **Fig. 3** Photograph showing smooth convex parietal surface of liver of pig. Towards dorsal border, coronary ligament (C) connects liver to the diaphragm (D). Right (R) and left (L) triangular ligament are seen on either side of coronary ligament. Ventral border presented 'V' shaped notch through which gall bladder (G) is noticeable. This notch was seen in right medial lobe.

Table 1: Gross biometrical parameters of gall bladder of adult pigs of Jammu region

Parameter		Mean $\pm$ SE	Range
Weight (gm)		12.62 $\pm$ 0.16	12.22 -13.17
Volume (ml)		13.58 $\pm$ 0.20	13.00 – 14.50
Density (gm/ml)		0.93 $\pm$ 0.01	0.87 – 0.96
Wall thickness (cm)		0.16 $\pm$ 0.01	0.13 – 0.18
Width (cm)	Proximal	2.27 ^b $\pm$ 0.05	2.11 – 2.44
	Mid	4.21 ^c $\pm$ 0.23	3.40 – 4.75
	Distal	1.59 ^a $\pm$ 0.05	1.48 – 1.76
Length (cm)		8.58 $\pm$ 0.03	8.47 – 8.66
Thickness (cm)		2.63 $\pm$ 0.06	2.45 – 2.85
Shape index		49.00 $\pm$ 2.58	40.14 – 54.85

Mean value with different superscript (a, b, c) within row differ significantly ($p < 0.05$)

REFERENCES

- Banerjee, G.C. 1998. A textbook of Animal Husbandry. 8th Edn. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi: 54-55.
- Barnwal, A.K. and Sinha, R.D. 1981. Macromorphology of the mandibular salivary gland of buffalo. *Indian Journal of Animal Sciences*, 51: 931.
- Carvalho-de-souza, B., Babinski, M.A. and Abidufigueiredo, M. 2005. Morphology and topographical aspect of the wild boar liver. *Revista Científica Eletrônica De Medicina Veterinária*.
- Cortez, E.S. and Maala, C.P. 2010. Anatomy of the gallbladder of the Philippine water buffalo (*Bubalus bubalis* L.). *Philippine Journal of Veterinary Medicine*, 47(2): 58-65.
- Dyce, K.M., Sack, W.O. and Wensing, C.J.G. 2010. Textbook of Veterinary Anatomy. W.B. Saunders Co. Philadelphia, 4th Edn. 768-769.
- Khalil, M.M., Islam, M.N., Khalil, M.M., Khan, M.Z.I. and Hossain, M.I. 2004. Morphology and morphometry of gall bladder, cystic duct and common hepatic

- duct in man and domesticated animals. *The Bangladesh Veterinarian*, 21(2): 101-108.
- Livestock Census. 2019. Department of Animal Husbandry & Dairying under Ministry of Fisheries, Animal Husbandry & Dairying.
- Mandal, A.K., Das, R.K., Mishra, U.K., Paridas, S. and Mondal, M. 2001. Morphometric study on prenatal liver cells of sheep and goat at different age groups. *Journal of Interacademia*, 5(2): 220-223.
- Niehues, S.M., Unger, J.K., Malinowski, M., Neymeyer, J., Hamm, B. and Stockmann, M. 2010. Liver volume measurement: Reason of the difference between in vivo CT-volumetry and intraoperative *ex vivo* determination and how to cope it. *European Journal of Medical Research*, 15: 345-350.
- Sethi, L. 2020. Anatomical studies on the liver of adult Bakerwali and non-descript goats of Jammu region-a comparative study. M.V.Sc Thesis submitted to SKUAST-Jammu.
- Sisson, S. 1975. Porcine Digestive System. In: Getty R., (Ed). Sisson and Grossman's, The Anatomy of the Domestic Animals. Vol. 2, W.B. Saunders Company, Philadelphia, London. pp. 1280-81.
- Vishwanath, M.S. 1967. A Textbook of Zoology. Vol. 2, S. Chand & Co., Madras, pp: 513.
- Wang, L., Piao, Y., Guo, F., Wei, J., Chen, Y., Dai, X. and Zhang, X. 2023. Current progress of pig models for liver cancer research. *Biomedicine & Pharmacotherapy*, 165: 115256.