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B Venkatesh

Department of Veterinary
Anatomy, College of Veterinary
Science, Hyderabad, P.V.
Narsimha Rao Telangana
Veterinary University,
Hyderabad, Uttar Pradesh,
India

G Purushotham

Department of Veterinary
Anatomy, College of Veterinary
Science, Hyderabad, P.V.
Narsimha Rao Telangana
Veterinary University,
Hyderabad, Uttar Pradesh,
India

D Pramod Kumar

Department of Veterinary
Anatomy, College of Veterinary
Science, Hyderabad, P.V.
Narsimha Rao Telangana
Veterinary University,
Hyderabad, Uttar Pradesh,
India

KBP Raghavender

Department of Veterinary
Anatomy, College of Veterinary
Science, Hyderabad, P.V.
Narsimha Rao Telangana
Veterinary University,
Hyderabad, Uttar Pradesh,
India

Correspondence**B Venkatesh**

Department of Veterinary
Anatomy, College of Veterinary
Science, Hyderabad, P.V.
Narsimha Rao Telangana
Veterinary University,
Hyderabad, Uttar Pradesh,
India

Morphometric analysis of hepatic artery in sheep

B Venkatesh, G Purushotham, D Pramod Kumar and KBP Raghavender

Abstract

The present study evaluated the more precise and detailed information on the structure of hepatic artery and its branches diameter in sheep (*Ovis aries*). The liver samples along with coeliac artery were collected from twenty two apparently healthy sheep irrespective of sex from local slaughter houses and Acrylic cast preparations were made. The morphometry of the hepatic artery in terms of length and diameter were recorded by using digital calipers. The observed mean length and external diameters of CHA and PHA in these cast preparations were 30.4 ± 2.2 mm, 5.5 ± 0.5 mm and 2.33 ± 0.07 mm, 1.94 ± 0.02 mm respectively. The mean external diameters of RHA and its branches RSILA, RCILA, RInFLA, CPA and CA were 1.39 ± 0.02 mm, 0.81 ± 0.08 mm, 0.6 ± 0.08 mm, 0.51 ± 0.09 mm, 0.61 ± 0.15 mm and 0.96 ± 0.05 mm respectively. The LHA gave branches to papillary process of caudate lobe and then sub divided into LMB and LLB. LMB gave rise to LSILA and LILA. LLB gave rise to QLA and LInFLA. The LHA, LMB and LLB mean external diameters were 1.64 ± 0.01 mm, 1.00 ± 0.07 mm and 1.16 ± 0.07 mm respectively while LSILA, LILA, QLA and LInFLA mean diameters were 0.82

Keywords: Sheep, liver, hepatic artery, Acrylic cast preparations, morphometry

Introduction

The aim of the present study was to describe the hepatic arterial diameters and its main branches. The hepatic arterial diameter is importance especially due to development of new techniques for liver transplantation. According to Silveira *et al.*, (2009) knowledge of the hepatic arteries diameters is mandatory for chemotherapy treatment of hepatic metastatic tumors so the correct size of the catheter can be safely chosen. It is noticed from the literature reviewed that there is very little information available on the hepatic arterial diameter and its branches. This has prompted to take up this study to establish a more precise and detailed information on the structure of hepatic arterial branching pattern with its diameter which would give a comprehensive and useful data for interdisciplinary works.

Material and methods

Prepare the vascular corrosion cast. The Cold cure self polymerizing acrylic (methyl methacrylate) solution was reconstructed in 1:2 ratio with few drops of red color dye. This solution was injected into the hepatic artery. The vessels were clamped and the injected liver specimens were kept at room temperature for effective polymerization. Subsequently the specimens were digested in 75% hydrochloric acid till the corrosion process was completed. The specimen was cleaned under running water to remove macerated tissue leaving the vessels exposed. The morphometry of the hepatic artery in terms of length and diameter were recorded by using digital calipers and accordingly tabulated (George and Cochran, 1994).

Results

Acrylic cast preparations were made for observing the branching pattern of Hepatic artery. The observed mean length and external diameters of common hepatic artery (CHA) and proper hepatic artery (PHA) in these cast preparations were 30.4 ± 2.2 mm, 5.5 ± 0.5 mm and 2.33 ± 0.07 mm, 1.94 ± 0.02 mm respectively.

The PHA was divided intrahepatically into right hepatic artery (RHA) and left hepatic artery (LHA). The right lobe of the liver was mainly supplied by right hepatic artery. The mean external diameters of right hepatic artery and its branches right superior interlobular artery (RSILA), right central interlobular artery (RCILA), right inferior inter lobular artery (RInFLA), caudate process artery (CPA) and cystic artery (CA) were 1.39 ± 0.02 mm, 0.81 ± 0.08 mm, 0.6 ± 0.08 mm, 0.51 ± 0.09 mm, 0.61 ± 0.15 mm and 0.96 ± 0.05 mm respectively.

The left lobe of the liver was supplied by LHA whose mean external diameter of was 1.64 ± 0.01 mm. The LHA was sub divided into left medial branch (LMB) and left lateral branch (LLB) whose external mean diameter was 1.00 ± 0.07 mm and 1.16 ± 0.07 mm respectively. LMB was further divided into LSILA and LILA whose mean diameters were 0.82 ± 0.06 mm

and 0.75 ± 0.06 mm respectively. LLB was divided into QLA and LInFLA whose mean diameters were 0.57 ± 0.09 mm and 0.76 ± 0.09 mm respectively.

Discussion

Acrylic cast preparations were made in the present studies for observing the branching pattern of Hepatic artery in completely digested liver specimen. The observed mean length and external diameters of CHA was 30.4 ± 2.2 mm and 2.33 ± 0.07 mm respectively. These findings could be compared with Silveira *et al.*, (2009) who measured the arterial diameter in human male cadavers and stated that the diameter of common hepatic artery was 0.5 ± 0.04 cm. The difference in diameter may be due to species difference. It would be pertinent to discuss that some of the researchers have done by employing CT and live angiography and measured the lengths and diameter of CHA. Researcher like Enge and Flatmark, (1972) reported that the maximum average length and diameter of the common hepatic artery in dogs was 6 cm from origin to hilus and 3.5 to 4.1 mm diameter respectively, Vdoviakova *et al.*, (2016) reported that the mean length and diameter of hepatic artery in laboratory rats ranged between 3 to 7 mm and 0.2 to 0.7 mm respectively, Zwingenberger and Schwarz, (2004) measured the hepatic artery diameter in canines by using CT angiography and stated that the hepatic artery diameter ranged between 2.7 to 4.1 mm and Singh *et al.*, (2014) reported that there was gender variation with respect to CHA mean diameter in males and females which ranged between 3 to 9 mm and 2 to 8 mm respectively.

The observed mean length and external diameters of Acrylic cast PHA was 5.5 ± 0.5 mm and 1.94 ± 0.02 mm respectively. Such information in different species was reported by Martins and Neuhaus, (2007) as 0.29 ± 0.11 mm and 3.75 ± 0.38 mm respectively in rats, Silveira *et al.*, (2009) measured arterial diameter in human male cadavers as 0.45 ± 0.03 cm. and Lee *et al.*, (2017) measured the diameters of the proper hepatic artery in normal cynomolgus monkeys (*Macaca fascicularis*) by using ultrasonography and stated that the diameter of proper hepatic artery ranged between 1 to 1.9 mm. It is noticed from the above reports that the diameter of PHA varied due to species difference.

The right lobe of the liver was mainly supplied by RHA. The mean external diameter of RHA in the cast preparation was 1.39 ± 0.02 mm. These observations are in line with the findings of Silveira *et al.*, (2009) and Tam *et al.*, (2013) who stated that the mean external diameter of the right hepatic arteries in rabbits was 0.3 ± 0.03 cm and 0.67 mm respectively. Contrasting feature in the thickness variations is due to the species difference.

The wall thickness in the cast preparations of RHA branches like RSILA, RCILA, RInFLA, CPA and CA were 0.81 ± 0.08 mm, 0.6 ± 0.08 mm, 0.51 ± 0.09 mm, 0.61 ± 0.15 mm and 0.96 ± 0.05 mm respectively. Such detailed split data was not available in the literature reviewed.

The left lobe of the liver of sheep in current investigation was supplied by LHA and the mean external diameter noticed in the cast preparation of LHA was 1.64 ± 0.01 mm. These findings are in acceptance with the findings of Silveira *et al.*, (2009) and Tam *et al.*, (2013) who stated that the mean external diameter of the left hepatic arteries in rabbits was 0.36 ± 0.04 cm and 1.25 mm respectively.

The LHA in the present study was sub divided into LMB and LLB whose external mean diameter noticed in cast preparation was 1.00 ± 0.07 mm and 1.16 ± 0.07 mm

respectively. The reports of Tam *et al.*, (2013) establish that the mean diameters in rabbits of the medial and lateral branches of the left hepatic artery were 0.63 mm and 0.91 mm respectively.

LMB in present study was further divided into LSILA and LIILA. The cast preparation revealed mean external diameters of 0.82 ± 0.06 mm and 0.75 ± 0.06 mm respectively. LLB was divided into QLA and LInFLA measuring mean diameters 0.57 ± 0.09 mm and 0.76 ± 0.09 mm respectively. In majority of the branches and their morphometric investigations, such detailed split data was not available in the literature reviewed.

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