Iraqi Journal of Veterinary Sciences

www.vetmedmosul.com

Os cordis in local adult male ruminants: Histomorphological and histochemical study

H.A. Aoun[1] and A.B. Kadhim[2]

[1]Department of Nursing, Al-Zahrawi University College, [2]Department of Anatomy and Histology, College of Veterinary Medicine, University of Al-Qadisiyah, Al-Qadisiyah, Iraq

Article information

Article history:
Received 07 March 2025
Accepted 13 August 2025
Published 26 September 2025

Keywords:
Os cordis
Morphology
Histochemical
Ruminants

Correspondence:
A.B. Kadhim
abdulrazzaq.alrabei@qu.edu.iq

Abstract

This study investigated the morphological and histological characteristics of the os cordis, also known as the heart bone, in domesticated male ruminants that were grown in the local area. These ruminants included camels, buffaloes, bulls, rams, and billy goats. For the purpose of the study, fifty samples of hearts were taken from mature male ruminants. These samples were separated into two categories: morphological and histological. Following the completion of the morphological investigation, it was discovered that the os cordis was a huge bone elongated in shape. Both dextrum and sinistrum of the os cordis, were exhibit or showed in bull and the buffalo. On the other hand, whereas, the buffalo had a dextrum that was more extended and irregular in shape. whereas, the buffalo had a dextrum that was more extended and irregular in shape. Histological examination revealed comparable features among the studied animals. In camels, the spongy bone was surrounded by multiple cavities containing one marrow, fatty connective tissue, blood vessels, and trabeculae. PAS staining demonstrated varying degrees of interaction with bone tissue, with bulls exhibiting strong reaction whereas Camels, buffaloes, and rams showed mild staining. The histochemical examination confirmed these different degrees of interaction. Collagen fibers were present in most examined animals, whereas elastic fibers were consistently observed in all specimens.

DOI: 10.33899/ijvs.2025.158034.4171,

Introduction

Ruminants play a crucial role in society, ecosystems, and they contribute to nutrient cycling, support sustainable farming practices, and are essential for human food production. The visceral skeleton varies greatly amongst animals. Soft tissue ossification playing a key role in formation of the skeletal system. Few domestic animals have internal skeletons. Visceral skeleton bones include the os cordis, os penis, and os rosti (1) Fibrous trigons four fibrous rings of connective tissue, partially cartilage, or bone, make form the cardiac skeleton. Trigons are dense connective tissue with fibrocartilage, hyaline cartilage, and bone in some species (2). These abnormalities are sometimes described as ectopic bones (ossification of tissues outside their native origins) and heterotopic bones (bone creation in non-skeletal tissues). When there are two os cordis, the bigger, right-sided dextrum and the smaller, left-sided sinistrum can indeed be distinguished (3). All bovine species have the os cordis near the base of the heart, where the aorta and pulmonary arteries originate. The ossa cordis may stabilize cardiac contraction and relaxation by limiting valve dilatation (4). They also electrically isolate the atrium and ventricle, helping synchronize cardiac contractions and maintain They also electrically isolate the atrium and ventricle, helping aortic valve, pulmonary ostium, and atrioventricular orifice. Syrian hamster hearts use cartilaginous foci as pivots to counteract cardiac motion (5).

Previous and current studies on ruminant os cardia and comparisons are scarce. Given the importance of these animals, the project to examine the histomorphological and histochemical structures of their os cardia and to compare these structures among studied ruminant species

Materials and methods

Ethical approval

The Scientific Ethical Committee for the research was obtained from the Research Ethics Committee at the University of Al-Qadisiya, College of Veterinary Medicine, Iraq, approved this study issued on 22/11/2022, numbered P.G/1890.

Study animals

The study involved 50 clinically healthy adult male ruminants, with the heart samples purchased from a supplier in a livestock massacre in al Diwaniyah city.

Samples collection

Each of the samples was separated into two groups: the first group was used for morphological and morphometric analysis, while the second group was used for histological and histochemical examination of the os cordis.

The morphological study

involved the weight, location, shape, and external features of the os cordis, with photographs taken using a digital camera to document its gross anatomy. Morphometric parameters included relative weight (kg.), length, width, thickness (cm.) and volume (cm^3).

Histological study

Histological and histochemical analysis involved decalcification and routine staining procedures fixed in 10% NBF for 24-48hrs. Then decalcification involved immersing the bone in either EDTA or formic acid solution, with the volume of the working solution being twenty times greater than the volume of the samples. The duration of the decalcification process varies among different animals, ranging from hours to days in ram, Billy goat, and camels extend months in bull and buffalo depending on the size of the body. Histological techniques involved preparing tissue for microscopic examination, preserving microscopic anatomy, and making it hard for thin sections. This was achieved through a series of processes, including dehydration, clearing, infiltration, embedding, sectioning, mounting, staining including hematoxylin and eosin (H&E), periodic acid Schiff reagent (PAS), Alcian blue pH 2.5, Masson trichrome and Verhoeff stains (6), and examination via light microscopy. The histological sections were examined and photographed using light microscopy and an Olympus microscope at various magnifications and a Canon 7D digital camera (18 megapixels) was used for imaging. The statistical analysis was conducted using an LSD with a significance level of P≤ 0.05 for mean difference.

Results

The os cordis is a large, elongated bone embedded between the heart's trigones, where cardiac muscles are inserted. It is situated within the aortic fibrous ring at the right side of the heart, particularly next to the aorta. In camels, it has one os cordis (os cordis dextrum), which is a triangular shape with compressed sides (Figure 1). In bulls, it has two ends (right and left) and is pointed and flexible on the right end (Figure 2). In buffaloes, both ossa cordis present (dextrum and sinistrum). The os cordis dextrum (OCD) is embedded at the base of the aortic fibrous ring close to the boundary between the walls of two atria and two ventricles, traversing between and inserting into the right and left atrio-ventricular rings. The os cordis sinistrum (OCS) is smaller than the dextrum and is located below the left coronary artery (Figure 3). In rams and goats, the os cordis dextrum only exists in the deep interatrial septum, specifically positioned at the lower part of the valvula semilunaris septalis. The os cordis dextrum is only present in the ram (Figures 4 and 5). The mean total weight of the hearts of camels, bulls, buffaloes, rams, and billy goats was up to 3145.4±144.861 gm, 1334.8± 130.477 gm, 3800.4± 121.189 gm, 179.2±11.683 gm, and 215.4±10.071 gm, respectively. The mean relative weight of the os cordis in all animals was up to 0.57±0.12 gm, 0.70±0.15 gm, 0.3±0.057 gm, 4.54±1.41 gm, 0.526±0.15 gm, 0.11±0.02 gm, and 0.132±0.04 gm, respectively (Tables 1 and 2). The study examined the heart skeletons of bulls, buffaloes, rams, and billy goats. The bull heart was found to be a cancellous structure with slender bone trabeculae enclosing irregular marrow cavities. These trabeculae fused with a thin shell of compact bone, whereas the surrounding periosteum integrated with loose connective tissue rich in blood vessels.

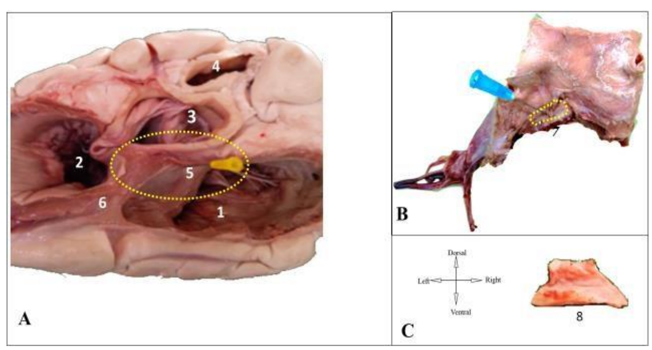

Figure 1: A, Morphological section of adult camel heart dorsal view, 1: ostium of R. atrio-ventricular,2: ostium of L. atrio-ventricular, 3: ostum of aorta, 4: ostum of pulmonary artery, 5: os cordis location,6: A.V.S: atrio -ventricular septum. B: aorta with ring leaflet of valve and O.C lateral view, C: shape of O.C bones in heart of camel.

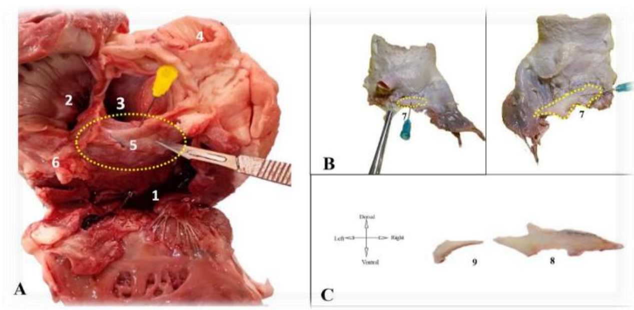

Figure 2: A, Morphological section of adult bull heart dorsal view,1: ostium of R. atrioventricular,2: ostium of L. atrio-ventricular, 3: ostum of aorta,4: ostum of pulmonary artery,5: os cordis location,6: atrio-ventricular septum. B,7: os cordis with aortic ring lateral view C:(8.dextrum, 9: sinistrum) os cordis bone.

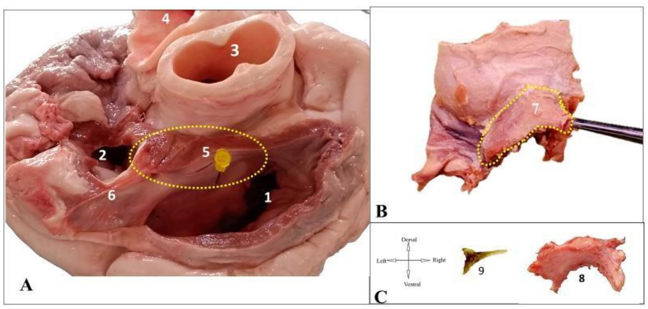

Figure 3: A, Morphological section of adult buffalo heart dorsal view,1: ostium of R. atrio-ventricular,2: ostium of L. atrio-ventricular, 3: ostum of aorta, 4: ostum of pulmonary artery,5: os cordis location, 6: atrio-ventricular septum. B,7: os cordis with aortic ring lateral view. C, (8. dextrum, 9: sinistrum) os cordis bone.

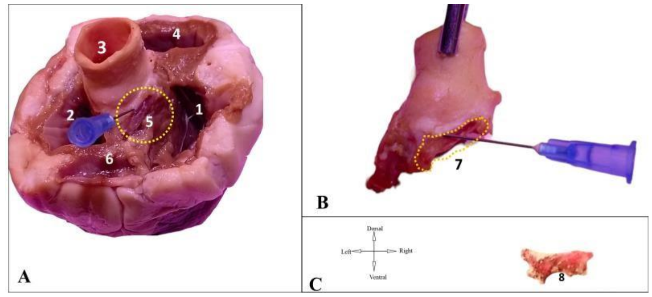

Figure 4; A, Morphological section of adult ram heart dorsal view,1: ostium of R. atrioventricular,2: ostium of L. atrio-ventricular, 3: ostum of aorta, 4: ostum of pulmonary artery,5: os cordis location, 6: atrio-ventricular septum. B,7: os cordis with aortic ring lateral view.C, 8: shape of os cordis ram bone.

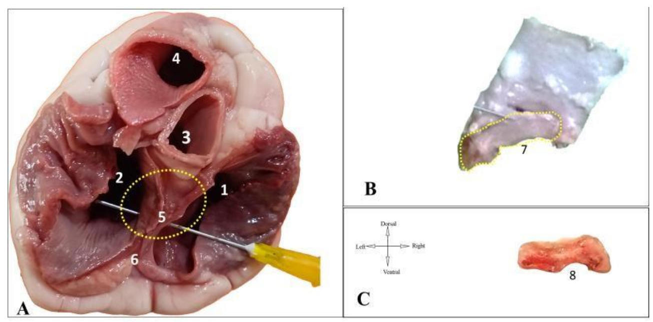

Figure 5: A, Morphological section in heart of adult Billy goat dorsal view,1: ostium of R. atrio-ventricular,2: ostium of L. atrio-ventricular, 3: ostum of aorta,4: ostum of pulmonary artery,5: os cordis location,6: atrio-ventricular septum. B,7: os cordis with aortic ring lateral view.C,8: shape of os cordis billy goat bone.

Table 1: The weight of heart, os cordis and relative weight

Species	heart weights (gm)	os cordis weights (gm)		Relative weights	
		OCD	OCS	OCD	OCS
Bull	1334.8±130.477	0.70±0.15	0.3±0.057	0.052±0.114	0.022±0.043
Buffalo	3800.4±121.189	4.54±1.41	0.52±0.15	0.119±1.163	0.013±0.123
Camel	3145.4±144.861	0.57±0.12		0.018±0.082	
Ram	179.2±11.683	0.11±0.02		0.061±0.171	
Billy goat	215.4±10.071	0.132±0.04		0.061±0.397	

The heart's skeleton was represented by two dextrum and sinistrum os cordis, developed within the central fibrous body and surrounded by aortic fibrocartilage. The heart's hyperdense structures showed specific areas where calcified cartilage tissue had formed bone marrow, consisting of fatty tissue, supportive stromal cells, numerous bone cells, and a filled with hematopoietic cells and megakaryocytes. The os cordis in rams showed a large cavity containing bone marrow surrounded by a compact bone zone and collagen fibers externally extended with cardiac muscle. The collars of the os cordis displayed many lacunae filled by osteoblasts and osteocytes, and bone marrow clearly consisted of megakaryocytes and hematopoietic cells (Figure 6). Histochemical results showed varying levels of interaction between the os cordis and bone across different studied animals Bulls had a strong interaction with bone attributed to their high neutral polysaccharide and mucin content, while camels, buffaloes, and rams had moderate interactions whereas Billy goats demonstrated weak interactions (Figure 7). Bulls had a strong interaction with the alcian blue and Masson's trichrome stain, while buffaloes, and rams showed a moderate interaction (Figures 8 and 9). The heart also contained elastic fibers in camels, bulls, buffaloes, rams, and Billy goats (Figure 10).

Table 2: The significant differences camels, bulls, buffaloes, Billy goats, and rams among in mean measurements of length, width, thickness, volume and weight of the os cordis

Animal		Weight gm	Length mm	Width mm	Thickness mm	Volume Cm^3
Bull	DEX	0.70±0.15 B	36.60±6.67 B	9.20±0.73 B	5.16±0.38 B	2.60±0.24 B
	SIN	0.30±0.05 B	20.83±0.52 B	5.75±0.64 B	3.24±0.51 B	0.20±0.03 B
Buffalo	DEX	4.54±1.41 A	54.80±2.39 A	17.70±1.22 A	10.74±0.45 A	6.76±0.68 A
	SIN	0.52±0.15 A	29.33±0.33 A	8.66±1.45 A	6.00±1.00 A	0.33±0.08 A
Camel		0.57±0.12 B	28.54±2.28 BC	8.62±1.12 B	5.40±0.24 B	0.30±0.03 C
Ram		0.11±0.02 B	15.00±1.58 D	4.16±0.60 C	1.00±0.00 D	1.16±0.21 B
Billy goat		0.13±0.04 B	19.20±1.24 CD	3.80±0.58 C	2.32±0.37 C	0.80±0.12 C
LSD		1.89	10.18	2.64	0.98	1.23

* Differences in the letters mean significant at P<0.05.

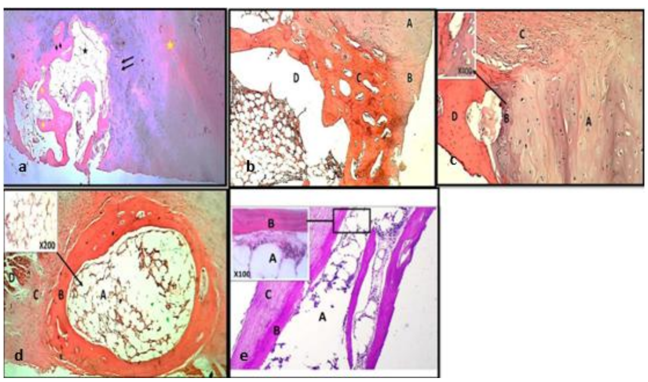

Figure 6: Histological sections of os cordis of adult male camel (a)buffalo (b), bull (c), ram(d) and goat (e) show connective tissue (A), sponge bone(periosteum) (B), cavities of bone marrow (c), Harversian cannel (D), bone marrow (E) trabecula's (F) and (G), adipose tissue (H), H&E (X 200).

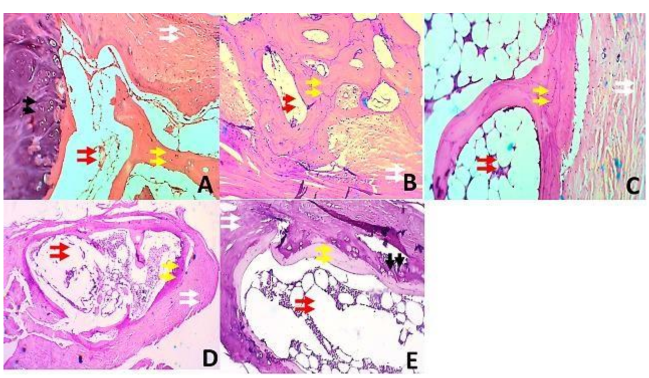

Figure 7: Histochemical sections of os cordis show: spongy (trabecular) bone (yellow arrow), connective tissue (white arrow), hyaline cartilage (black arrow), bone marrow (red arrow), camels(A), buffalo(B), bull(C), ram(D), Billy goat (E), PAS (X200).

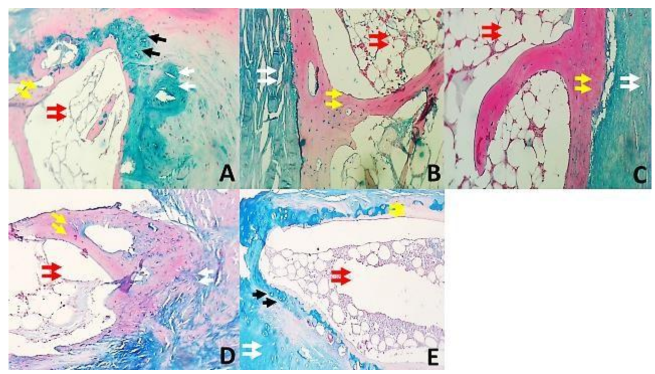

Figure 8: Histochemical sections of os cordis show spongy (trabecular) bone (yellow arrow), connective tissue (white arrow), hyaline cartilage (black arrow), bone marrow (red arrow), camels(A), buffalo(B), bull(C), ram(D), Billy goat (E), alcian blue (X 200).

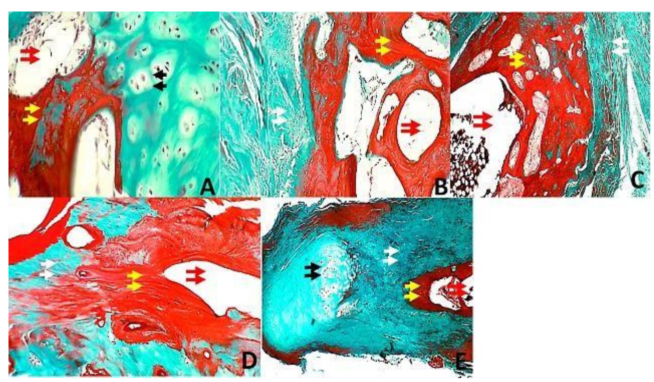

Figure 9: Histochemical sections of os cordis show: spongy (trabecular) bone (yellow arrow), connective tissue (white arrow), hyaline cartilage (black arrow), bone marrow (red arrow), camels (A), buffalo (B), bull (C), ram (D), Billy goat (E), Masson’s trichrome (X200).

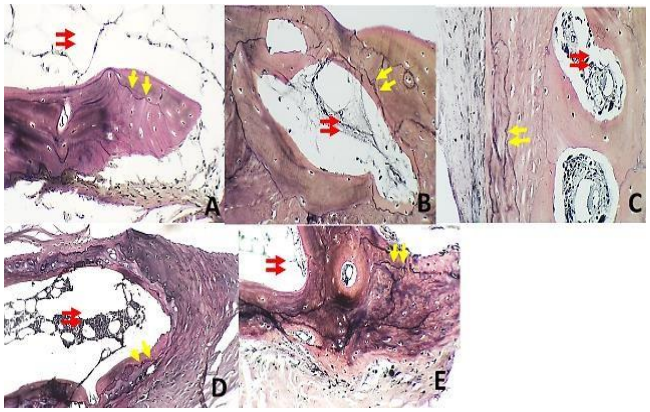

Figure 10: Histochemical section of os cordis shows: elastic fibers in sponge bone trabecular (yellow arrow), hyaline cartilage (black arrow) bone marrow (red arrow), camels (A), buffalo (B), bull (C), ram (D), Billy goat (E), Vierhoff's stain (X 200).

Discussion

Os cordis is usually related to the atrioventricular rings and major cardiac septa like the interatrial and interventricular septa. The os cordis' presence, quantity, size, form, and positioning vary according to specie. The camel had a single big, irregular-shaped dextrum os cordis at the base of the aorta between the septum of the atrium and the ventricles on the right side of the heart. Its main purpose is to support the heart during contraction and relaxation, especially by preventing aortic distortion (7). The bull os cordis is well-documented. Each person may have one or two dextrum and sinistrum os cordis. The right side of the heart houses the principal os cordis, the os cordis dextrum, near the interventricular and interatrial septa. It extends into the right atrioventricular ring from below. The os cordis dextrum was located superior to the bundle of His and directly across from the atrioventricular node, and the small os cordis implanting into the left atrioventricular ring, called the sinistrum site, was relatively reliable across individuals (7). Deer bones sustain both heart valves. Buffalo has a longer, uneven os cordis dextrum and a smaller sinistrum (8). Os cordis dextrum (OCD) and os cordis sinistrum (OCS) differ in weight, length, width, thickness, and volume, with the former being larger and the latter smaller.

We believe the animal's greater weight and heart's increased efficiency in pumping vast amounts of blood throughout the body caused bone on both sides. Most importantly, bones are needed to support heart valves, atrioventricular fibrous rings, and major blood arteries. In contrast, OCD and OCS, which are positioned under the coronary arteries, do not support blood vessels (9). All ram hearts have the right os cordis, a 10-15mm bone, while 10 heart samples had the sinistrum (10). No cartilaginous connections were found between the bones. The os cordis dextrum always blocked the bundle of His' course, causing it to deviate beneath the bone (11).

The Billy goat's right os cordis is near the anterior septum between the ventricles and atria. Billy goats had leaner and longer os cordis than rams without protrusions. Like ram, all hearts studied lacked os cordis sinistrum (11,12). The study analyzed male adult camel, bull, buffalo, ram, and Billy goat heart weight. Animal weight caused considerable heart weight disparities. Camels' heart shape differs from other animal species' bone mass distribution. The study also detected os cordis dextrum in adult camel, buffalo, bull, ram, and Billy goat hearts. Buffalo and bull hearts had two bones with differing amounts of dextrum and sinistrum os cordis. Several factors explain the discrepancies in cardiac bone anatomical measurements (length, width, thickness, volume, and weight) between the animals in this study and the results. Buffalo as belonging to Artiodactyla-Bovidae. Buffalo and other animals in this division vary in species and Ecological diversity Rams and Billy goats are Artiodactyl -Caprinae predators. The *Antiodactyia camelidae* classification (13), humped camels are classified this way.

In addition to anatomical measurements, inherited factors affect the presence of the os cordis in some animals' hearts. Type-specific parametric parameters are closely connected. We also believe that crossbreeding between breeds causes heart bone appearance and these differences, as well as pressure conditions to which the heart is exposed and according to the nature of the animal, especially in grazing and food-gathering methods, as the animal's conditions vary from place to place and from one feeding method to another. Our histological findings in all animals show that endochondral ossification develops os cordis (14).

Our study found that endochondral ossification, when cartilage becomes bone tissue, rather than intramembranous ossification, which deposits mesenchyme directly, forms the os cordis. We found that mature camels retain hyaline and fibrous cartilages, unlike buffalo, ram, Billy goats and horses (15-18). Only cats and dogs lack endochondral ossification. Canine hearts have cartilage that is strongly related to bone tissue (19). Some typical hyaline cartilage with a basophilic matrix became calcified cartilage with an uneven red and eosinophilic matrix early in bone development. Calcified cartilage gradually becomes irregular bone lamellae-adorned spongy bone. The spongy bone had many adipocytes, osteocytes, red, and white bone marrow. Increased calcium ion precipitation causes ossification.

According to Otters (20) often have 1-3 cartilage pieces and cartilage with early ossification beside their bones. Specific bone tissues or cell types can be identified with special staining. This study used specialized stains such periodic acid-schiff (PAS) stain to distinguish glycogen and glycoprotein in bone tissue. Alcian blue (AB) stain reliably detects acidic sugars, specifically glycosaminoglycan's in bone and cartilage ground material. The verhoffer stain also detects bone elastic fibers. Specific stains were used to confirm bone and cartilage. Each cardiac os cordis was PAS stained to determine the types of neutral mucopolysaccharides and macromolecules (glycogen and glycoprotein). Microscopic examinations showed thicker red fibers around bone and cartilage tissue. Camels, buffaloes, and rams stained positively, save for the Billy goat. Like certain mammals with os cordis (21-23). The heart's cartilage was stained with Alcian blue to identify acid mucopolysaccharides. Camels and Billy goats had inadequate cartilage tissue decalcification, while other species had a negative reaction for cartilage and os cordis. Less or no acidic mucopolysaccharides in Artiodactyl os cordis. Due to high collagen fibers in bone and cartilage, camel, buffalo, bull, ram, and billy goats react positively to Masson's trichrome stain (24,25). According to various researches, os cordis affects aged hearts. Otter hearts, like nyala and giraffe hearts, were found. Verhoeff stain can identify elastic fibers in cartilage and bone. We found no elastic cartilage during bone development. Instead, we found collagen-merged elastic fibers in the same bone. Thus, bone is considered a supporting connective tissue. Thus, every animal examined showed its excellence, as well as Elastic fibers give organs and tissues elasticity and endurance. Young animals have these fibers it in their bones, whereas adults rarely do (26-29).

Conclusions

Anatomically, camels, rams, and billy goats have os cordis dextrum on the right side of the heart between the right and left atrioventricular orifices, while buffalo and bulls have both. The os cordis dextrum and sinistrum were uneven. Camel, bull, buffalo, ram, and billy goat anatomy differed significantly. Buffalo has the greatest proportion. Histologically, os cordis tissue has bone marrow surrounded by compact bone or spongy bone surrounded by connective tissue, like the rest of the body. Adult bull, buffalo, ram, and billy goat cartilage decalcifies completely, whereas camel cartilage does not. All animals' os cordis structures showed a positive reaction for PAS stain, indicating a large amount of neutral polysaccharide and mucine in the ground substance, while AB stain (PH 2.5) showed a weak reaction, indicating a small amount of acidic mucopolysaccharides or none. Masson's trichrome stain and Vierhoff's stain showed favorable findings because the os cordis bone tissue contains collagen and elastic fibers.

Interest of conflict

None.

Acknowledgments

The College of Veterinary Medicine supported this research, Worthy of appreciation University Al-Qadisiya, Iraq, and the Department of Anatomy, Histology, and Embryology.

References

1. Alsafy MA, El-Gendy SA, Atkinson B, Sturrock CJ, Kamal BM, Alibhai A, Rutland P. Novel insights into the architecture of macro and microstructures in cattle *ossa cordis*. Microsc Microanal. 2024;30(3):574–93. DOI: 10.1093/mam/ozae046
2. Anderson RH, Yanni J, Boyett MR, Chandler NJ, Dobrzynski H. The anatomy of the cardiac conduction system. Clin Anat. 2009;22(1):99–113. DOI: 10.1002/ca.20700
3. Arackal A, Alsayouri K. Histology heart. In: StatPearls. USA: StatPearls Publishing; 2024. [available at]
4. Aretz I. Das Herzskelett von Schaf (*Ovis aries*) und Ziege (*Capra hircus*) [Ph.D. dissertation]. Munich: University of Veterinary Medicine; 1981.
5. Balah A, Bareedy MH, Abuel-Atta AA, Ghonimi W. Os cordis of mature dromedary camel heart (*Camelus dromedarius*) with special emphasis on cartilago cordis. J Adv Vet Res. 2014;1:130–5. DOI: 10.4172/2157-7579.1000193
6. Al-Mahmood SS, Khalil KW, Edreesi AR. Histopathology and Immunohistochemistry of tumors in animals attending veterinary teaching hospital. Iraqi J Vet Sci. 2022;36(2):309-314. DOI: 10.33899/ijvs.2021.130114.1733
7. Berendsen AD, Olsen BR. Bone development. Bone. 2015;80:14–8. DOI: 10.1016/j.bone.2015.04.035
8. Best A, Egerbacher M, Swaine S, Pérez W, Alibhai A, Rutland P, Sturrock C. Anatomy, histology, development and functions of *ossa cordis*. Anat Histol Embryol. 2022;51(6):683–95. DOI: 10.1111/ahe.12861
9. Best AS. Investigation into mammalian os cordis and cartilago cordis [master's thesis]. England: University of Nottingham; 2022. [available at]
10. Bhagawan PS, Kumar PN, Uppal PK. Chondro-osteoid metaplasia in ram hearts (a pathological study). Indian J Anim Health. 1978;17:115–6. DOI: 10.1177/104063870701900509
11. Bishop JE, Lindahl G. Regulation of cardiovascular collagen synthesis by mechanical load. Cardiovasc Res. 1999;42(1):27–44. DOI: 10.1016/S0008-6363(99)00021-8
12. Boersema S, da Silva J, Mee J, Noordhuizen J. Farm health and productivity management of dairy young stock. Netherlands: Wageningen Academic Publishers; 2010.
13. Carosi M, Scalici M. Baculum (os penis). In: Fuentes A, editor. The international encyclopedia of primatology. USA: John Wiley and Sons; 2017. 1–5 p.
14. Chen L, Qiu Q, Jiang Y, Wang K, Lin Z, Li Z, Zhang X, Huang T. Large-scale ruminant genome sequencing provides insights into their evolution and distinct traits. Science. 2019;364(6446):eaav6202. DOI: 10.1126/science.aav6202
15. Crick SJ, Sheppard MN, Ho SY, Gebstein L, Anderson RH. Anatomy of the pig heart: comparisons with normal human cardiac structure. J Anat. 1998;193:105–19. DOI: 10.1046/j.1469-7580.1998.19310105.x
16. Daghash SM, Farghali HA. The cardiac skeleton of the Egyptian water buffalo (*Bubalus bubalis*). Int J Adv Res. 2017;4:1–13. DOI: 10.22192/ijarbs.2017.04.05.001
17. De Almeida MC, Sánchez-Quintana D, Davis N, Charles FR, Chikweto A, Sylvester W, Loukas M. The ox atrioventricular conduction axis compared to human in relation to the original investigation of Sunao Tawara. Clin Anat. 2020;33(3):383–93. DOI: 10.1002/ca.23524
18. Dubansky BH, Dubansky BD. Natural development of dermal ectopic bone in the American alligator (*Alligator mississippiensis*) resembles heterotopic ossification disorders in humans. Anat Rec. 2018;301(1):56–76. DOI: 10.1002/ar.23682
19. Dupuy G. L'os du cœur du cerf. Les Cahiers Cynegetiques du Naturaliste. Montbel; 2011. [available at]

20. Durán AC, López D, Guerrero A, Mendoza A, Arqué JM, Sans-Coma V. Formation of cartilaginous foci in the central fibrous body of the heart in Syrian hamsters (*Mesocricetus auratus*). J Anat. 2004;205(3):219–27. DOI: 10.1111/j.0021-8782.2004.00336.x
21. Dyce KM. Dyce, Sack, and Wensing's textbook of veterinary anatomy. 5th ed. Netherlands: Elsevier; 2018.
22. Egerbacher M, Weber H, Hauer S. Bones in the heart skeleton of the otter (*Lutra lutra*). J Anat. 2000;196(3):485–91. DOI: 10.1046/j.1469-7580.2000.19630485.x
23. El-Gendy SA, Alsafy MA, Rutland CS, Ez Elarab SM, AbdElhafeez HH, Kamal BM. *Ossa cordis* and *os aorta* in the one-humped camel: computed tomography, light microscopy and morphometric analysis. Microsc Res Tech. 2023;86(1):53–62. DOI: 10.1002/jemt.24256
24. Endo H, Sakai T, Itou T, Koie H, Kimura J. Macroscopic observation and CT examination of the heart ventricular walls in the Asian elephant. Mammal Study. 2009;30:125–30. DOI: 13486160(2005)30[125:MOACEO]2.0.CO;2
25. Erdoğan S, Lima M, Pérez W. Inner ventricular structures and valves of the heart in white rhinoceros (*Ceratotherium simum*). Anat Sci Int. 2014;89(1):46–52. DOI: 10.1007/s12565-013-0199-5
26. Frink RJ, Merrick B. The sheep heart: coronary and conduction system anatomy with special reference to the presence of an os cordis. Anat Rec. 1974;179(2):189–200. DOI: 10.1002/ar.1091790204
27. Livak KJ, Schmittgen TD. Analysis of relative gene expression data using real-time quantitative PCR and the 2−ΔΔCT method. Methods. 2001;25(4):402–8. DOI: 10.1006/meth.2001.1262
28. Elsheikh EM, El-Hady E, Abdallah SH, Selem AA, Konsowa MM. Histogenesis of the rabbit liver (pars hepatica) with particular reference to the portal area. Iraqi J Vet Sci. 2023;37(1):177–82. DOI: 10.33899/ijvs.2022.133722.2284
29. Kadhim AB, Almhanna HK, Sharoot HH, Al-Redah SA, Al-Mamoori NA. Anatomical and histological study of the kidney of the one-humped camel. Iraqi J Vet Sci. 2023;37:72–9. DOI: 10.33899/IJVS.2023.1372310.2655

عظمة القلب في ذكور المجترات: دراسة هستومورفولجية وهستوكيميائية

هادي عبد عون[١] و عبد الرزاق باقر كاظم[٢]

[١]قسم التمريض، كلية الزهراوي الجامعة، [٢]فرع التشريح والأنسجة، كلية الطب البيطري، جامعة القادسية، القادسية، العراق

الخلاصة

هذا الدراسة بحثت في الخصائص الشكلية والنسجية لعظم القلب، المعروف أيضًا بعظم القلب، في المجترات الذكور المستأنسة التي تم تربيتها في المنطقة المحلية. شملت هذه المجترات الجمال، والجاموس، والثيران، والأغنام، والماعز الذكور. لغرض الدراسة، تم أخذ خمسين عينة من قلوب المجترات الذكور البالغة. تم تقسيم هذه العينات إلى فئتين: مورفولوجية ونسجية. بعد الانتهاء من البحث المورفولوجي، تم اكتشاف أن عظم القلب كان عظمة ضخمة وممدودة الشكل. كل من الديسترم والسينستروم من عظم القلب تم عرضهما أو إظهارهما في الثور والجاموس. من ناحية أخرى، كان لدى الجاموس دكستروم أكثر اتساعًا وغير منتظم في الشكل. كشف الفحص النسيجي عن خصائص قابلة للمقارنة بين الحيوانات المدروسة. في الجمال، كان العظم الإسفنجي محاطًا بعدة تجاويف تحتوي على نخاع العظم، والأنسجة الضامة الدهنية، والأوعية الدموية، والتربيق. أظهرت صبغة حامض البريودك كاشف سيف درجات مختلفة من التفاعل مع النسيج العظمي، حيث أظهرت الثيران تفاعلًا قويًا، بينما أظهرت الجمال والجاموس والأغنام تلوينًا خفيفًا. أكد الفحص الكيميائي النسيجي هذه الدرجات المختلفة من التفاعل. كانت ألياف الكولاجين موجودة في معظم الحيوانات التي تم فحصها، بينما لوحظت ألياف المرونة بشكل متسق في جميع العينات.