Popular Article

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Comparative gross anatomy of the Heart in Human (*Homo sapiens*), Dog (*Canis lupus familiaris*), Horse (*Equus caballus*), and Ox (*Bos taurus*)

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★ Key message

- Although the human, dog, horse, and ox hearts share a common four-chambered mammalian design, they exhibit significant species-specific differences in size, shape, orientation, valve morphology, and supporting structures that reflect adaptations to body size, physiology, and lifestyle.
- Understanding these anatomical variations is essential for comparative anatomy, veterinary cardiology, species-specific surgical procedures, and the interpretation of cardiovascular function and disease across different mammalian species.

Abstract

The heart is a vital muscular organ responsible for maintaining systemic and pulmonary circulation in vertebrates. While the basic structural plan is conserved across mammals, distinct interspecies variations exist in morphology, weight, orientation, and internal architecture, reflecting adaptations to body size, physiology, and lifestyle. This study is aimed to document and compare gross anatomical features of the heart in humans, dogs, horses, and oxen. Observations were based on available anatomical literature and dissection reports. Significant differences were noted in size, shape, cardiac axis orientation, valve morphology, and the presence of additional structures such as *ossa cordis* in oxen. These differences have clinical implications for veterinary and comparative cardiovascular medicine.

Keywords: Heart, anatomy, human, dog, horse, ox, *ossa cordis*

1. Introduction

The mammalian heart exhibits a conserved four-chambered design; however, species-specific variations in its morphology are influenced by metabolic demand, thoracic conformation, and evolutionary adaptations (Nickel et al., 1979; Dyce et al., 2017). Comparative cardiac anatomy is not only of academic interest but also of practical value in clinical cardiology, veterinary medicine, and surgical interventions (Getty, 1975; König & Liebich, 2020). In humans (*Homo sapiens*), the heart is adapted for an upright posture, while

in quadrupeds such as the dog (*Canis lupus familiaris*), horse (*Equus caballus*), and ox (*Bos taurus*), the orientation and supporting structures differ significantly. This study provides a detailed comparative account of the gross anatomy of the heart in these four species.

2. Materials and Methods

Hearts from adult specimens of the dog (*Canis lupus familiaris*), horse (*Equus caballus*), and ox (*Bos taurus*) were collected during postmortem examinations conducted at the FVSc & AH, Shuhama Alusteng. Only specimens without gross pathological lesions of the cardiovascular system were selected for the study to ensure normal anatomical representation. Following collection, the hearts were thoroughly rinsed with physiological saline to remove residual blood and preserved in 10% neutral buffered formalin until examination. Detailed morphometric measurements including length, width, circumference, and weight were recorded using a calibrated measuring tape and digital weighing scale. External and internal anatomical features were carefully examined and documented. For reference and comparative illustration, detailed anatomical descriptions and high-resolution photographs of the human heart were obtained from preserved specimens available in the Anatomy Division. All photographic documentation was performed using a digital camera with macro capability under consistent lighting conditions.

3. Results and Discussion

The human heart was broad and conical, weighing approximately 300–350 g (Moore et al., 2018). It had four surfaces (sternocostal, diaphragmatic, and two pulmonary) and distinct right and left borders. The long axis was moderately oblique (Fig. 1). The right atrioventricular (AV) valve was tricuspid, and the left AV (mitral) valve was bicuspid, each semilunar valve having three cusps. No *ossa cordis* was present.

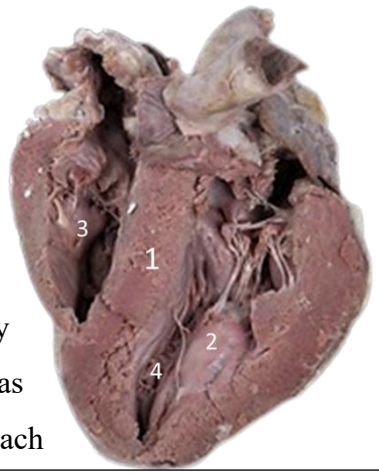

Fig.1 Longitudinal section of human

1. Interventricular septum 2. Papillary muscle 3. Right ventricle 4. Left ventricle

The heart of dog was ovoid, with a blunt, rounded apex. The long axis was highly oblique, with the base facing the thoracic inlet and the apex near the sternal diaphragm (Fig.2). The heart weighed about 155 g (Evans & de Lahunta, 2013). The tricuspid valve had two major cusps and three or four minor cusps; the mitral valve had two large and four to five small cusps.

Fig.2 Plasticated heart of dog

An intermediate groove was present, and the right ventricle contained four *musculi papillares*. No *ossa cordis* was present.

1. Atrium 2. Right ventricle 3. Left ventricle

The heart in equines had a broad base and shorter base-to-apex length compared to humans. The long axis was more oblique, and the anterior border was strongly convex (Fig. 3) It weighed approximately 2.9–3.1 kg (Nickel et al., 1979). The intermediate groove was absent. Instead of *ossa cordis*, the aortic ring on the right side contained a cartilaginous plate. The right AV valve was functionally bicuspid.

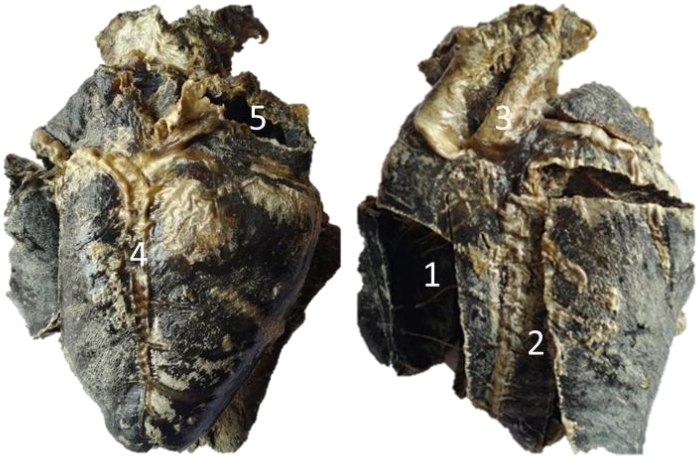

Fig. 3 plasticated heart of equine

1. Right ventricle 2. Left ventricle 3. Pulmonary trunk 4. Longitudinal groove 5. Left atrium

The heart of ox was large, weighing around 2.5 kg. It had a strongly convex anterior border and a shorter posterior border (Fig.4). The coronary groove nearly encircled the heart, separating atria from ventricles. Both left and right longitudinal grooves were well-defined, with an additional shallow intermediate groove. A fibrocartilaginous *ossa cordis* was present at the base of the aortic valve, providing structural support. The right AV valve was functionally bicuspid.

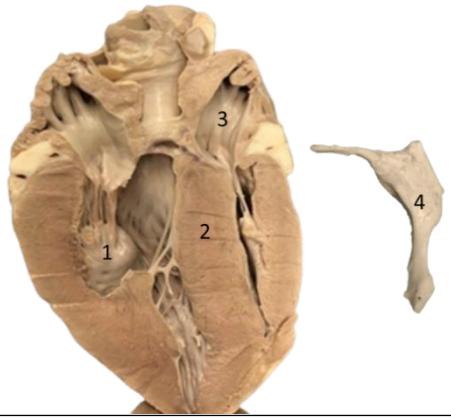

Fig.4 Longitudinal section of heart of ox

1. Papillary muscle 2. Interventricular septum 3. Right atrium 4. Ossa cordis

Although the overall plan of the heart is conserved across mammals, notable interspecies variations were observed. Humans had relatively smaller, upright-oriented hearts adapted for bipedal circulation. Dogs had a proportionally smaller heart with high obliquity, reflecting their thoracic conformation. Horses possessed large, powerful hearts suited for high-speed endurance, while oxen had robust hearts with structural reinforcements such as *ossa cordis*, possibly aiding in maintaining valve stability in large ruminants (Nickel et al., 1979; Frink & Merrick, 1974). The variation in AV valve structure—tricuspid in humans and dogs versus functionally bicuspid in horses and oxen—highlights evolutionary adaptations in large herbivores. The presence or absence of an intermediate groove also varied between species.

Conclusion

The comparative study demonstrates that while the mammalian heart maintains a common four-chambered architecture, significant variations exist in external morphology, orientation, weight, and internal valve structure. Such differences are essential to consider in veterinary cardiology, species-specific surgical approaches, and evolutionary biology.

Conflict of interest: There is no conflict of interest between the authors

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