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Heart biometry of domestic poultry bird

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Abstract

A biometrical study were conducted on the heart of poultry bird revealed that the average weight was 8.92 ± 0.28 g, the mean percentage ratio between the length of rostral and caudal borders was 54:46 and the circumference at the coronary groove was 6.94 ± 0.06 cm. The right and left longitudinal grooves anastomosed with each other 1.06 ± 0.09 cm above the apex of the heart on the right side. The distance between the termination of caudal venacava and the apex of the heart was less (3.36 ± 0.13 cm) than the distance between the latter and origin of pulmonary artery (3.84 ± 0.13 cm). The cardiac skeleton was characterized by the presence of hyaline cartilage. The rostrocaudal diameter of the base of heart was greater (3.11 ± 0.08 cm) than the transverse diameter (2.18 ± 0.09 cm). The cross-sectional area of common aorta (46.00 ± 3.12 mm²) was greater than the area of pulmonary artery (32.36 ± 2.16 mm²). The total area of two anterior aortae (8.46 mm²) was lesser than the area of caudal aorta (10.6 mm²). The moderator bands could not be seen in both the ventricles.

Keywords: Biometry, heart, poultry bird

Introduction

Poultry sector is one of the fastest growing sectors in the production of food animals in India. India currently ranks fifth in broiler chicken production in the world. The heart of ox ^[6] and biometry of heart of buffalo and small ruminants have been reported ^[2, 3, 4]. However, detailed such records on the heart of poultry are rare ^[7].

Material and Methods

The hearts of 22 broiler birds were collected from poultry farm, Jaipur. The hearts were washed off their contents and the following parameters for formalin fixed individual heart were recorded.

1. Weight of the heart.
2. Length of the rostral and caudal borders from base to the apex.
3. Length of heart from middle of the base (of the left side) to the apex.
4. Sagittal and transverse diameters of the base of heart.
5. Circumference of heart measured along the coronary groove with the help of meter
6. Tape/thread.
7. Distance between apex of heart and (a) junction of right and left longitudinal grooves (b) origin of pulmonary
8. Artery and (c) termination of posterior vena cava.
9. Thickness of (a) right and left wall of heart; and (b) interventricular septum at upper,
10. Middle and lower third of the heart.

Also, the walls and inter-ventricular septum of the heart specimens were cut in the dorsal, middle and ventral third and measured (thickness) with the help of scale/ Vernier callipers. The heart was then dissected out to locate the cardiac bones/cartilage

Results and Discussion

The heart of fowl was proportionally larger and was placed on the median line. It weighed 8.92 ± 0.28 g which was 1% of the body weight. The apex of heart lied in the anterior part of fissure formed by two lobes of the liver. The right auricle was larger than left, whereas the right ventricle was small, narrow and crescentic in shape and the left ventricle was larger than right and circuloid in shape. Its lumen in fixed specimens varied in shape at different levels of the heart. It was triangular/Y shaped, rhomboidal and circuloid in the upper, middle and lower third of the heart, respectively. The upper two-thirds of the rostral convex border was formed

by the right ventricle and the lower one-third by the left ventricle. The posterior border was slightly shorter; thicker, nearly straight and was formed by the left ventricle. The anterior border was

longer than posterior one and the mean percentage ratio between their length was 54:46 (Table 1).

Table 1: Heart biometry in poultry in Jaipur area

	Parameters	Range		Mean \pm SE	
Weight of heart (g)		6.22-10.86		8.92 \pm 0.28	
Length (cm)	Rostral border	3.6	-4.6	4.15	\pm 0.18
	Caudal border	3	-4	3.53	\pm 0.17
	Heart (base to apex)	3.6	-4.6	4.08	\pm 0.16
	Circumference at the coronary groove (cm)	6.5-7		6.94 \pm 0.06	
Distance (cm) between apex and	Junction of left and right longitudinal groove	0.75-1.3		1.05 \pm 0.09	
	Origin of pulmonary artery	3.2-4		3.83 \pm 0.13	
	Termination of caudal vena cave	3-3.8		3.36 \pm 0.13	
Diameter of base (cm)	Transverse	1.9	-2.5	2.18	\pm 0.09
	Antero-posterior	3-3.5		3.11 \pm 0.08	
	Thickness (mm) of ventricular walls at its :				
Dorsal third	Right ventricular wall	1.6	-3.6	2.36	\pm 0.13
	Left ventricular wall	4-8.5		6.56 \pm 0.33	
	Inter-ventricular septum	5.5-7		6.0 \pm 0.34	
Middle third	Right ventricular wall	0.5	-1.5	1.17	\pm 0.08
	Left ventricular wall	4	-8	6.36	\pm 0.24
	Inter-ventricular septum	5.3	-5.9	5.86	\pm 0.12
Ventral third	Right ventricular wall		0		0
	Left ventricular wall	5.5	-6.5	5.83	\pm 0.13
	Inter-ventricular septum		0		0
Area (mm ²):					
Common aorta		34-56		46.00 \pm 3.12	
Pulmonary artery		24-36		32.4 \pm 2.16	
Caudal aorta		8-12		10.6 \pm 1.16	
Rostral aorta	1	3-6		4.28 \pm 0.36	
	2	3.2-4.6		4.19 \pm 0.02	

The right surface was formed more than one-third by right ventricle and the rest by the left ventricle. There was one transverse and two longitudinal grooves (right and left) evident on the external surface of heart. The intermediate groove reported [6] in ox could not be seen. The right and left grooves curved towards each other and anastomosed at the lower one third of the surface, a little above (1.06 \pm 0.09 cm) the apex of the heart (Table). Also some worker recorded that the right groove descends upto 3-4cm above the apex of the heart in horse [8]. The thickness of cardiac musculature (ventricular walls and interventricular septum) of fowl gradually decreased (Table 1) as reported in sheep [4]. Probably the greatest thickness of cardiac walls in the dorsal part may be due to greater activity of heart for propulsion of blood in systemic circulation.

Comparatively thinner cardiac wall at the apex of the heart may predispose deeper penetration of foreign object in the traumatic pericarditis as in sheep [4]. The right ventricular wall was thinner (1.17 \pm 0.08 mm) in the middle third of heart and its thickness decreased (50%) in relation to that of (2.36 \pm 0.13 mm) dorsal part and ventrally it was absent. Left ventricular wall was thicker than the interventricular septum and both of these showed maximum thickness (6.56 and 6.0 mm) in dorsal cardiac region and decreased 11% and 10% respectively in the ventral third (Table 1). Variable decrease (17 to 18%) of the ventricular walls has been reported in sheep [4]. The moderator bands were inconspicuous in both the ventricles. The left auriculo-ventricular opening was guarded by single cusp which was supported by respective thin chordae tendinae and the right one was guarded by thin membrane without any chordate tendinae. Range and mean values of the luminal cross sectional area (Table 1) of different arterial vessels showed greater area of the aorta (46.00 \pm 3.12 mm²) than that of the pulmonary artery (32.40 \pm 2.16 mm²). The difference in the size of cross sectional area may probably be due to histo-architectural organization and factors precipitating cardiac arrest at the time of death. The cross sectional area of each of the rostral aortae was in approximation (Table 1).

However, the total cross-sectional area of both these aortae (8.46 mm²) was lesser than that of the caudal aorta (10.6 mm²). The total cross-sectional area of rostral aortae and caudal aorta represented 18.40 and 23.50 percent of the size of common aorta. The caudal aorta has been reported to be larger than the rostral one in different domestic animals [1,6,8]. Probably the presence of two anterior aorta perhaps is to ensure equal and adequate blood supply to both the sides in the anterior part of the body as in birds it is comparatively more voluminous than the caudal part in comparison to other domestic animals.

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