Anatomical & morphological study of the heart's chambers & valves in one humped camel *Camelus dromadarius*

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Abstract

(25) specimene of camel heart, from both sexes (9 female, 16 male) with different age ranging (4-12 years) were included in this study. The blood vessels were injected by rubber material as emulsion (Latex) mixing with colouring material carmine (red colour). The site of injection is coronary arteries by using surgical canula gauge-19. The study revealed that the camel heart is funnel like in shape wide in base and pointed in the apex, the cardiac notch was clearly appeared by inspection of camel heart and the left ventricular cavity elongated and reach to the apex, the left atrioventricular valve has two large, tough, thickened cusps connected by strong fibrous band chordae tendinae to two papillary muscles in the left ventricle of camel heart. While the right atrioventricular valve have three cusps connected by chordae tendinae to three papillary muscles (Cranial + Septal and Parietal). The results of this study concluded that the camel heart characterized by absence of vena azygus. The diameter of the left coronary artery is lesser than the right one also the right ventricular cavity was appeared rounded somewhat, and not reached the apex (5 cm from the apex). The anastomosis of coronary arteries and vein are different from its corresponding in other domestic animals.

Introduction

The heart is located centrally or slightly to the left side, and toward the apex of the thoracic cavity lying between the two lungs. This fact is regarded as general in most domestic animals. The heart is chiefly a muscular pump that occupies the pericardial cavity, the walls consists of an endocardium, myocardium, epicardium, which correspond, respectively to the tunca intima, adventitia tunca of the arteries. (Kent & Carr, 2001; Tilley, 1977; Getty, 1975; Ettinger & Suter, 1970; Ott, 1964). The mass of the heart, the myocardium is suspended within a tough membrane called the pericardium that provides attachment to the dorsal wall and apex of the thorax in all mammals the heart have four chambers, two atria and two ventricles, these part of the heart normally beat in an orderly consequence, contraction of the atria is followed by contraction the ventricles called ventricular systole, and during diastole stage all four chambers are relaxed. (Barker, 1993; Ganong, 1971; Marshall and Shepherd, 1968). The atrium is a large thin walled muscular sac that is a sort of staging area for blood that is about to enter the ventricle, which has very thick muscular walls and is actual pumping portion of the heart. The right and left atria of mammals are completely separated by interatrial septum. They are confluent during embryonic development via an international foramen, or foramen ovalae, which closes near the time of birth. The site of the obliterated foramen is marked in adult mammal's hearts by depression, the fossa ovalae in the medial wall of the right atrium. (Mansman et al., 1982; Currie, 1988). The major blood vessels enter the base of heart at acraniodorsal location, the apex of the heart lies in contact with the diaphragm, the pulmonary vessels pass bilaterally to and from the lung. (Kent and Carr, 2001; Mansmann et al., 1982; Ott and Suter, 1970). The major trunk vessels pass more dorsally, forward and back, along the dorsal wall of the thorax. The pulmonary artery arise from the conus arteriosus of the right ventricle and after crossing the aorta curves dorso posteriorly, dividing into right and left pulmonary artery to the lung (Shievely, 1984; Getty, 1975). Aorta is two
parts, ascending aorta which is the portion within the pericardium, gives rise only two branches, namely the right and left coronary arteries which leaks the aorta close to its origin and run downward over the heart supplying its walls. The aortic Arch crosses ventral to the trachea then turns dorsally and posteriorly to the left of the trachea, and continuing downward as descending aorta (Getty, 1975; Sisson, 1953). The left atrium receives blood from pulmonary veins, the muscular walls that line the ventricular cavities exhibits sturdy interanastomosing muscular ridges and columns, the tunca trabeculae, they strength the walls, of these powerful pumps and increase the force exerted by them (Shievely, 1984; Sack and Habel, 1982). One way valves guard the passage way from the atria into ventricles, each valve consists of one or more fibrous flaps cusps connected by tendenous cord (Chordae Tendinae) to papillary muscles that project from the ventricular walls. During relaxation of the ventricles is (diastole). The blood from the atria flows freely past the cusps and into the ventricles, during ventricular contraction (systole). (Barker, 1993; Marshall and Shepherd, 1968). The cusps are forced forward or upward into the atrioventricular passage way, preventing reflux of blood into the atria. Each valve has cusps, into the atria. Each valve has cusps, the left valve has two cusps (bicuspid valve) or called (mitral valve) and the right has three cusps (tricuspid valve). Semilunar valve at the exits of the ventricle, into the pulmonary and aortic trunks prevent back flow into the ventricle as the latter prevent back flow into the ventricle as the latter relax. (Currie, 1988; Ganong, 1971). The characteristic anatomical features of the camel heart, is very important work in order to facilitate the study of camel heart, Cavities and valves, because the shape of the camel heart is different from the hearts for the other animal species. it is wide at the base and more pointed at the apex with wide, thicket large blood vessels walls (Merhish, 2003)

Materials and methods

Twenty five specimen camel hearts from both sex (9 female + 16 male) at different age (4-12 Years old) were used in this study. All camel hearts were collected from different slaughter house in Iraq (Najaf + Baghdad + Koot and Babylon). The specimens were then washed by running tape water and fixed in (10%) formalin solution for (72) hours. The injection of the two coronary arteries was carried out by using surgical canula (Gauge 19) into their origin from the aorta artery. The heart veins were injected into the sinus venosus this process completed by injection of the small heat veins near the apex of the heart camel. The material used for the injection was latex mixing with carmine (red colouring stain) after completion of the injection all specimens were socked in (5%) formalin solution with (1%) of glacial acetic acid was added. Dissection of the specimens had been done after (4 ) days Latex demonstrates the topography vessels distribution system by dissection.

Results

The results of this study showed the characteristic anatomical features of camel heart. It’s shape was funnel-like (Figs. 1,2,3) wide in the base and narrow cylindrical in apex. The left ventricle chamber was narrow oblique and curved (Figs. 3,4), directed to the left side, while the right ventricle appeared as small chamber in comparison with the left one, rounded and bulging to forming sac like cavity (Figs. 5,6,7). The cardiae notch was formed by the meeting of left and right longitudinal groove on the external surface of the camel heart (fig 4,5). The left side of camel heart was thick and massive muscular with large cylindrical chamber of the left ventricle reach the apexes of the heart while the right side was lesser in size and flabby. The left ventricle have two papillary muscles (musculi papillaris one of them on the wall and the other one on the ventricular septum, and the blood
supply of them from the left coronary artery (Arteria coronaria sinistra), the papillary muscle on the wall of left ventricle was supplied from proximal collateral branch of descending paraconalis branch of left coronary artery. While the papillary muscle on the septum supplied via left proximal and distal ventricular branch left circumflex ventricular artery. The right ventricles of camel heart have three papillary muscles, one of them was located on the wall of right ventricle and the other two papillary muscles situated on the ventricular septum. The blood supply of these three papillary muscles are via right proximal ventricular branch of right circumflex artery for the single papillary muscle on the wall, while those on the septum supplied through ventricular septum branch of left coronary artery. This study revealed that the proximal collateral branch derived from the branching of left coronary artery which was wide more curved and larger. Also this study fixed that the vena cordis caudalis present and more clear than in other domestic animals which is terminate into the vena cordis magna meanly (5cm) from its end in the right atrium. In all specimens the study revealed that the vena cordis magna and vena cordis media terminate in the coronary venous sinus ventrally to the posterior vena cava termination. Ossa cordis noticed very clear in the most of the specimens of camel heart located somewhat in the right side of cardiac muscle mass, and have triangle shape with elongation in transverse section. The results of this study fixed that the right atrioventricular valve (tricuspid) has angular cusps, parietal cusp, cranial cusp adjacent to the free wall. Septal cusp chordae tendineae, appeared as fibrous cord, with anchor free edges of cusps to papillary muscles. The chordae tendineae of left ventricles are fewer in number but larger than those of the right ventricle. The moderator bands are variable.

Fig 1: left side of camel heart showing the muscle mass of left ventricle

Fig 2: Right side of camel heart showing the right longitudinal groove and cardiac notch (→)
Fig 3: Camel heart showing the pointed apex and wide base (open right auricle)

Fig 4: Camel heart Showing funile - like shaped.

Fig 5: Left side of fresh camel heart showing the left auricle and ventricle muscle masses.
Fig 6: Right side of camel heart showing the cardiac notch, the wide base, pointed apex and right longitudinal groove.

Fig 7: Schmatic drawing of the section in camel heart showing:

1- semi lunar valve  
2- pulmonary veins  
3- left atrium  
4- aortic arch  
5- anterior vena cava  
6- posterior vena cava  
7- right atrium  
8- right ventricle  
9- left ventricle  
10- cusp of bicuspid valve  
11- cusp of tricuspid valve  
12- apex of camel heart notice the left ventricular chamber extend in the apex more than the right ventricular chamber
Discussion

The present study revealed that the external shape of the camel heart was funnel-like, this feature lead to change the shapes of chambers (atria & ventricles). These results are disagreeing with many workers on the heart of domestic animals, bovine, equine, ovine, caprine and canine (Getty, 1975; Sisson, 1954). From the present study the cardiac notch is clearly appearance which formed by meeting of right and longitudinal grooves. The aorta of camel heart thick, strong and large massive, these results agree with (Sisson 1953; Mnsmann et al, 1982; Sheively, 1984; Currie, 1988; Young and Heath, 2000).

The camel heart lies essentially on the Midline, but the apex more pointed end is inclined caudally, ventrally, and to the left these results disagree with results of the worker on feline (Tilley, 1977) and on the canine (Ettinger & Suter, 1970; Ott, et al 1964), the conclusion of these studies revealed that the heart of canine and feline lies somewhat to the left side. The present study revealed the blood supply of septal cardis, papillary muscles are the same as in other, also fossa ovalis (which is the depression caudal to the inter venous tubercle) where the foramen ovalis was located, this present in camel heart resemble with domestic animal heart (Sheively, 1984; Ganong, 1971; Currie, 1988; Barker, 1993; Kent Carr, 2001). The tricuspid and bicuspid valves and the shape of chordae tendinae are like to the corresponding those of other domestic animals (Kent & Carr, 2001; Curr, 1988; Getty, 1975; Sisson, 1953). According to the results of this study it could be fixed that the right ventricle in camel heart is bulging and the left and right coronary could be seen from each side clearly. The termination of vena cordis magna, and vena cordis media, are differ from that of other domestic animals hearts (ovine, bovine, canine, feline, porcine, caprine) also the absence of vena hemiazygus in the heart of the camel and the presence of vena Azygus opens into the cranial vena cave (Sisson 1953; Mnsmann et al, 1982; Shievely, 1984). This study fixed that the branching of left coronary artery via cordis magna are large in size (wide) and forming wide aches these notice differ from other domestic animals (Sack and Habel, 1982; Getty, 1975; Sisson, 1954). The termination of vena cordis magna and vena cordis media in the sinus of coronary vein in the right atrium below termination of the caudal vena cava and not contact with each other were in different in other domestic animals (Kent & Carr, 2001; Merhish 2003).

References

دراسة تشريحية شكلية لتجاويف وصمامات القلب في الجمل ذي السنام الواحد Camelus Dromadarius

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الخلاصة

شملت الدراسة خمسة وعشرون عينة قلب من كلا الجنسين (9 ذكور و16 أنثى) وتبين من الدراسة أن قلب الجمل ذي شكل قماعي ومتضاف عند قمته، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الجمل ذي شكل قماعي ومتضاف عند قمته، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين الأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، وبين البطين والأذين المفرعاء من جسم ثلاثي الشرايين المتصلة بجهاز القلب الوردي، وتبين من الدراسة أن قلب الحيوانات الاليفة، بين المرافق}(5) سم، وأن تقاطعات الأوردة الأكليلية وتثبيتها يختلف عما هو عليه في الحيوانات الاليفة.

References: