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IN VITRO ULTRASONOGRAPHY OF THE NORMAL SHEEP HEART

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ABSTRACT

The anatomical structure of normal heart was studied in vitro through ultrasonography of 60 healthy hearts of sheep collected following slaughter. After removing the clot or any remained blood in atria and ventricles, the organs were imaged under water immersion at 25^0C, using a B-mode real time ultrasound scanner fitted with a 3.5 or 5.0 MHz sector transducer. The different cavities of the heart were imaged. The thickness of left ventricle wall (LV), right ventricle wall (RV) and inter-ventricular space (IVS) were measured. All the sizes obtained by ultrasonography were compared with those obtained by ruler. These sizes were quite comparable. Atrio-ventricular valves, semilunar valves and papillary muscles were seen as echogenic masses. The wall of ventricles, atrium and space between them were also echogenic and had homogeneous echotexture. The heart cavities did not show any echo and were observed homogenous. Apex of the heart, the root of the aorta, and pulmonary tract were also distinguishable.

Key words: Anatomy, ultrasonography, heart, sheep.

INTRODUCTION

Ultrasonography is a recent technique that is applied to study normal and abnormal structures of different body organs. This is a valuable tool to investigate organs which can not be examined physically by other methods. It is very useful in determining the size and presence of lesions in the body organs. Ultrasonography apparatus dispatches ultrasound waves into the body and detects reflected waves from the body. Since the body organs have different densities, they vary in their ability to reflect sound waves. Different rates of reflected waves can be used to make two or three dimensional images of body organs (Bushong and Archer, 1991; Takeo and Noboru, 1993; Goddar, 1995), which can be used to diagnose lesions in various body organs.

Ultrasonography can be used for recognizing anatomical and structural disorders in the interior of the body organs in the clinic. A sonologist must be familiar with the normal ultrasonographic appearance (echotexture) of an organ to differentiate it from the abnormal views (Anderson, 1992; Braun and Gotz, 1994; Braun and Sicher, 2006).

The heart is an important body organ. However, its normal anatomical structure can not be studied without dissection and surgery. In the present study, the anatomical structure of normal heart was studied in vitro by using ultrasonography of 60 healthy hearts of sheep after slaughter.

MATERIALS AND METHODS

For utrasonographic study of the heart in vitro, 60 healthy sheep hearts were collected from East Azerbaijan Industrial Slaughterhouse, Tabriz, Iran. The hearts were transferred to laboratory of the Faculty of Veterinary Medicine, University of Tabirz, Tabirz, Iran. After completely removing the clot or any remained blood in atria and ventricles, ultrasono- graphic imaging of the hearts was carried out under water immersion at 25^oC by using a B-mode real time ultrasound scanner fitted with a 3.5 or 5.0 MHz sector transducer from a distance of 1.5-2.0 cm. The thickness of left ventricle wall (LV), right ventricle wall (RV) and inter-ventricular space (IVS) were measured by ultrasonography.

After imaging in vitro, the hearts were cut by a scalpel and thickness of LV, RV and IVS were measured by a special ruler (Fig. 1). The biometrical measurements were compared with ultrasonic measurements.

RESULTS

The thickness of the right ventricle (RV) wall, thickness of left ventricle (LV) wall, and thickness of inter ventricular space (IVS), as seen grossly, are shown in Fig. 1. The values for the thickness of RV wall, LV wall and IVS measured through ultrasonography and by using ruler are given in Table 1. It is clear from the table that values for the thickness of RV wall, LV wall and IVS measured by the two methods are quite comparable, although ultrasonographic measurements were slightly higher than values obtained by the use of a ruler.

The ultrasonographic appearance of various segments of the sheep heart are shown in Figs. 2 and 3. The semilunar valve and the papillary muscles were seen as echogenic structures. Inter-ventricular space

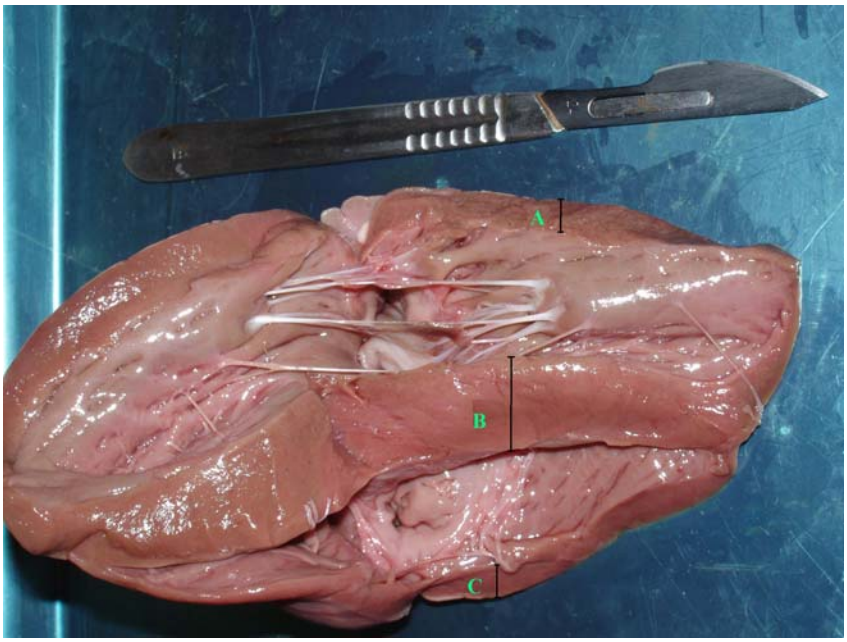

Fig. 1: Anatomical measurements of the right ventricle (RV) wall, left ventricle (LV) wall and inter-ventricle space (IVS). A: RV wall, B: IVS, C: LV wall.

Table 1: Mean values (± SE) of the thickness of wall of the left ventricle (LV), right ventricle (RV) and inter-ventricular space (IVS) of the sheep heart measured by two methods

Method of measurement	Thickness of LV wall (mm)	Thickness of RV wall (mm)	Thickness of IVS (mm)
Ultrasonography	21.59 ± 2.549	9.70 ± 2.892	19.97 ± 2.642
Callipers	20.37 ± 2.136	8.45 ± 0.478	18.00 ± 1.825

Fig. 2: Ultrasonograph of the heart of a sheep: RA: right atrium, LA: left atrium, MV: mitral valve, TCV: tricuspid valve, PM: papillary muscle.

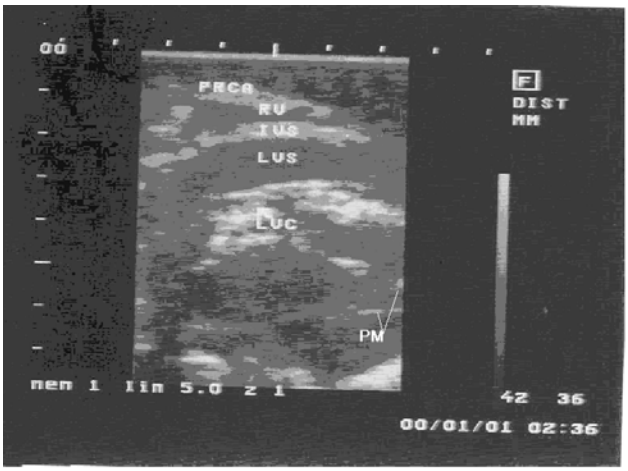

Fig. 3: Ultrasonograph of sheep heart. PRC: pericardia, RV: right ventricle, IVS: inter ventricular space, LVC: a clot in the left ventricle, PM: papillary muscle.

and inter-atricular space also appeared as echogenic areas and had similar echogenicity. The heart chambers were anechoic. Base and apex of the heart, separation point of aortic artery and pulmonary vein had different echogenicity and could be recognized easily.

DISCUSSION

Ultrasonography is relatively a new technique. However, these days this technique is routinely used for pregnancy diagnosis and for the detection of lesions in various body organs. Therefore, enough information is available in the literature about normal and abnormal echotexture of various body organs (Dyce *et al.*, 1996; Braun and Sicher, 2006).

Scientists have used ultrasonography for the study of superficial lymph nodes, spleen, kidneys, urinary bladder, ovaries, uterus, testes, liver, gall bladder, and also mucosa of reticulum, omasum, abomasums and rumen. Furthermore, rumen, omasum and abomausm have physiological diagnostic differences with other organs. Inflammation, adhesions, cystic lesions, abscesses and other lesions can easily be diagnosed by ultrasonography (Ahmad *et al.*, 1991; Jackson and Salter, 1997; Nautrup, 2000).

Importance of the heart and its location in the chest area indicates that the ultrasonography could be a better technique for the diagnosis of heart disorders. A comparison of results obtained by ultrasonographic and biometrical measurement methods shows that the results of both the methods were quite comparable. It indicates that in vivo ultrasonography can be used for the anatomical and biometrical study of heart. The values for the thickness of LV wall, RV wall and IVS can be used as basis for detecting changes in these parts due to any heart disease.

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