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Cadaveric Heart: Innovative Basic Anatomy in Echocardiography

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Abstract

Echocardiogram often referred to as cardiac echo or simply an echo, is a sonogram of heart. Echocardiography uses standard two-dimensional, three-dimensional and Doppler ultrasound to create images of the heart. It is a modern technique that allows the physician to evaluate the heart without inserting any tubes or wires. The present study is being done to see the location of chambers of heart in cadaveric specimens so as to contribute additional information to our existing knowledge to arrive at a diagnosis of various cardiac anomalies before any surgical interventions.

Keywords: Echocardiograph; Heart; Heart Chambers; Ventricles; Atria; Aorta.

Introduction

Echocardiography is routinely used in the diagnosis, management and follow-up of patients with any suspected or known heart diseases. It is one of the most widely used diagnostic tests in cardiology. It can provide a wealth of helpful information including the size, shape, pumping capacity, location and extent of any tissue damage. The fundamental knowledge of the structure and body functions has been studied by gross anatomy to molecular level. In the last few decades and also with the explosion of new imaging techniques ranging from endoscopy, laparoscopy, CT scans and MRI, Digital subtraction angiography with 3D visualization technique helped the medical fraternity with minimal invasive surgical procedures including therapy targeted to specific organs [1].

The gross anatomy of the heart can be evaluated by two-dimensional echocardiography in the parasternal apical, suprasternal and subcostal positions [2].

Hence the knowledge of innovative techniques in understanding gross anatomy has become increasingly important not only to understand and interpret the images produced by these sophisticated techniques but also before rationalizing the treatment including surgical interventions.

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Material and Method

The present study is carried out on 25 specimens of cadaveric heart from the department of anatomy at Goa Medical College Bambolim Goa, India. Each specimen was nicely dissected, cleaned and carefully examined. The chambers of the heart were filled with water.

The specimen was placed in a thin transparent polythene bag filled with water sufficient enough to accommodate the specimen. The polythene bag was then tied tightly to prevent leakage of the water. Each specimen was examined by Phillips 33 echocardiography machine. The probe was applied to the cadaveric specimen to see the orientation and to visualize the normal basic anatomy of the heart, also the three dimensional images of the chambers of the heart including valvular anatomy by three main echocardiography techniques. The standardized planes used are long axis, short axis and four chambers.

Cross-sectional two-dimensions give the impression of a moving picture.

M Mode- Uses a single static beam and appears as horizontal lines with superficial structures at the top and deep structures at the bottom.

Doppler- Uses pulsed wave and color was not possible in cadaveric specimens.

The photographic images were then captured and saved on the computer for further analysis.

Observation and Results

The following structures were visualized.

- Valves
- Four chambers of the heart
- Wall thickness
- Pericardium
- Ascending aorta

Discussion

Clinically significant developmental anomalies of the heart are rarely seen during the routine dissections. Echocardiography along with computer technology has made it possible to create three-dimensional images from the anatomical specimens. These abnormal specimens are very useful to correlate the theoretical knowledge of embryology of heart emphasizing the abnormal defects and the degree of variability from the normal [3]. Stress echocardiogram can be done after exercise which is relatively safe and noninvasive method to evaluate patients with coronary heart disease [4].

Echocardiography can also give physicians other estimates of heart function such as calculation of the cardiac output, ejection fraction and diastolic function. Echocardiography can help detect cardiomyopathies, such as hypertrophic cardiomyopathy, dilated cardiomyopathy. The use of Stress Echocardiography may also help to determine whether any chest pain or associated symptoms are related to heart disease. Echocardiography is used in Valvular heart disease-valve dysfunction and follow-up prosthesis.

Abnormal ventricular function used to assess any underlying cause to estimate left ventricular ejection fraction.

Atrial fibrillation assesses structural cause, risk of thromboembolism and likely response to direct current cardio-version.

Congenital heart disease

Cardiomyopathy

Infective endocarditis including assessment of valvular lesions and their haemodynamic severity.

After embolic stroke

Pericardial disease-presence of fluid and allows guide drainage of pericardial fluid in cardiac tamponade.

Thoracic aortic disease-aneurysm, dissection [5].

The biggest advantage to echocardiography is that it is noninvasive and has no known risks or side effects. Not only can an echocardiogram create ultrasound images of heart structures, but it can also produce accurate assessment of the blood flowing through the heart, using pulsed or continuous wave Doppler ultrasound. This allows assessment of both normal and abnormal communications between the left and right side of the heart, any leaking of blood through the valves (valvular regurgitation) and to estimate how well the valves open (valvular stenosis).

3D echocardiography is now possible using a matrix array ultrasound probe and an appropriate processing system. This enables detailed anatomical assessment of cardiac pathology, particularly valvular defects and cardiomyopathies. The ability to slice the virtual heart in infinite planes in an anatomically appropriate manner and to reconstruct three dimensional images of anatomic structures make 3D echocardiography unique for the understanding of the congenitally malformed heart [6].

In our present study we have seen pericardial effusion (fig.1), right ventricle, aorta and left ventricular outflow tract (fig.2), ascending aorta (fig.3), long axis view showing right ventricle, aortic valves, left ventricle and papillary muscles (fig.4), right ventricle, left ventricle, tricuspid and mitral valves, right and left atria (fig.5), short axis view of right and left ventricle, left atrium and aorta (fig.6), two chamber view right and left ventricle (fig.7),right and left ventricle, aorta (fig.8).

Fig.1: Echocardiography showing pericardial effusion

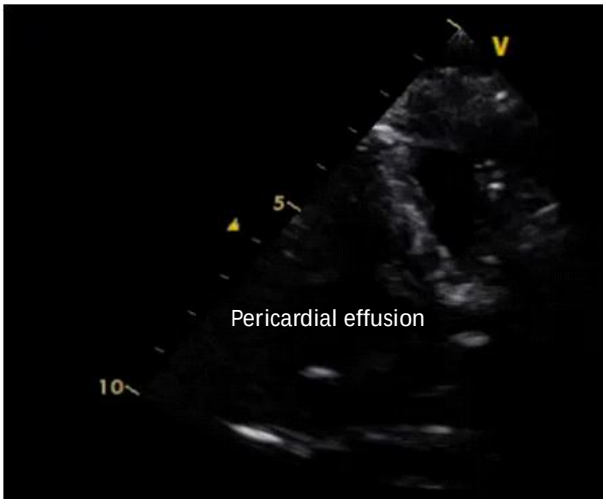


Fig. 2: Echocardiography showing right ventricle, aorta and left ventricular outflow tract

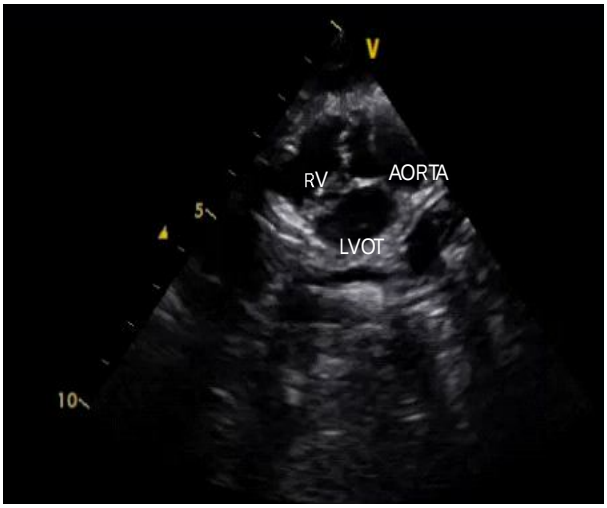


Fig. 3: Echocardiography showing ascending aorta

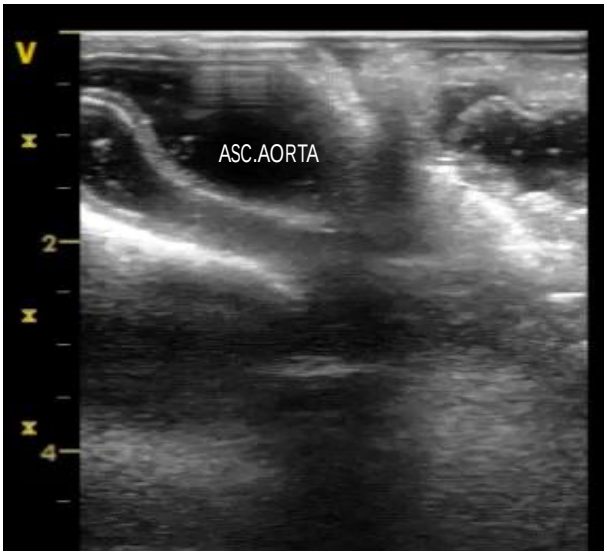


Fig. 4: Long Axis view showing right ventricle, aortic valve, left ventricle and papillary muscle

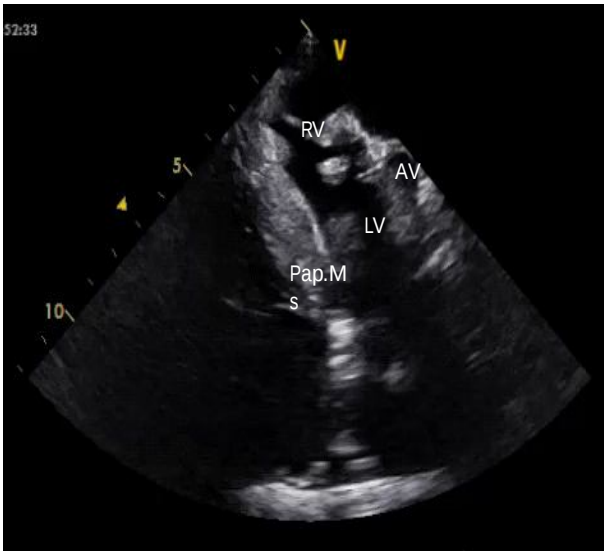


Fig. 5: Showing right ventricle, left ventricle, tricuspid valve, mitral valve, right atrium and left atrium

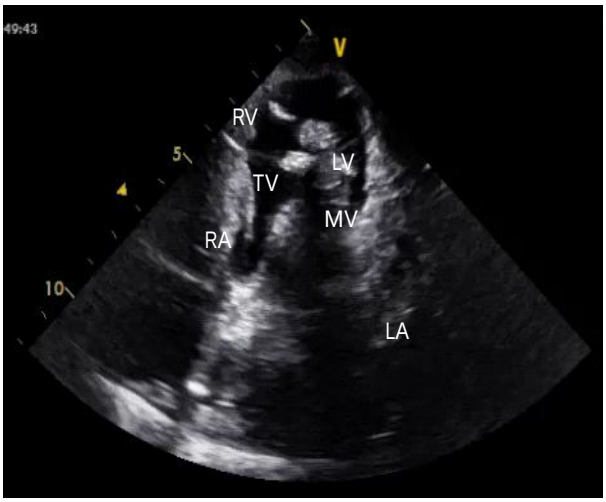


Fig. 6: Short axis view showing right ventricle, left ventricle, left atrium and aorta

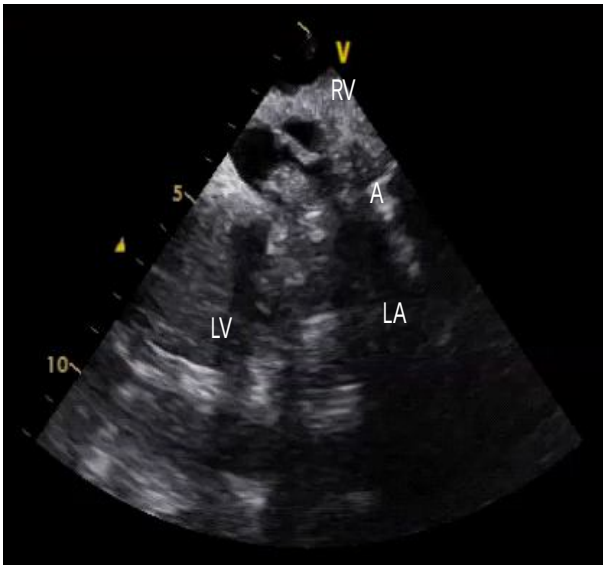


Fig. 7: Two chamber view showing right ventricle and left ventricle

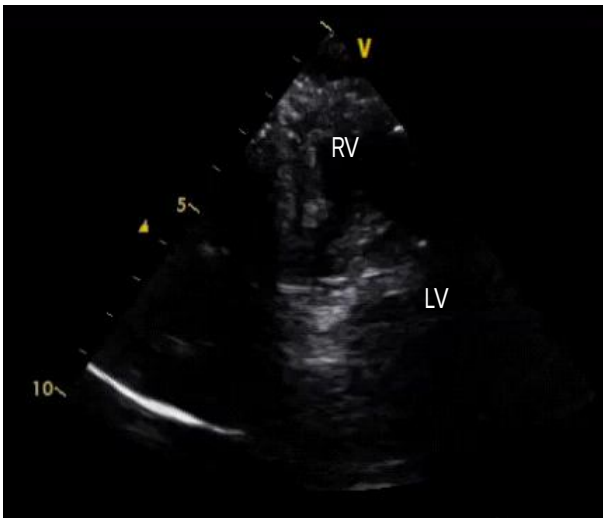
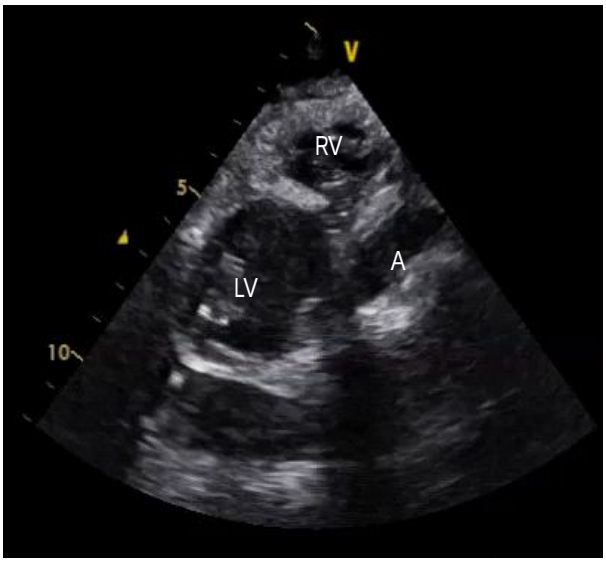


Fig. 8: Showing right ventricle, left ventricle and aorta



With the advanced sophisticated technology and research we owe it to the future to ensure that the role of anatomists is to carry out more research so as to verify the results, guide and share their knowledge with appreciation for the human body.

Also with the cooperation of fellow anatomists specimens of rare human developmental anomalies can be collected and studied for the better understanding of echocardiography so as to rationalize the treatment both preoperatively and surgically.

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