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Original Research Article

Effect of aging on end systolic volume, mean heart rate, stroke volume of left ventricle, cardiac output

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Abstract

Introduction: Ageing is difficult to define and it is a natural process which each leaving being has to undergo. Knowledge of ageing process and the care of older patients has been increasing with rapid pace the science which deal with the chronological changes in human body is called gerontology. The modern trends in lifestyle like more dependency on domestic, rather than manual handwork, transportation by motor vehicles rather than by walking and rapid pacing of life with change in eating habits, dependency on fast food has added a burden to all organ system of the body.

Materials and Methods: The present study of 'effect of ageing on cardiovascular functions using 2 dimensional echocardiography was conducted at the department of physiology**, .**100 healthy subjects of both sexes between the ages of 35-85years were included in the study after conducting a baseline study to measure height, weight & blood pressure & to exclude pregnancy in females subjects, hypertension, diabetes mellitus, coronary artery disease and smoking by taking a detail history.

Results: End systolic diameter increases as age advance due to structural changes in myocardium and reduction in ejection fraction. As age advances increased vascular resistance impedes left ventricular ejection and reduce sympathetic responsiveness limits hearts ability to increase rate and contractibility. This is the factor which predisposes the elderly individual for development of heart failure. Mean ejection fraction in old age may not show any decrease. In my study ejection fraction is decreased and this can be attributed to decrease in number of cardiac myocytes and increase in after load. Ejection fraction which is defined as fraction of end diastolic volume that is ejected is usually equal to about 60% the total EDV-ESV which gives rise to ejection fraction % which is less in the age group of 70-84 years.

Conclusion: The effect of age on different parameter of the heart was the objective the of the present study the effect of some of the parameter with significant result is observed and interpreted with reference to age group between 35-84 years of the both sexes. The mean end diasystolic volume has increased from 70-84 years and decreased in the age group of 50 – 69 years.

Key Words: Ageing, gerontology, cardiovascular functions

INTRODUCTION

Ageing is difficult to define and it is a natural process which each leaving being has to undergo. Knowledge of ageing process and the care of older patients has been increasing with rapid pace the science which deal with the chronological changes in human body is called gerontology.[1] The modern trends in lifestyle like more dependency on domestic, rather than manual handwork, transportation by motor vehicles rather than by walking and rapid pacing

of life with change in eating habits, dependency on fast food has added a burden to all organ system of the body.[2] Chronology added with these hazards has made the chronological changes set in earlier with better standard of life and awareness of health regime and national health programs all have led to longevity of life span and the date shows that 40 years ago, the average worldwide life expectancy was 50 years.[3]

According to professor H.dingle," time produces effect, events occur in it but not because of it." This implies that me times is solely a frame of reference for measurement of changes .This facts shows that chronological age varies significantly for different individual and this is correlated with chemical alteration in body fluid and structural changes in organ system like degeneration and atrophy. Cardiovascular age changes occur, according to **Doll S,Paccaud F,Bovet et al** earlier due to alteration in cholesterol metabolism, changes in muscular skeletal system by alteration physical activities.[4,5] Thus we can say that ageing changes result from weakening or breakdown of "organizer" or controller of organic structure. As stated earlier cardiovascular ageing plays a very important role in affecting the changes structure and functions of other organs like brain, kidneys, etc. The reason for this is obvious as all the tissues depend for their nutritional supply on biological conduits or channels which are the blood vessels.[6,7]

The title of my study is "Effect of ageing on Cardiovascular function using, 2 Dimensional Echocardiography and realizing the importance of blood vessels in maintaining health of the individual, this study was selected.[8] If the changes produced due to chronology are known we can differentiate them from changes which occur as a result of disease and after knowing that the age predisposes the individual for certain kind of structural changes which has impact on the functions, we can take care of senile subjects and by taking proper precautionary management planning cardiovascular catastrophes can be prevented.[9] Intensive exercise prevented shortening of telomeres, a protective effect against ageing of the cardiovascular system."This is direct evidence of an anti-ageing effect of physical exercise. Physical exercise could prevent the ageing of the cardiovascular system, reflecting this molecular principle.[10]

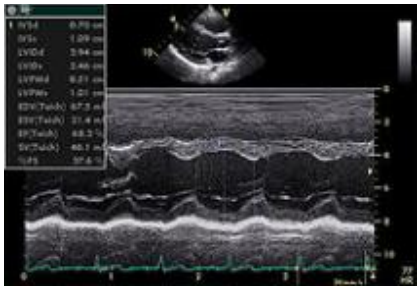
MATERIALS AND METHODS

The present study of 'effect of ageing on cardiovascular functions using 2 dimensional echocardiography was conducted at the Department of Physiology**.**

100 healthy subjects of both sexes between the ages of 35-85years were included in the study after conducting a baseline study to measure height, weight & blood pressure & to exclude pregnancy in females subjects, hypertension, diabetes mellitus, coronary artery disease and smoking by taking a detail history.

The subjects were divided into four groups .

Normal ECHO Image



ECHOCARDIOGRAPHIC STUDY

INSTRUMENTATION

Echocardiogram, often referred to cardiac ECHO or simply an ECHO is sonogram of the heart Also known as a cardiac ultrasound, it uses standard ultrasound techniques to image two-dimensional slices of the heart. The latest ultrasound systems now employ 3D real-time imaging.

According to Taleno and gardin suggested that echocardiogram can also produce accurate assessment of the velocity of blood in addition to creating two-dimensional pictures of the cardiovascular system, it allows assessment of cardiac valve areas and function, any abnormal communications between the left and right side of the heart, any leaking of blood through the valves (valvular regurgitation), and calculation of the cardiac output as well as the ejection fraction. Other parameters measured include cardiac dimensions (luminal diameters and septal thicknesses) and E/A ratio.

Echocardiography was an early medical application of ultrasound. Echocardiography was also the first application of intravenous contrast-enhanced ultrasound. This technique injects gas-filled microbubbles into the venous system to improve tissue and blood delineation. Contrast is also currently being evaluated for its effectiveness in evaluating myocardial perfusion. It can also be used According to Labovitz, Anent D,Garcia MJ Doppler ultrasound to improve flow-related measurements Transthoracic echocardiogram

Tran thoracic echocardiogram: A standard echocardiogram is also known as a transthoracic echocardiogram (TTE), or cardiac ultrasound. In this case, According to NikitinNP,Thackery SD,Joel Morganroth the echocardiography transducer (or probe) is placed on the chest wall (or thorax) of the subject, and images are taken through the chest wall. This is a non-invasive, highly accurate and quick assessment of the overall health of the heart

Transesophageal echocardiography

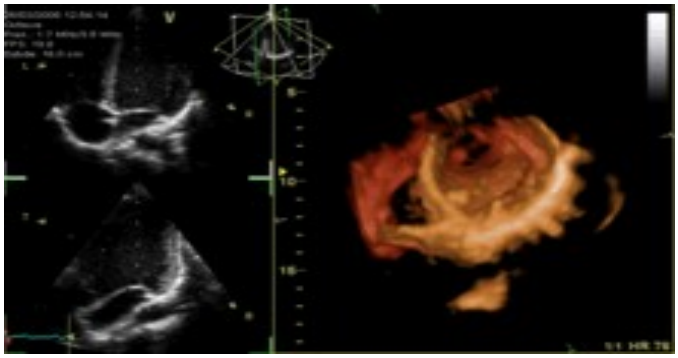
This is an alternative way to perform an echocardiogram. A specialized probe containing an ultrasound transducer at its tip is passed into the patient's esophagus ,according to **Folland** ED,Weber **MA** allows image and Doppler evaluation which can be recorded. This is known as a transesophageal echocardiogram, or TOE (TEE in the United States). Transesophageal echocardiograms are most often utilized when transthoracic images are suboptimal and when a more clear and precise image is needed for assessment. This test is performed in the presence of a cardiologist, registered nurse, and ultrasound technician.

Stress echocardiography

Cardiac stress test

A stress echocardiogram, also known as a stress echo or SE, utilizes ultrasound imaging of the heart to assess the wall motion in response to physical stress. First, images of the heart are taken "at rest" to acquire a baseline of the patient's wall motion at a resting heart rate. The patient then walks on a treadmill or utilizes another exercise modality to increase the heart rate to 80% of the target heart rate (target heart rate = 220 - your age). Finally, **Paolo,shung,micheal** described images of the heart are taken "at stress" to assess wall motion at the peak heart rate. A stress echo assesses wall motion of the heart; it does not, however, image the coronary arteries directly. Ischemia of one or more coronary arteries could cause a wall motion abnormality which could indicate coronary artery disease (CAD). The gold standard test to directly image the coronary arteries and directly asess for stenosis or occlusion is a cardiac catheterization. A stress echo is a non-invasive test and is performed in the presence of a licensed medical professional, such as a cardiologist, and an ultrasound technologist.

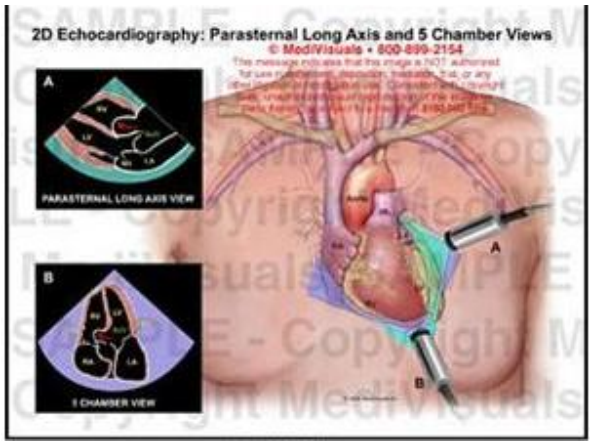
Three-dimensional echocardiography



3D echocardiography is now possible, using an ultrasound probe with an array of transducers and an appropriate processing system. Ahluwalia,Waneet,Martin showed 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.

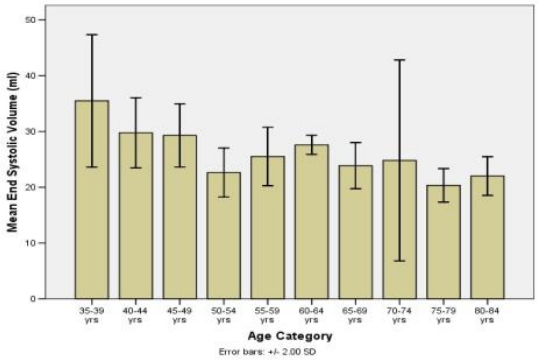
Echocardiography is used routinely in practice to assess changes in cardiac dimensions and valvular integrity. M-mode analysis of the left ventricle allows for measurement of the myocardial thickness and also the diameter of the cardiac chambers in systole and diastole. Furthermore, the fractional shortening is used to assess the degree of contractility of the left ventricle. The expected cardiac changes in response to exercise training include an increase in the left ventricular internal diameter in diastole as a result of increased stroke volume.

A recent study has also demonstrated subclinical valvular regurgitation, also thought to be a result of chamber dilation in response to training (Young et al. 2008).Fractional shortening has also been showntodecrease.

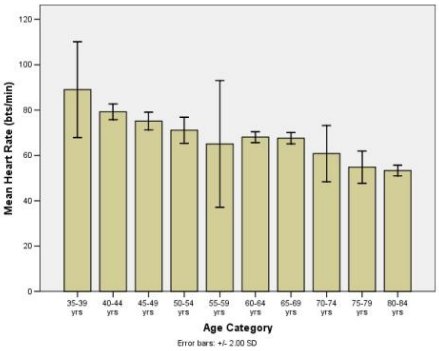


RESULTS

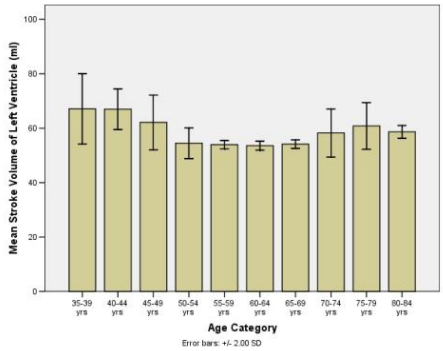
Graph 1: Age Vs End Systolic Volume (ml)



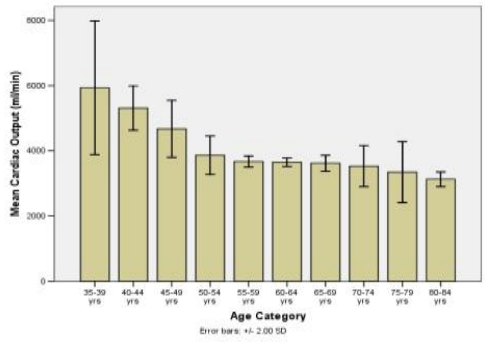
Graph 2: Age Vs Mean Heart Rate (bts/min)



Graph 3: Age Vs Stroke Volume of Left Ventricle (ml)



Graph 4: Age Vs Cardiac Output (ml/min)



DISCUSSION

End systolic diameter increases as age advance due to structural changes in myocardium and reduction in ejection fraction. As age advances increased vascular resistance impedes left ventricular ejection and reduce sympathetic responsiveness limits hearts ability to increase rate and contractibility. This is the factor which predisposes the elderly individual for development of heart failure. Mean ejection fraction in old age may not show any decrease. In my study ejection fraction is decreased and this can be attributed to decreased in number of cardiac myocytes and increase in after load. Ejection fraction which is defined as fraction of end diastolic volume that is ejected is usually equal to about 60% the total EDV-ESV which gives rise to ejection fraction % which is less in the age group of 70-84 years.[11]

Heart Rate: There is an inverse relations ship between age and heart rate. The heart rate decreases in old age by about 1/3 between the ages of 35 years to 84 years. This decreases in heart rate is attributed to increased vascular resistance, and reduce sympathetic responsiveness of Sino atrial node and other conducting system of heart and may be also due to fat accumulation around Sino atrial node reducing partial or complete separation of sino- atrial node from atrial musculature. Second it may be also due to decrease in number of pacemaker cells in the Sino atrial node beginning at the age of 35 years to 84 years.[12]

Heart rate also decrease due to progressive increase in vagal tone in old age and concomitant unresponsiveness of cardiac receptors to circulating catecholamines.[13]

The 2 D echocardiography in present study shown mean stroke volume of L.V. in (ml) mean heart rate/min, mean End diastolic volume(ml) mean End systolic volume in ml, mean Fractional shortening %, mean Ejection fraction % ,mean Left ventricular end diastolic diameter(cms), mean Left ventricular end systolic diameter in cms, Mean Diastolic blood pressure in mmHg, mean Systolic blood pressure in mmHg, mean Cardic output ml/min, mean Stroke volume of LV are recorded.[14,15]

CONCLUSION

The effect of age on different parameter of the heart was the objective the of the present study the effect of some of the parameter with significant result is observed and interpreted with reference to age group between 35 – 84 years of the both sexes.

1. The mean end diasystolic volume has increased from 70 – 84 years and decreased in the age group of 50 – 69 years.
2. The mean end systolic volume is significantly decreased in age group of 75 to 84 years.
3. The mean Heart rate has decreased gradually from age group of 35 years to 84 years.
4. The mean stroke volume of left ventricle is decrease in age group of 50yrs - 69 years but slightly increased in age group of 70 – 82 years.

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