Sudan University of Science and Technology

College of Graduate Studies

Role of Echocardiography in Detection of the Cardiac Diseases in Adult Patients

دور موجات القلب في كشف أمراض القلب في المرضى البالغين

A thesis Submitted for Partial Fulfillment of Requirements of Msc Degree in Medical Diagnostic Ultrasound

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الآيـة

قال تعالى :

بِسْمِ اللهِ الرَحْمَن الرَحِيم

وَقُل رَبِّ زِدني عِلمًا ﴿١١٤﴾

صدق الله العظيم

سورة طه الآية (114)

Dedication

For my parent.

To my father, who taught me that the beast

Kind of knowledge to have is that

Which is learned for

Its own sake…

To my mother, who taught me that even the largest task can be accomplished if

It's done one step at a time...

The reason of what and become today.

Thanks for your great support and continuous care….

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Thanks to all my committee members for their support, patience, encouragement and useful suggestions.

Abstract

This was a cross sectional study conducted in Khartoum state, Sudan; in the echocardiography departments of Sudan Heart Center. The study carried out during the period from December 2016 to April 2017.The problem of the study was most of cardiac disease were common causes of death and so we needed available and saved tool for differentiation between them. The study aimed to detect role echocardiography in cardiac disease in adult patients.

There were 131 patient scanned using ARTIDA machine with multi frequency phased array probe to evaluate cardiac disease. All patients had classified and analyzed by using statistical package for the social sciences. The study found that (55.7%) were male and (44.3%) were female out of 113 patients. The most common age group above than 60 years which represented (51.1%) was affect by cardiac disease. Most common causes of Cardiac disease were ischemic heart disease represent (45.8%). Most common symptom of cardiac disease was chest pain represent (29.8%). Most common risk factor of cardiac disease was hypertension represent (19.8%) and also the study reflects significant correlation between the heart disease with symptom, also between the heart disease with risk factor.The study concluded that older patients and risk factor for example hypertension, diabetes, obesity and smoking more exposure to cardiac disease. the study recommended that echocardiogram should be routinely used in the diagnosis, management and follow up of patients with any suspected or known cardiac disease.

المستخلص

هذه الدراسة دراسة مقطعيه.تمت في مستشفيات ولاية الخرطوم - السودان بأقسام الموجات فوق الصوتية للقلب بمركز السودان للقلب.جرت في الفترة من ديسمبر2016 إلى أبريل 2017م. تكمن مشكله الدراسة معظم أمراض القلب هي المسبب الشائع للوفيات و نحن نحتاج الى توفير وحفظ أجهزه لأجل التفريق بينهم.هدفت الدراسة إلي كشف دور الموجات الصوتية للقلب في أمراض القلب في المرضى البالغين.

هناك 131 مريض تم مسحهم باستعمال جهاز أرتيدا لأجل تقييم أمراض القلب.كل المرضى صنفوا و حللوا بواسطة برنامج تحليل المتغيرات . وجدت الدراسة أن (55,7%) رجال (44,3%) نساء من أصل 131 مريضا. وجدت الدراسة أن معدل حدوث هذه الحالات مرتفع في الفئة العمرية أكبر من 60 سنة التي تمثل (51,1%) يعانون من أمراض القلب. وجد أن اكبر أعراض لمرض القلب هو ألام الصدر بعدد(29.8%). وجد أن أكبر عوامل الخطر لأمراض القلب هو ارتفاع ضغط الدم بنسبة (19.8%). وأيضا أظهرت الدراسة أن اعراض المريض علاقة إحصائية ذات دلالة مع أمراض القلب وايضا أظهرت الدراسة أن عوامل الخطر على علاقه إحصائية مع أمراض القلب.خلصت الدراسة أن المرضى كبار السن وعوامل الخطر مثلا ارتفاع ضغط الدم, مريض السكري, السمنة و التدخين أكثر تعرضا الى أمراض القلب.أوصت الدراسة بان تصبح موجات القلب روتين يستعمل في التشخيص, ادارة ومتابعة المريض لتوقع أو معرفة أمراض القلب.

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List of Abbreviations

ASHD	Atherosclerotic Heart Disease
A V node	Atrioventricular node.
BMI	Body mass index.
CD	Cardiac Disease.
CHD	Coronary Heart Disease.
DM	Diabetes Mellitus.
HOCM	Hypertrophic Cardiomiopathy.
HTN	Hypertension.
IHD	Iscemic Heart Disease.
IVC	Inferior Vena Cava.
LA	Left Atrium.
LV	Left Ventricle.
LVH	Left Ventricular Hypertrophy.
MV	Mitral Valve.
PE	Pericardial Effusion.
PW	Pulse Wave.
RA	Right Atrium.
RHD	Rheumatic Heart Disease.
RV	Right Ventricle.
S A node	Sinoatrial node.
SAX	Short Axis.
SHHS	Sudan Household Survey.
TTE	Trans Thoracic Echocardiography.
VD	Valvular Disease.

introduction

1-1 Introduction

The heart is like any other muscle in body. It needs an adequate blood supply to provide oxygen so that the muscle can contract and pump blood to the rest of the body, it also pumps blood to itself via the coronary arteries.when one or more coronary arteries narrow, it any make it difficult for adequate blood to reach the heart, especially during exercise. Should the arteries continue to narrow, it may like less activity to stress the heart and provoke symptoms. The classic symptoms of chest pain or pressure and shortness of breathdue to atherosclerotic heart disease or coronary artery disease (Benjamin,2014).

Should one of the coronary arteries become complete blocked usually due to plaque that ruptures and causes a blood clot to form– blood supply to part of the heart may be lost. This causes a piece of heart muscle to die. This is called a heart attack or myocardial infarction.The term cardiac disease is often used interchangeable with the term cardiovascular disease. Cardiovascular disease includes coronary artery disease (CAD), myocardial infarction, stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease and venous thrombosis. This may be caused by high blood pressure (hypertension), smoking, raised blood sugar (diabetes), lack of exercise, obesity, high blood cholesterol, unhealthy diet, excessive alcohol consumption, family history of cardiovascular disease and low educational status.Cardiovascular disease are the leading cause of death globally. They resulted in 17.3 million deaths (31.5%) in 2013 up from 12.3 million (25.8%) in 1990. The average age of death from coronary artery disease and stroke in the developed world is around 80. Death, at given age, from CVD are more

common and have been increasing in much of the developing world, while rates have declined in most of the developed world since the 1970s. Most cardiovascular disease affects older adults.Cardiac disease is prevalent in Sudan, with at least 2.5% of the population affected and it is one of the major causes of hospital mortality. Diagnosis of cardiac disease is able to be accomplished by electrocardiography is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin. (To show right or left ventricular hypertrophy, myocardial ischemia and arrhythmia), X-ray chest (to show hilar congestion, cardiomegaly, evidence of pulmonary hypertension and pneumonia), and echocardiography. An echocardiogram is sonogram of the heart. It has become routinely used in the diagnosis, management and follow up of patients with any suspected or known heart disese.it can provide a worth of helpful information, including the size and shape of the heart, pumping capacity and the location and extent of any tissue damage. It can also give physicians other estimates of heart function such as a calculation of the cardiac output, ejection fraction, and assessment left ventricular systolic function, diastolic function and even myocardial and coronary perfusion and is therefor, useful in the diagnosis and triage of patients with acute chest pain or dyspnea. Echocardiography can also product accurate assessment of the blood flowing through the heart by Doppler echocardiography, using pulsed or continuous wave Doppler ultrasound (Benjamin,2014)

This allows assessment of both normal and abnormal blood flow through the heart. Color Doppler as well as spectral Doppler is used to visualize any abnormal communications between the left and right sides of the heart, any leaking of blood through the valves (valvular regurgitation)

and estimate how well the valves open (or do not open inthecaseofvalvularstenosis(Benjamin,2014)

1-2 Study Problems:

Most of cardiac disease are common causes of death and so we need available and save tool for differentiation between them.

1-3 Objectives:

1-3-1-General objective:

To role of echocardiography in detection of cardiac disease in adult patients.

1-3-2 Specific objectives:

- To diagnose cardiac disease using echocardiography.
- To correlate cardiac diseases with age, gender, symptoms and risk factor.

Literature review @ previous study

2-1 Anatomy of the heart:

The heart weighs between 7 and 15 ounces (200 to 425 grams) and is a little larger than the size of your fist. The heart is located in the thoracic cavity between theLungs. This area is called the mediastinum. The baseof the cone-shaped heart is uppermost, behind thesternum, and the great vessels enter or leave here. Theapex (tip) of the heart points downward and is justabove the diaphragm to the left of the midline.The heart is enclosed in the pericardial membranes,of which there are three layers(Valerie, 2007).

The outermost is the fibrous pericardium, the serous pericardium is a folded membrane;the fold gives it two layers, parietal and visceral.Lining the fibrous pericardium is the parietal pericardium.On the surface of the heart muscle is thevisceral pericardium, often called the epicardium.Between the parietal and visceral pericardial membranesis serous fluid, which prevents friction as theheart beats(Valerie, 2007).

The walls of the four chambers of the heart are madeof cardiac muscle called the myocardium. The upper chambers of the heart are the right andleft atria, which have relatively thinwalls and are separated by a common wall of myocardiumcalled the interatrial septum. The lower chambersare the right and left ventricles, which havethicker walls and are separated by the interventricularseptum(Valerie, 2007).

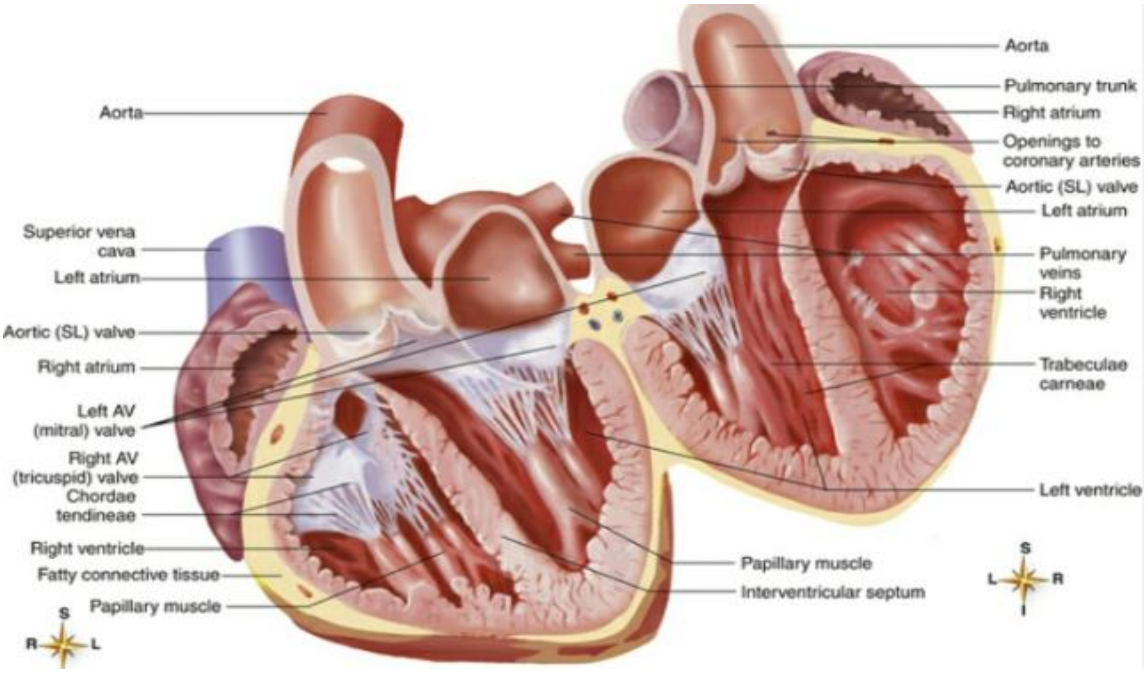


Figure (2-1): coronal section of the heart anatomy(Valerie, 2007).

2-1-1The Heart Valves:

Four valves regulate blood flow through your heart, the tricuspid valve regulates blood flow between the right atrium and right ventricle, the pulmonary valve controls blood flow from the right ventricle into the pulmonary arteries, which carry blood to your lungs to pick up oxygen, the mitral valve lets oxygen-rich blood from your lungs pass from the left atrium into the left ventricle , the aortic valve opens the way for oxygen-rich blood to pass from the left ventricle into the aorta, the body's largest artery . (Snell, 2011)

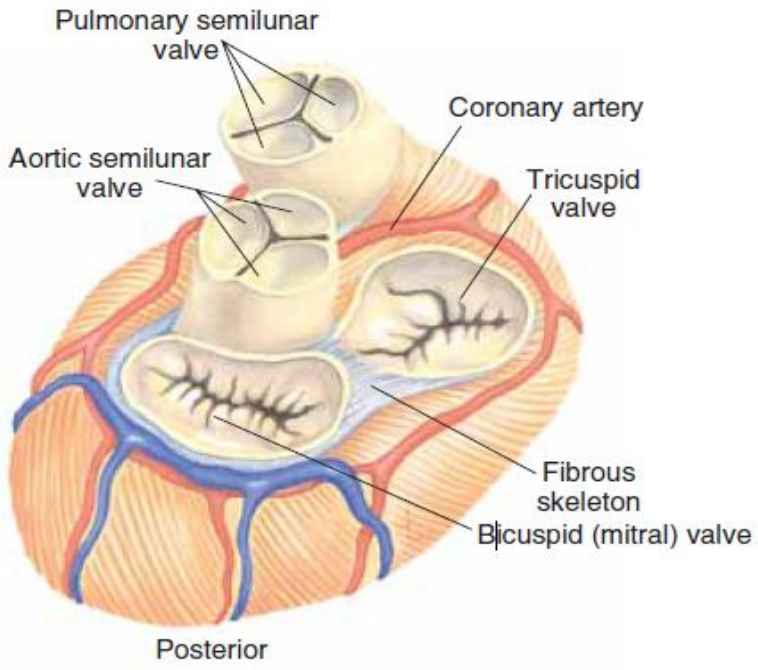


Figure (2-2) shows cardiac valves(Valerie, 2007).

2-2 Physiology of the heart:

The normal heart is a strong muscle that beats about 100,000 times a day to pump blood through the body. The blood carries oxygen and nutrients to tissues and organs and waste products to the kidneys and liver. The blood travels through a large network of blood vessels known as the circulatory system. This system includes the arteries, veins, and lungs. The heart responds to the body's needs and adjusts its rate of pumping to meet the body's requirements. The heart consists of four chambers that work together. Right and left atria – these are the small upper chambers. Right and left ventricles – these are the larger, lower chambers. The right ventricle pumps blood out of the heart to the lungs, and the left ventricle pumps blood to the rest of the body. The left ventricle is the heart's main pumping chamber. Blood flow during each heartbeat, the right side of the heart receives blood from your body and then sends it to the lungs to pick

up oxygen. The left side of the heart receives the blood from the lungs and then sends the blood to the rest of the body to deliver oxygen (Snell, 2011).

The heart has an electrical system that causes it to beat and pump blood in a smooth and regular way. Special cells in the heart start electrical signals; these signals then travel along pathways through the heart and cause it to beat(Snell, 2011).

During a normal heart beat, an electrical signal is first made in a group of cells called the sinus node (SA node). The signal then spreads like a wave through both of the upper chambers of the heart (the atria) and travels to another group of cells called the atrioventricular node (AV node). The AV node serves as an electrical filter between the upper and lower chambers (ventricles) of the heart. After a pause, the electrical signal spreads through the ventricles(Snell, 2011).

In a healthy heart, the heart beats once and pumps blood for each electrical signal that starts in the SA node. A normal heart rate is generally between 60 and 100 beats per minute, but will vary based on age and how active a person (Snell, 2011).

A single cardiac cycle of cardiac activity can be divided into two basic phases' diastole and systole: diastole represents the period of time when the ventricles are relaxed (not contracting). Throughout most of this period, blood is passively flowing from the left atrium (LA) and right atrium (RA) into the left ventricle (LV) and right ventricle (RV), respectively. The blood flows through atrioventricular valves (mitral and tricuspid) that separate the atria from the ventricles. The RA receives venous blood from the body through the superior vena cava (SVC) and inferior vena cava (IVC). The LA receives oxygenated blood from lungs through four pulmonary veins that enter the LA. At the end of diastole,

both atria contract, this propels an additional amount of blood into the ventricles (Snell, 2011).

Systole represents the time during which the left and right ventricles contract and eject blood into the aorta and pulmonary artery, respectively. During systole, the aortic and pulmonic valves open to permit ejection into the aorta and pulmonary artery. The atrioventricular valves are closed during systole, therefore no blood is entering the ventricles; however, blood continues to enter the atria though the vena cava and pulmonary veins. Uncontrolled high blood pressure (HTN) can damage your heart in a number of ways, such as hinder the movement of blood through the chambers of the heart,Coronary artery disease,enlarged left heart and Heart failure(Snell, 2011).

The cardiovascular system is made up of: heart, lungs, arteries and veins, and it are under the control of the autonomic nervous system (sympathetic and parasympathetic). In a healthy individual with a healthy heart, heart rate is dictated by the body's needs. If an individual is resting then organs, muscles and tissues require a reduced amount of blood and oxygen(Snell, 2011).

When the individual becomes active then the organs, muscles and tissues require an increasing amount of blood and oxygen, resulting in raised blood pressure and an increase in heart rate and respirations. These responses are all involuntary, under the direct control of the autonomic nervous system. If the individual remains reasonably healthy with no cardiac complications then the cardiovascular system will continue to work just like this for life(Snell, 2011).

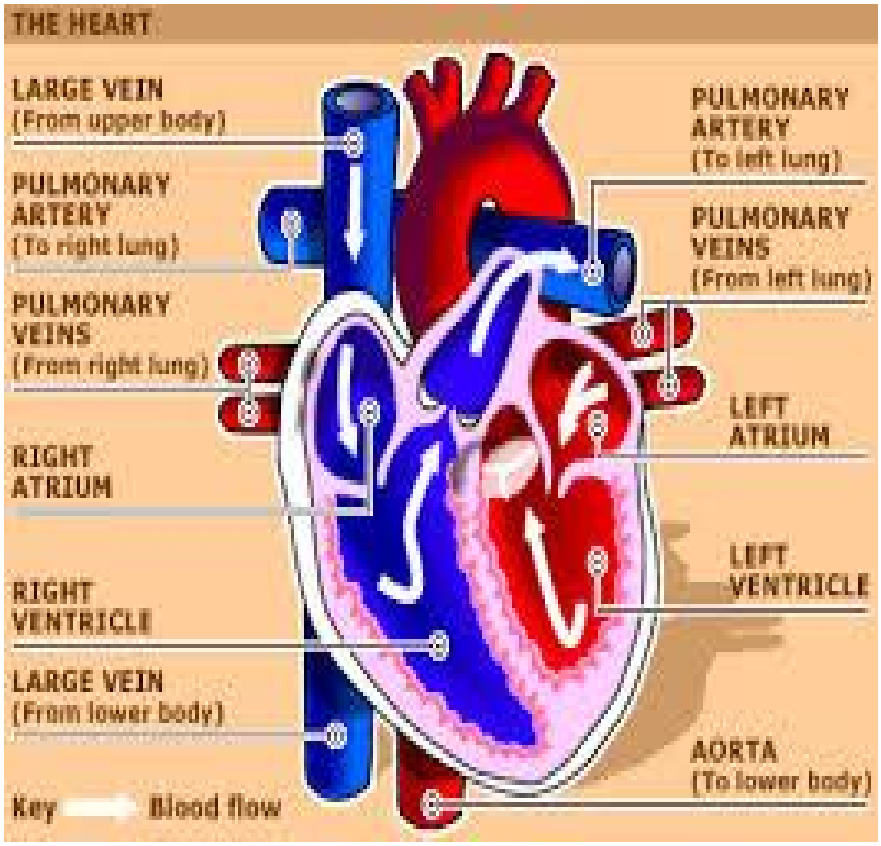


Figure (2-3) shows circulation of blood in the heart(Snell, 2011).

2-3 Pathology of heart:

Heart disease is any disorder in the heart. Examples include coronary heart disease, congenital heart disease, and pulmonary heart disease, as well as rheumatic heart disease , hypertension, inflammation of the heart muscle (myocarditis) or of its inner or outer membrane (endocarditis , pericarditis), and heart valve disease. Abnormalities of the heart's natural pacemaker or of the nerves that conduct its impulses cause arrhythmias. Some connective tissue diseases (notably systemic lupus erythematosus, rheumatoid arthritis, and scleroderma) can affect the heart. Heart failure may result from many of these disorders.

2-3-1 Coronary heart disease:

Also called ischemic heart disease, disease characterized by an inadequate supply of oxygen-rich blood to the heartmuscle (myocardium) because of narrowing or blocking of a coronary artery by fatty plaques.is group of diseases that includes: stable angina, unstable angina, myocardial infarction and sudden cardiac death. (Douglas, 2014)

Infarction of the myocardial tissue occurs when there is ischemia of the myocardium, which leads to cell death. There will be a rise in cardiac enzymes signifying tissue damage and echocardiographic changes, in addition to the classical clinical symptoms. If the infarcted area is small or sub endocardial, ECG will often not be able to detect any changes. If the infarction is transendocardial (full thickness), regional wall abnormalities can be detected, the region involved corresponding to the occluded coronary artery. In most cases the amount of muscle that appears to be affected on ECG will be greater than the actual amount infarcted. There will be reduced contraction in the affected area. *Hypokinesia* refers to contraction that is decreased but still in the same direction as normal. The myocardium will also show reduced thickening in systole. *Akinesia* is when the myocardium is static. *Dyskinesia* occurs when the most damage to myocardial tissue has occurred and the muscle moves out of synchronisation with the rest of the ventricle; often, paradoxical motion (movement in the opposite direction) will result.

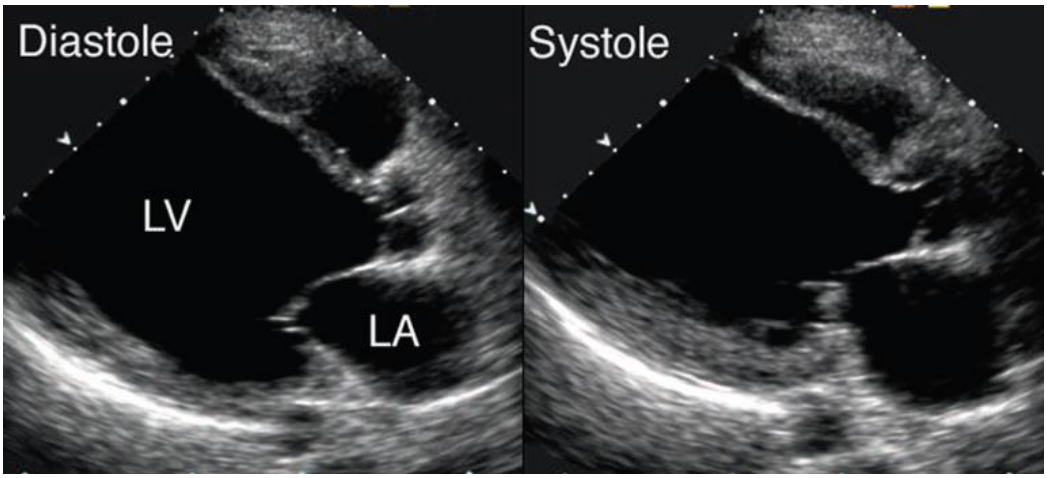


Figure (2.4) : shows occlusion of the proximal left anterior descending coronary arterycausesthe interventricular septum is thin and akinetic.

The principal goal of echocardiography in patients with CAD is the evaluation of regional variations in systolic function(Catherine,1999).Main complication:

2-3-1-1 Pericardial Effusion:

Is a small amount of pericardial fluid is typically seen following infarction, a large pericardial effusion(Catherine, 1999).

2-3-1-2 Ruptured Myocardium

If ischemia to an area of muscle is sudden and there are no collateral vessels to supply the myocardium, the risk of rupture of the affected myocardium is increased. Severe tissue ischemia will damage the myocardium to the point where it cannot support its normal pressure stresses(Catherine, 1999).

2-3-1-3 Ruptured Papillary Muscle.

If the acutely damaged and ruptured myocardium is a papillary muscle, this can cause sudden torrential mitral regurgitation(Catherine, 1999).

2-3-1-4Thrombus Formation

Thrombus is a typical late finding after a large full-thickness myocardial infarction. It will occur adjacent to sites of hypokinesia or akinesia where there is stasis of blood. The most common site is within the apex(Catherine,1999).

2-3-1-5Aneurysm

An aneurysm occurs when there is stretching of scar tissue following a large full thickness myocardial infarction. Typically the myocardium will be thinned in the area of the aneurysm. The area will be a kinetic, or may sometimes display paradoxical motion during systole(Catherine,1999).

2-3-3Left Ventricular Hypertrophy (LVH):

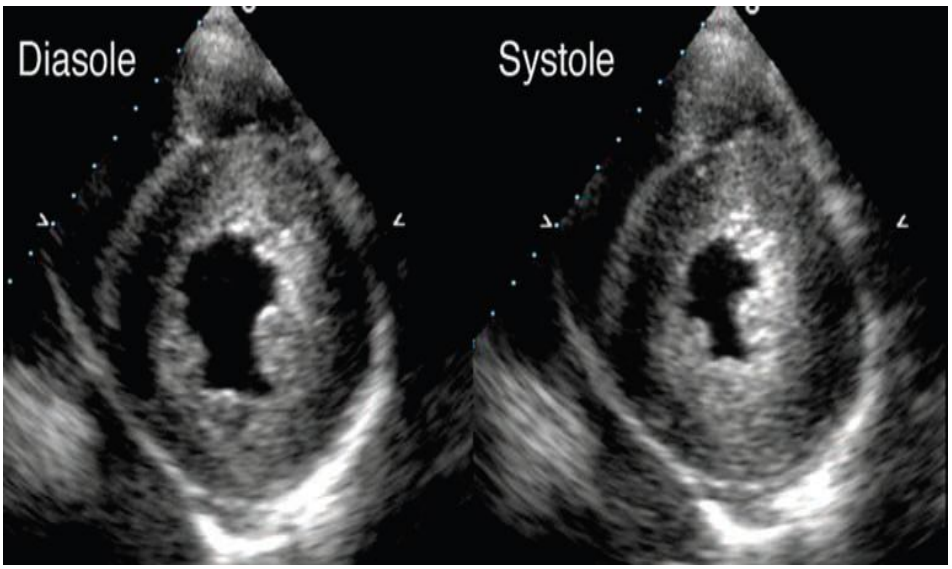
Left ventricular hypertrophy (LVH) is a condition in which the muscle wall of heart's left pumping chamber (ventricle) becomes thickened (hypertrophy).

The heart is a muscle. And so, like other muscles, it gets bigger if it is worked hard over time. The most common cause of LVH is high blood pressure (hypertension), Other causes include athletic hypertrophy (a condition related to exercise), valve disease, hypertrophic cardiomyopathy (HOCM), and congenital heart disease.

Some patients have no symptoms related to LVH. The condition usually

develops over time, and most symptoms occur when the condition causes complications. The most common symptoms of LVH are, Feeling short of breath ,Chest pain, especially after activity ,Feeling dizzy or fainting ,Rapid heartbeat, or a pounding or fluttering sensation in the chest(Douglas, 2014).

An echocardiogram is the most common way to determine if a patient has LVH. This test allows the doctor to measure the walls of the ventricle. A measurement greater than 1.5 cm is considered enlarged.



Figure(2.5) : shows severe concentric left ventricular hypertrophy.

2-3-4 Valvular heart disease :

Valvular heart disease is characterized by damage or defect in one of the four heart valves: the mitral, aortic, tricuspid or pulmonary.

The mitral and tricuspid valves control the flow of blood between the atria and the ventricles (the upper and lower chambers of the heart). The pulmonary valve controls the flow of blood from the heart to the lungs, and the aortic valve governs blood flow between the heart and the aorta, and thereby the blood vessels to the rest of the body. The mitral and aortic valves are the ones most frequently affected by valvular heart disease.

(Douglas, 2014).

The four cardiac valves normally open to allow unimpeded forward flow and close securely to prevent retrograde blood flow.

Conditions that impair these two functions alter chamber sizes, cardiac function, and hemodynamics, in proportion to their severity. Doppler echocardiography is ideally suited to assess obstruction to forward flow, regurgitant flow, and their consequent effects on cardiac architecture, function, and hemodynamics (Catherine, 1999).

In valvular heart disease, the valves become too narrow and hardened (stenotic) to open fully, or are unable to close completely (incompetent)(Douglas, 2014).

A stenotic valve forces blood to back up in the adjacent heart chamber, while an incompetent valve allows blood to leak back into the chamber it previously existed. To compensate for poor pumping action, the heart muscle enlarges and thickens, thereby losing elasticity and efficiency. In addition, in some cases, blood pooling in the chambers of the heart has a greater tendency to clot, increasing the risk of stroke or pulmonary embolism (Douglas, 2014).

The severity of valvular heart disease varies. In mild cases there may be no symptoms, while in advanced cases, valvular heart disease may lead to congestive heart failure and other complications.
Valve disease symptoms can occur suddenly, depending upon how quickly the disease develops. If it advances slowly, then your heart may adjust and you may not notice the onset of any symptoms easily. Conversely, severe symptoms could arise from even a small valve leak, many of the symptoms are similar to those associated with congestive heart failure, such as

shortness of breath and wheezing after limited physical exertion and swelling of the feet, ankles, hands or abdomen (edema). Other symptoms including Palpitations, chest pain (may be mild)Fatigue. Dizziness or fainting (with aortic stenosis) Fever (with bacterial endocarditis) Rapid weight gain. (Douglas,2014)

There are many different types of valve disease; some types can be present at birth (congenital), while others may be acquired later in life heart valve tissue may degenerate with age rheumatic fever may cause valvular heart disease. Bacterial endocarditis, an infection of the inner lining of the heart muscle and heart valves (endocardium), is a cause of valvular heart disease.High blood pressure and atherosclerosis may damage the aortic valve. A heart attack may damage the muscles that control the heart valves. Other disorders such as carcinoid tumors, rheumatoid arthritis, systemic lupus erythematosus, or syphilis may damage one or more heart valves. (Douglas, 2014).

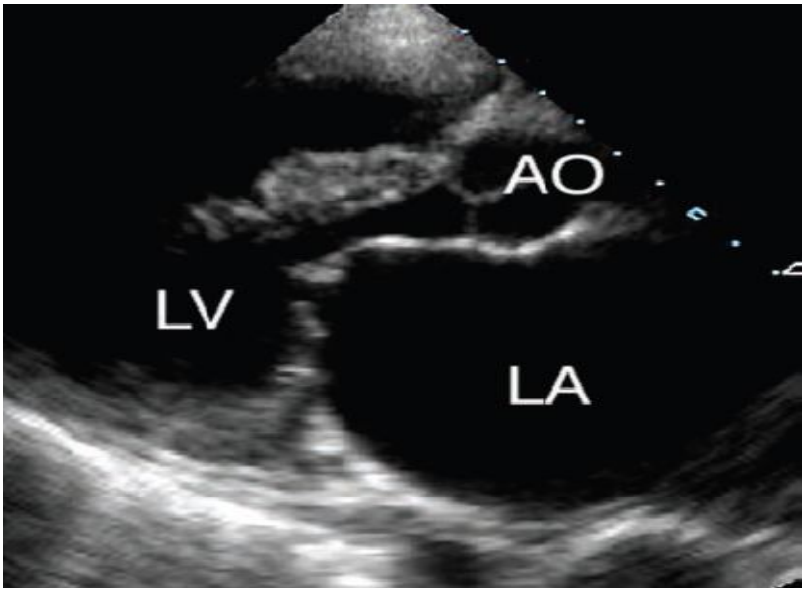


Figure (2.6): shows mitral stenosis of valvular disease.

2-3-5Reumatic heart disease:

Reumatic heart disease is cardiac inflammation and scarring triggered by an autoimmune reaction to infection with groupA streptococci. In the acute stage, this condition consists of pancarditis, involving inflammation of the myocardium, endocardium and epicardium. Chronic disease is manifested by valvular fibrosis, resulting in stenosis or/and insufficiency. It is most frequently observed in children and adolescents.There may be no symptom in early stages of RHD. The first symptoms of RHD include: fatigue or feeling short of breath. It is diagnosis by echocardiography (seen changes in heart valves)

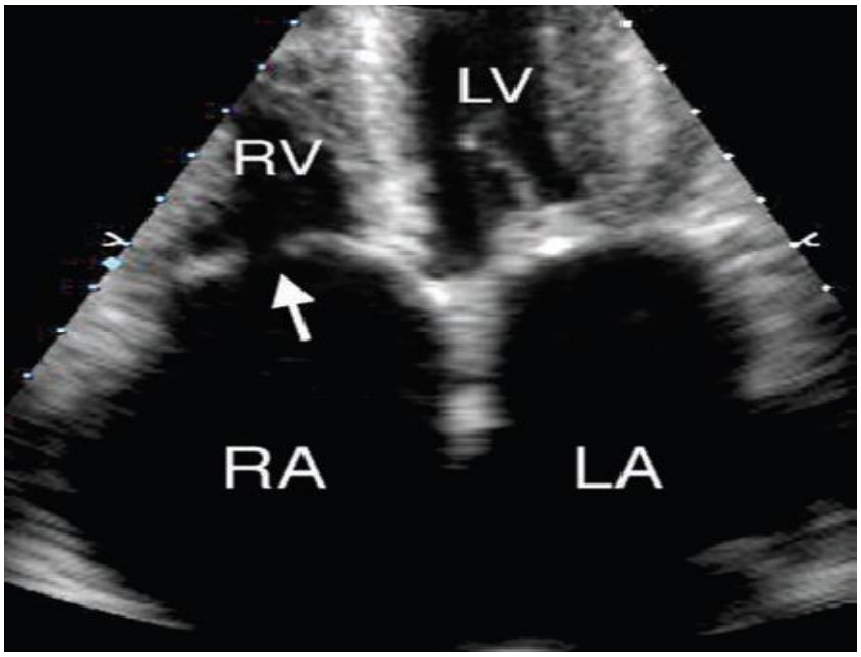


Figure (2.7) : shows Rheumatic heart disease.

2-4 Investigation done for heart

2.4.1 laboratory:

cardiac risk testing is performed to screen asymptomatic people to help determine their risk of developing coronary heart disease is group of tests include: lipid profile(LDL- HDL- cholesterol)is tests the amount and type of lipids in the blood, hs-CRP is detect low concentrations of C- reactive protein, marker inflammation and Lp is lipid test used to identify elevated level of lipoprotein lead to increased risk of atherosclerosis.

2.4.2 Radiology

2.4.2.1 Chest X-ray:

Help to check certain heart problem e.g.if the heart is enlarged –Cardio thoracic ratio >50% -then look for other features of heart failure.

2-4-2.2 Echocardiography studies:

Echocardiography as being an appropriate investigation in the assessment of patients with ultrasonography uses high-frequency (ultrasound) waves bounced off internal structures to produce a moving image. It is one of the most widely used procedures for diagnosing heart disorders because it is noninvasive, harmless, relatively inexpensive, and widely available andbecause it provides excellent images. Ultrasonography is also used in the diagnosis of disorders affecting blood vessels in other parts of the body **(** Susan. i2002)

It is essential that echo requests contain adequate clinical data both to judge the appropriateness of the request and also to allow the sonographer to place the echo findings into an appropriate clinical context(Houghton, 2013).

Prior to performing the echo study, it is good practice to record the patient's height and weight, as this will allow the indexing of echo measurements for body surface area. When the patient is in a comfortable position, apply the ECG electrodes and ensure that a clear ECG tracing is visible on the screen of the echo machine(Houghton, 2013).

There are five TTE windows, each providing one or more views of the

heart. The right parasternal window is optional and can be used when other view are suboptimal or when additional information is needed: Left Parasternal Window (Parasternal long axis view, Parasternal right ventricular (RV) inflow view, Parasternal RV outflow view), Parasternal short axis view (base, mid-cavity, apex), Right parasternal window, Apical window (Apical 4-chamber view Modified apical 4-chamber view, Apical 5-chamber view, Apical 2-chamber view, Apical 3-chamber view), Subcostal window (Subcostal long axis view, Subcostal short axis view) and Suprasternal window (Aorta view).(Houghton, 2013).

2-4-2-2-1 Left parasternal window

The left parasternal window is located to the left of the sternum, usually in the third or fourth intercostal space, but in some patients you may need to adjust the position to optimize the image by moving the probe up/down a rib space or further towards/away from the sternum. From the left parasternal window a number of views can be obtained(Houghton, 2013).

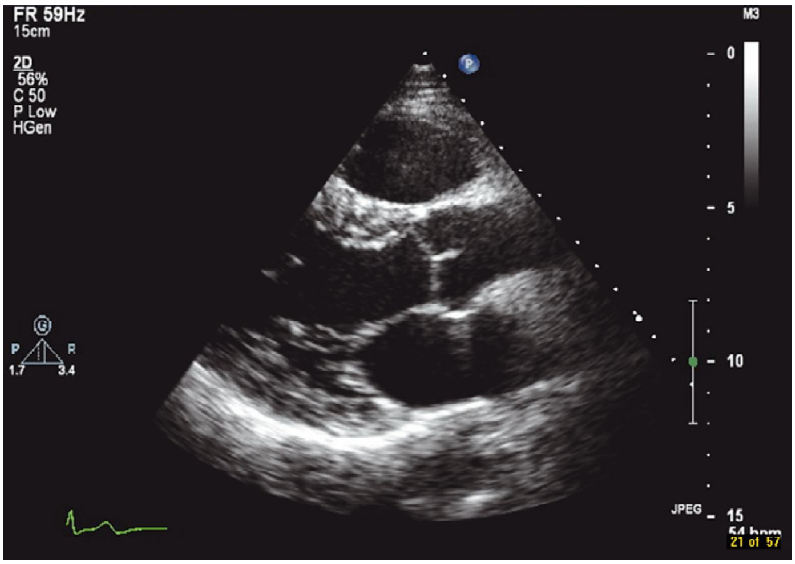


Figure (2-8) shows normal parasternal long axis view(Houghton, 2013).

2-4-2-2-2 Parasternal short axis view

To obtain the parasternal short axis (SAX) view, keep the probe in the left

parasternal window and rotate it so that the ‘dot’ is pointing towards the patient’s left shoulder. There are actually four SAX views, obtained by sweeping the probe along the axis of the heart from the level of the aortic valve down to the apex(Houghton, 2013).

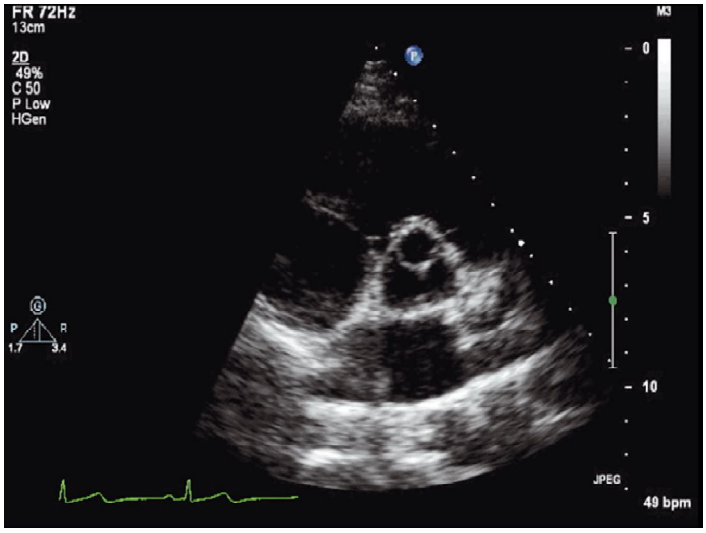


Figure (2-9) shows normal parasternal short axis view (aortic valve level) (Houghton, 2013)..

2-4-2-2-3 Apical window:

The apical window is located at the LV apex. This is normally in the mid-clavicular line and the fifth intercostal space, but may be displaced downwards and to the leftif the heart is enlarged. From the apical window a number of views can be obtained (Houghton, 2013).

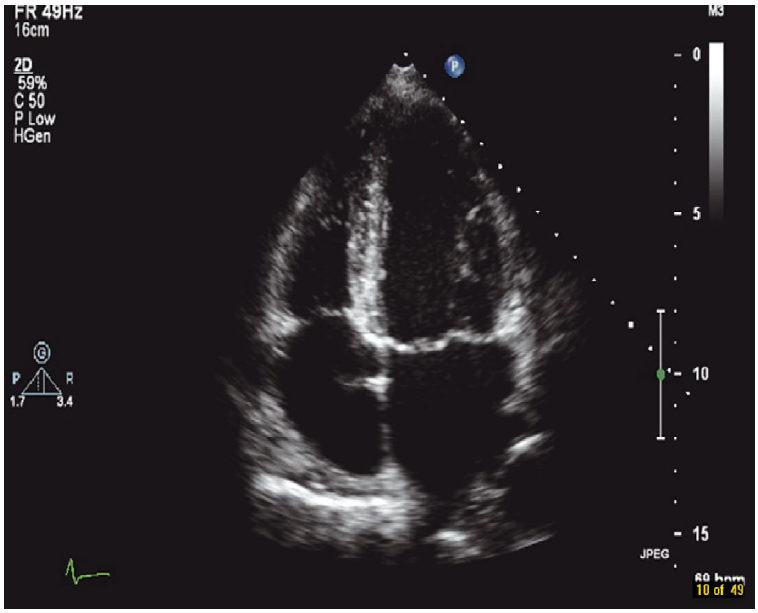


Figure (2-10) shows normal apical 4-chamber view(Houghton, 2013).

2-4-2-2-4 Subcostal window

The subcostal window is obtained with the patient lying supine with their arms by their sides. It is important that the abdominal wall is relaxed, and asking the patient to lie with their knees bent can help this. Place the probe just below the xiphisternum and angle it up towards the heart, with the 'dot' to the patient's left. From then subcostal window a number of views can be obtained(Houghton, 2013).

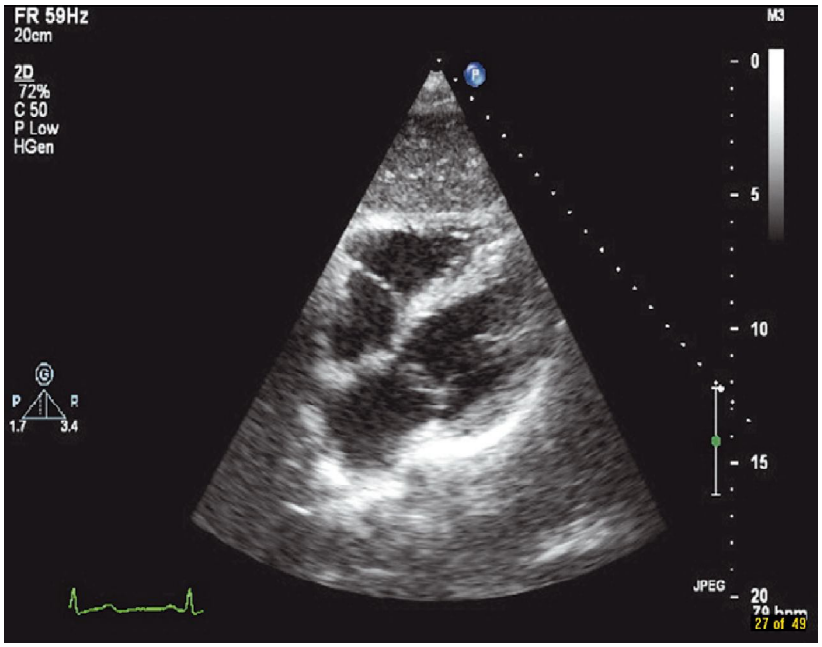


Figure (2.11): shows normal subcostal long axis view(Houghton, 2013).

2-4-2-2-5 Suprasternal window

The suprasternal window is located in the suprasternal notch. Ask the patient to lie supine and to raise their chin. Place the probe in the notch and angle it downward into the chest. Be mindful that some patients find this uncomfortable. This view shows the aortic arch. A similar view can, if needed, be obtained from the right supraclavicular position(Houghton, 2013).

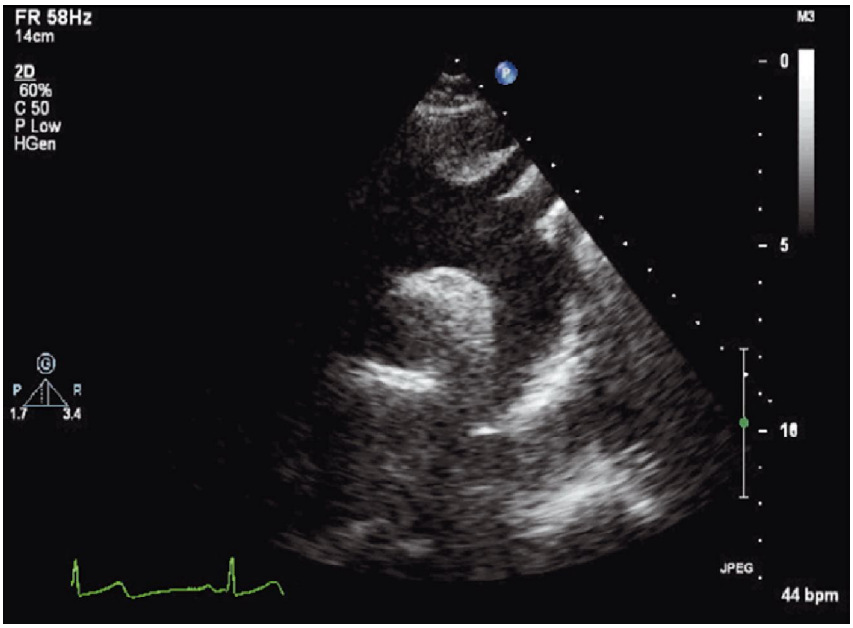


Figure (2-12): shows normal suprasternal aorta view(Houghton, 2013).

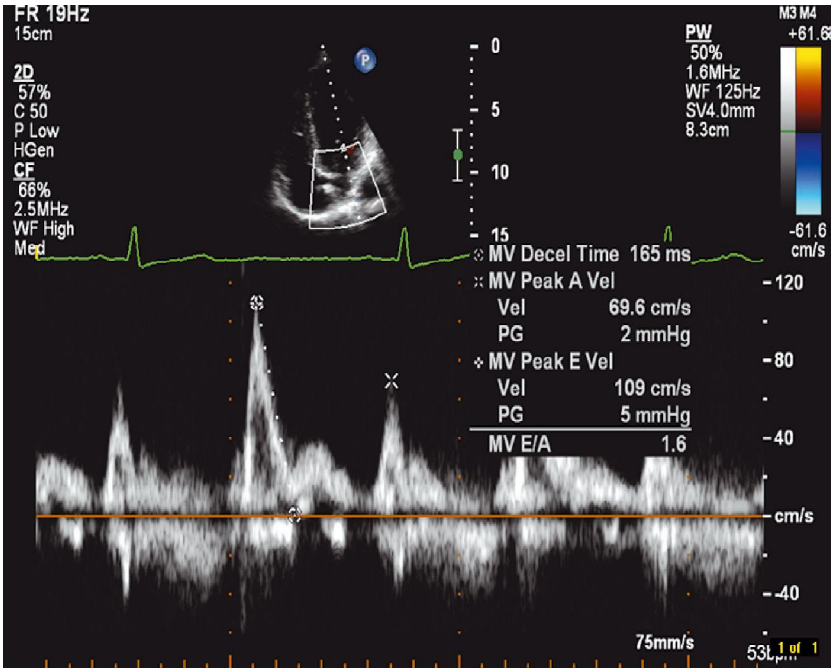


Figure (2-13):Pulsed-wave (PW) Doppler of mitral valve (MV) inflow(Houghton, 2013).

2-5 Previous studies

Study Done by Pekka, et al under the title of sex, age, cardiovascular risk factor and coronary heart disease done 1987 in Finland.

The study was used to assess the relation between risk factors and CHD risk .It was cohort consists of 14786 Finnish men and women 25 to 64 years old at baseline. The following cardiovascular risk factors were determined: smoking, serum total cholesterol, HDL cholesterol, blood pressure, body mass index and diabetes.

There were statistical significant found relative difference in CHD risk between sexes was largest among the youngest subjects, 25 to 49 years old and smallest among oldest subjects 60 to 64years old. The absolute difference in CHD risk, however, was largest in the oldest age group.Smoking was more common, HDL cholesterol was lower and blood pressure was higher among men in both the 25 to 64. In the age group 50 to 59 years systolic blood pressure of women nearly reached that of men and serum total cholesterol and BMI were already higher in women. The HDL/total cholesterol ratio was higher among women but this difference diminished with increasing age. Diabetes prevalence was fairly similar and increase similarly with age in both sexes.

The above mentioned risk factors except BMI predicted the risk of CHD in both sexes. BMI and diabetes had a stronger association with coronary mortality in women than in men.

Study Done by Minh Van, et al.Under title Smoking and Obesity are associated with the progression of aortic stenosis done April 2001 in Washington.

The purpose of the study was to identify clinical predictors of progression of aortic stenosis of valvular disease. In retrospective study, patients with diagnosis of aortic stenosis were identified by continuous wave Doppler

and follow up study of at least 6 months.

Result, one hundred twenty_ three patients and complete data were obtained for 87 patients (mean age 70.7+ or- 10 years; men, 81% mean follow up 2.54 + or – 1.6 years). The initial gradient was mild in 61% of patients and moderate in 31%. The mean rate of progression was 6.3+ or – 13 mm Hg/year. Independent clinical factors associated with progression of 5mm Hg/year or greater included history of smoking (relative risk [RR] = 3.06, 95% confidence interval [CI]= 1.09-8.61, p=0.034) and body mass index (RR= 1.16, 95% CI=1.03-1.30, p=0.013). Hypertension, diabetes, cholesterol, age and gender were not independently associated with progression.

Conclusion; body mass index and history of smoking are independent predictors of significant progression of aortic stenosis.

Study Done by Kuch B et al. under the title sex differences in the correlation between obesity and hypertension with left ventricular mass and hypertrophy, done 1996 in Augsburg.

The study was used to assess development of left ventricular hypertrophy in overweight and hypertension patients. We investigated selected subgroup (n= 520, aged 52 to 67 years). M-mode echocardiography measurement in 293 women and 227 men. In men the increase in LVMIm was 31% from lean to several obese subjects (145 g/m, p<0.003) and 25% from normotensive to treated hypertensive subjects (145 g/m, p< 0.0001). in women respective values were 36% (113g/m, p<0.0001) and 27% (112g/m, p`0.0001). In particular, the increase in LVMIm from the group of lean normotensives to the group of severely obese treated hypertensive was 85% (133 g/m, p< 0.0001) in women and 49% (144 g/m, p< 0.002) in men. The odds ratio for the LVH –prevalence in hypertensive obese subjects opposed to normal weight normotensive subjects were 11.9 (p<0.0001) in women

and 4.9 ($p<0.0004$) in men.

The combined occurrence of hypertension and obesity had additional impact on left ventricular mass and hypertrophy, in women the effects were significantly more pronounced than in men.

Study Done by Suliman A, under the title The state of heart disease in Sudan, done 2011 Aug in Sudan.

Data were obtained from Sudan Household Survey (SHHS) prevalence of 2.5% for heart disease. Hypertension heart disease, rheumatic heart disease, ischemic heart disease and cardiomyopathy more than 80% of CVD in Sudan. Hypertension had prevalence of 20.1 and 20.4% in the SHHS. RHD prevalence data were available only for Khartoum state and the incidence has dropped from 3/1000 people in the 1980 to 0.3% in 2003.

The coronary event rates in 1989 were 112/100000 people. Prevalence rates of low physical activity, obesity, HTN, diabetes and smoking were 86.8, 53.9, 23.6, 19.8, 19.2, and 12%. Peripartum cardiomiopathy occur at rate of 1.5% of all deliveries.

Material and method

3-1 materials

3-1-1 Sampling and sample size

131 cardiac disease patients, selection was done through simple random sampling.

3-1-2 Area of study

The study was conducted in echocardiography department in the Sudan heart center.

3-1-3 Duration of the study

The study was carried out in period from December 2016 to April 2017.

3-1-4 Inclusion criteria

All patients with cardiac disease were included in this study.

3-1-5 Exclusion criteria

Child patients and congenital heart disease patients.

3-1-6 Equipment used

- Lab^{TM} 50 made by Esaote corporation– Italy, with multi-frequency phased array probe (2.5-5MHZ)
- ARTIDA^{TM} made by Toshiba medical system corporation- Japan with multi -frequency phased array probe (2.5-5)
- APLIO^{TM} 400- Toshiba medical system corporation Japan with multi-frequency phased array probe (2.5-4,4MHZ).

3-2 method

3-2-1 position of patient:

The patient lie supine and rotated slightly to the left , the patient relaxed , lying comfortably and breathing quietly .lubricate the area of chest in heart by gell , hair anywhere on the chest will trap air bubbles so apply coupling agent generously

3-2-2 Scanning techniques:

The real time ultrasound scanning is performed with supine position. The scan can be performed by both curvilinear sector phased array probes, but all cases of study were scanned by phased array probe as a part of full echocardiography study. Firstly applied coupling gel "a coupling agent is necessary to ensure good acoustic contact between the transducer and the skin and allow total transmission of the sound beam" then the probe placed on left sternum between third and fourth ribs is Long axis plane (LAX). This plane runs from the right shoulder to the left hip and cuts the left side of the heart along its long axis is measurement (AO, LA, IVS and LVPW) and determine if the heart valves open and close properly , the pericardial space is normally visible in systole as a capillary space posterior to LV. And then use Color Doppler ultrasonography shows the different rates of blood flow in different colors and discover(MR, MS, Mitral prolapsed, Mitral stenosis, AR and AS).

Then scan the Short axis plane (SAX) this is perpendicular to LAX. It runs from the left shoulder to the right hip and cuts the heart in cross section , cross sectional images from the apex to the base of the heart can be imaged by serial tilt of the transducer infero- superiorly .this is plane assessment systolic function. In each imaging plane, the left ventricle is divided into

several segments and is assessment the type of myocardial motion.

Three section are important of (SAX) continue scan to(Apex 4- chamber view) This is perpendicular to the other planes and are assessment (diastolic function, MS,MR,TR,TS,AR and dilated ventricle).

3-2-3 image interpretations;

Interpretation images appropriate fall area s , both normal and abnormal , should be recorded . Variation from normal size should be accompanied by measurements; images should be labeled with patient identification, examination date and side (right &left) of anatomicultrasound printer using thermal paper, CD, DVD, PAC5.

3-2-4 Data analysis:

All data were entered and analyzed using Microsoft excel and statistical package for social science (SPSS) all statistical analysis included description statistics of frequency tables and figure.

3-2-5 Ethical consideration

Especial consideration was given to the right confidentially and anonymity of all research participants. Anonymity was achieved by using numbers for each research participant that would provide link between the information collected and the participants.

Results

4-Result

Table (4.1): frequency distribution the Age :

Age	Frequency	Percent (%)
Less than 30	**14**	**10.7%**
30 – 45	**15**	**11.5%**
45 – 60	**35**	**26.7%**
Greater than 60	**67**	**51.1%**
Total	**131**	**100.0%**

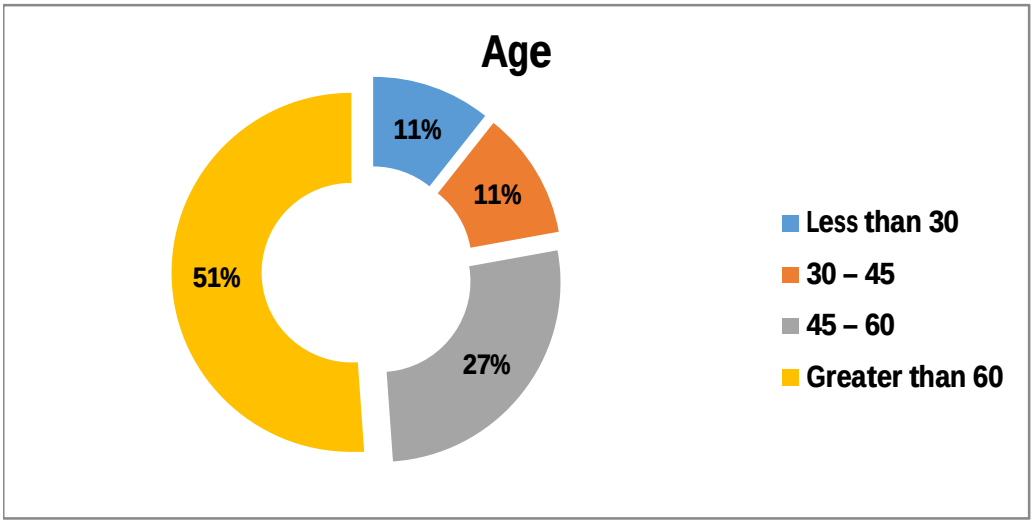


Figure (4.1) ; shows frequency distribution of the age.

Table (4.2); frequency distribution of the gender.

gender		
	Frequency	Percent (%)
Male	73	55.7%
Female	58	44.3%
Total	131	100.0%

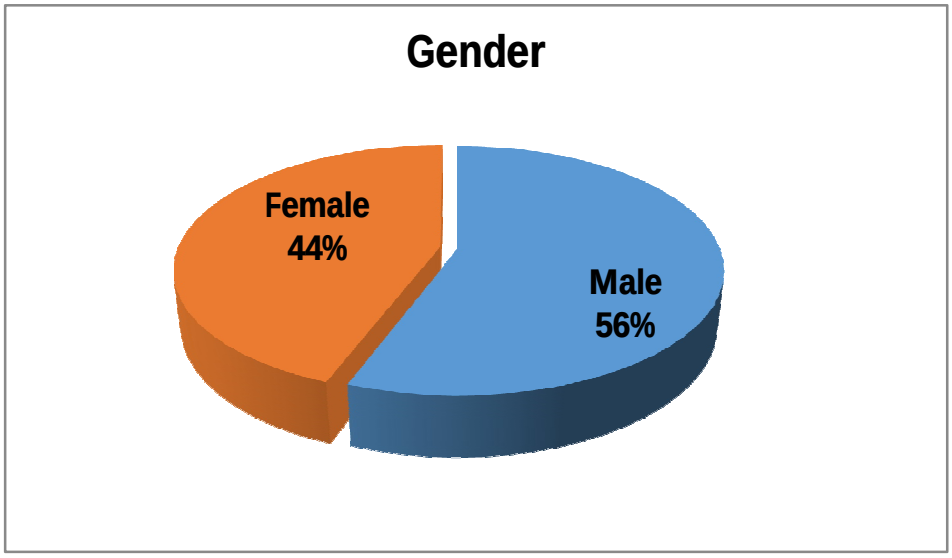


Figure (4.2):shows frequency distribution of the gender.

Table (4.3): Frequency distribution of the Heart Disease

	Frequency	Percent (%)
IHD	60	45.8%
LVH	25	19.1%
VD	18	13.7%
RHD	13	9.9%
Other	15	11.5%
Total	131	100.0%

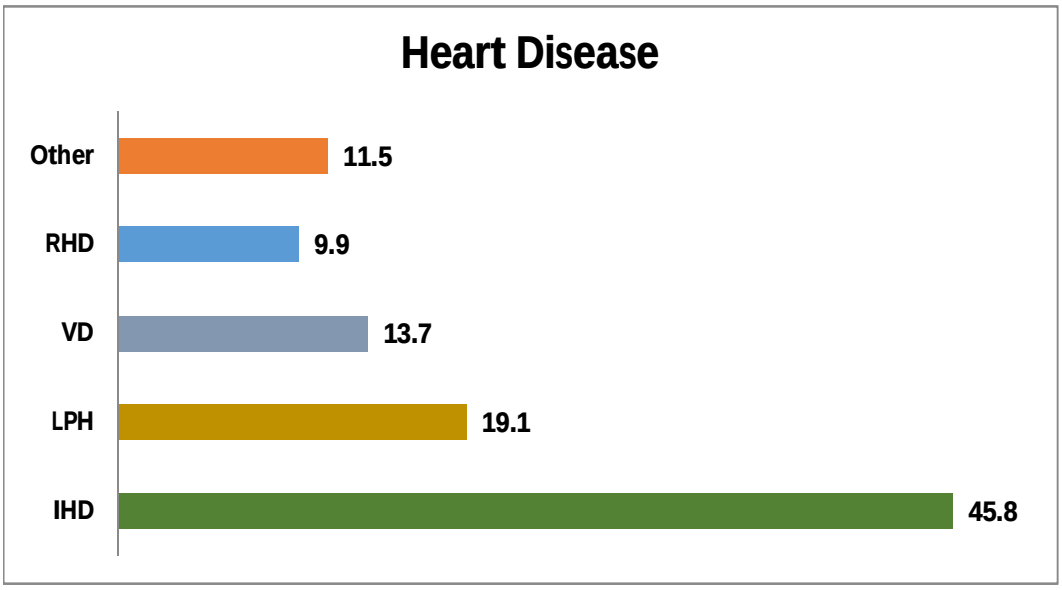


Figure (4.3) : Shows frequency distribution of theHeart Disease

Table (4.4): Frequency distribution of the CD Symptom

	Frequency	Percent
No Symptom	7	5.3
Shortness	21	16.0
Chestpain	39	29.8
Dyspnea	8	6.1
Palpitation	3	2.3
Other	23	17.6
shortness+chestpain	7	5.3
shortness+Dyspnea	3	2.3
shortness+palpitation	3	2.3
shortness+other	11	8.4
chestpain+palpitation	1	.8
chestpain+other	3	2.3
Dyspnea+other	2	1.5
Total	131	100.0

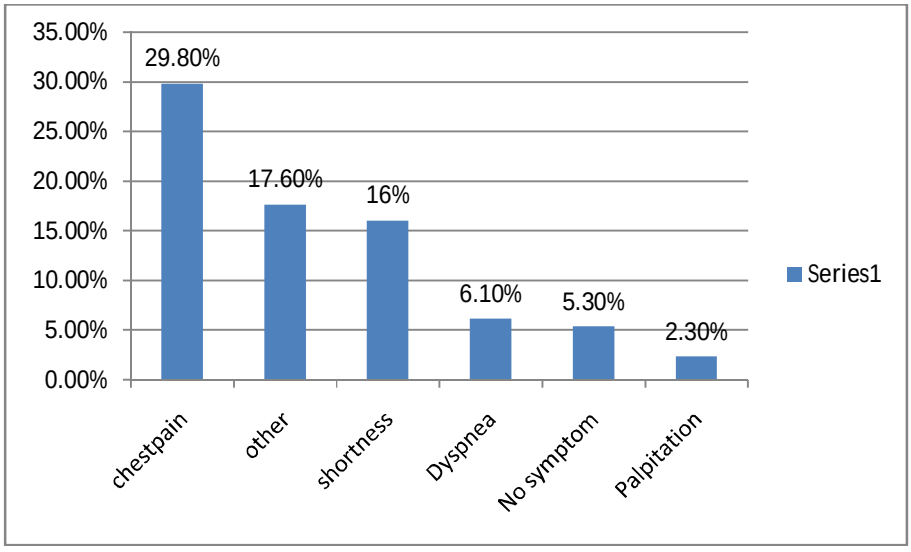


Figure (4.4): Shows frequency distribution of the CD Symptom

Table (4.5): Frequency distribution of the Risk Factor

	Frequency	Percent
NO Risk Factor	22	16.8
Smoker	1	.8
HTN	26	19.8
DM	10	7.6
Obesity	8	6.1
Other	2	1.5
smoker+HTN	5	3.8
smoker+DM	7	5.3
smoker+Obesity	3	2.3
HTN+DM	2	1.5
HTN+Obesity	17	13.0
HTN+Other	3	2.3
DM+Obesity	16	12.2
Smoker+HTN+DM	3	2.3
Smoker+DM+Obesity	1	.8
HTN+DM+Obesity	3	2.3
HTN+DM+Other	1	.8
Smoker+HTN+DM+Obesity	1	.8
Total	131	100.0

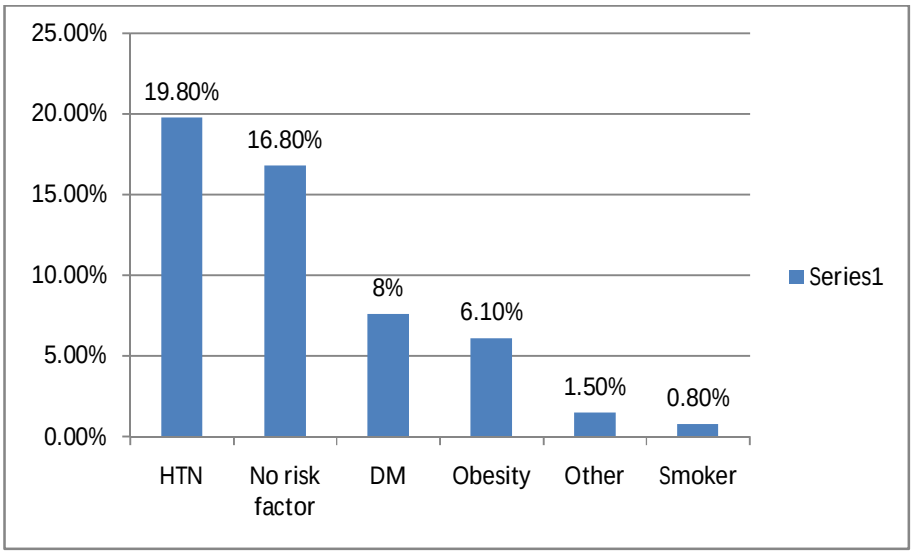


Figure (4.5): Shows frequency distribution of the Risk Factor.

Table (4.6): Chi-Square Statistic & P-value(Significance) of correlation Heart Disease with (Gender, Age, Symptom, and Risk Factor).

Heart Disease	Ischemic heart disease	Left ventricular hypertrophy	Valvular disease	Rheumatic heart disease	other	Total	Chi-Square	P-value
Gender								
Male	**38(63.3)**	**16(64.0)**	**7(38.9)**	**2(15.4)**	**10(66,7)**	**73(55.7)**	**13.472**	**.09***
Female	**22(36.7)**	**9(36.0)**	**11(61.1)**	**11(84.6)**	**5(33.3)**	**58(44.3)**		
Total	**60(45.8)**	**25(19.1)**	**18(13.7)**	**13(9.9)**	**15(11.5)**	**131(100.0)**		
Age								
Less than 30	**0(0.0)**	**0(0.0)**	**4(22.2)**	**8(61.5)**	**2(13.3)**	**14(10.7)**	**56.085**	**.000***
30 – 45	**5(8.3)**	**3(12.0)**	**2(11.1)**	**3(23.1)**	**2(13.3)**	**15(11.5)**		
45 – 60	**21(35.0)**	**6(24.0)**	**5(27.8)**	**1(7.7)**	**2(13.4)**	**35(26.7)**		
Greater than 60	**34(56.7)**	**16(64.0)**	**7(38.9)**	**1(7.7)**	**9(60.0)**	**67(51.1)**		
Total	**60(45.8)**	**25(19.1)**	**18(13.7)**	**13(9.9)**	**15(11.5)**	**131(100.0)**		

Heart Disease	Ischemic heart disease	Left ventricular hypertrophy	Valvular disease	Rheumatic heart disease	other	To
Symptom						
No Symptom	**1(1.7)**	**0(0.0)**	**1(5.6)**	**5(38.5)**	**0(0.0)**	**7(5**
Shortness	**5(8.3)**	**6(24.0)**	**2(11.1)**	**6(46.2)**	**2(13.3)**	**21(1**
Chestpain	**27(45.0)**	**7(28.0)**	**3(16.7)**	**0(0.0)**	**2(13.3)**	**39(2**
Dyspnea	**4(6.7)**	**3(12.0)**	**1(5.6)**	**0(0.0)**	**0(0.0)**	**8(6**
Palpitation	**0(0.0)**	**1(4.0)**	**2(11.1)**	**0(0.0)**	**0(0.0)**	**3(2**
Other	**7(11.7)**	**4(16.0)**	**5(27.8)**	**2(15.4)**	**5(33.3)**	**23(1**
shortness+chestpain	**5(8.3)**	**0(0.0)**	**1(5.6)**	**0(0.0)**	**1(6.7)**	**7(5**
shortness+Dyspnea	**1(1.7)**	**2(8.0)**	**0(0.0)**	**0(0.0)**	**0(0.0)**	**3(2**
shortness+palpitation	**1(1.7)**	**0(0.0)**	**1(5.6)**	**0(0.0)**	**1(6.7)**	**3(2**
shortness+other	**6(10.0)**	**1(4.0)**	**1(5.6)**	**0(0.0)**	**3(20.0)**	**11(**
chestpain+palpitation	**1(1.7)**	**0(0.0)**	**0(0.0)**	**0(0.0)**	**0(0.0)**	**1(0**
chestpain+other	**1(1.7)**	**0(0.0)**	**1(5.6)**	**0(0.0)**	**1(6.7)**	**3(2**
Dyspnea+other	**1(1.7)**	**1(4.0)**	**0(0.0)**	**0(0.0)**	**0(0.0)**	**2(1**
Total	**60(45.8)**	**25(19.1)**	**18(13.7)**	**13(9.9)**	**15(11.5)**	**131(1**

Heart Disease	Ischemic heart disease	Left ventricular hypertrophy	Valvular disease	Rheumatic heart disease	other	T
Risk Factor						
NO Risk Factor	**0(0.00)**	**0(0.00)**	**7(38.9)**	**11(84.6)**	**4(26.7)**	**22(1**
Smoker	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(6.7)**	**1(0.8**
HTN	**9(15.0)**	**12(48.0)**	**2(11.1)**	**1(7.7)**	**2(13.3)**	**26(1**
DM	**3(5.0)**	**0(0.00)**	**5(27.8)**	**0(0.00)**	**2(13.3)**	**10(7.**
Obesity	**4(6.7)**	**0(0.00)**	**2(11.1)**	**0(0.00)**	**2(13.3)**	**8(6.1**
Other	**2(3.3)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**2(1.5**
smoker+HTN	**5(8.3)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**5(3.8**
smoker+DM	**6(10.0)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(6.7)**	**7(5.3**
smoker+Obesity	**2(3.3)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(6.7)**	**3(1.5**
HTN+DM	**2(3.3)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**2(1.5**
HTN+Obesity	**5(8.3)**	**10(40.0)**	**1(5.6)**	**0(0.00)**	**1(6.7)**	**17(1**
HTN+Other	**0(0.00)**	**3(12.0)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**3(2.3**
DM+Obesity	**15(25.0)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(6.7)**	**16(1**
Smoker+HTN+DM	**3(5.0)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**3(2.3**
Smoker+DM+Obesity	**1(1.7)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(0.8**
HTN+DM+Obesity	**2(3.3)**	**0(0.00)**	**1(5.6)**	**0(0.00)**	**0(0.00)**	**3(2.3**
HTN+DM+Other	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(7.7)**	**0(0.00)**	**1(0.8**
Smoker+HTN+DM+Obesity	**1(1.7)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**0(0.00)**	**1(0.8**
Total	**60(45.8)**	**25(19.1)**	**18(13.7)**	**13(9.9)**	**15(11.5)**	**131(**

Discussion, conclusion @recommendation

5.1. Discussion

The study was conducted on 131 patients with cardiac disease investigated by echocardiography.

Regarding the frequency distribution of the age group affected by CD was greater than 60 years, which represented (51.1%), this agree (Pekka, Erkki 1993) whom found that CHD was more commons in older persons and effects of the population aged 60 to 64 years old.

Regarding the frequency distribution of the gender was found the males are more affected by CD was (55.7%)than female 58 cases (44.3%), this disagree with(Pekka, Erkki, 1993 and by Kuch, 1996)result from smaller sample size.

Regarding the frequency distribution of the heart disease was found that IHD are more affected (45.5%) than LVH, VD, RHD and other were (19.1%), (13.7%), (9.9%) and (11.5%),(by Suliman, 2011)

Data were obtained from Sudan Household Survey (SHHS) prevalence of 2.5% for heart disease. Hypertension heart disease, rheumatic heart disease, ischemic heart disease and cardiomyopathy more than 80% of CVD in Sudan. Hypertension had prevalence of 20.1 and 20.4% in the SHHS. RHD prevalence data were available only for Khartoum state and the incidence has dropped from 3/1000 people in the 1980 to 0.3% in 2003. The coronary event rates in 1989 were 112/100000 people.

Regarding frequency distribution of symptoms was found that the most common symptoms were chest pain which represented (29.8%). Regarding the frequency distribution of the risk factor, the study showed

that most common risk factor of CD was hypertension forming (19.8%), this disagree with (Suliman, 2011).

In correlation between the heart disease and gender the study found that male more affected by IHD(63.3%), LVH(64%) and other(66.7%).while female more affected by RHD(84.6%) and valvular disease (61.1%). no significant correlation between the heart disease with gender (p-value =0.09).

In correlation between the heart disease and the age the study found that greater than 60 more affected by IHD(56.7%), LVH (64%), VD (38.9%) and other (60%).while less than 30 more affected by RHD (61.5%). The study reflects significant correlation between between the heart disease with age (p-value =0.000).

In correlation between the heart disease and the symptom the study found that chest pain more affected by IHD (44.7%), shortness more affected by LVH (31.1%), other more affected by VD (36.4%), RHD (53.8%) and other (42.9%). The study reflects significant correlation between the heart disease and symptom (p-value =0.001).

In correlation between the heart disease and the risk factor the study found that diabetes mellitus more affected by IHD (30%), hypertension more affected by LVH (65.8%), other more affected by VD (33.4%) and RHD (80%) and obesity more affected by other (26.3%).The study reflects significant correlation between the heart disease with risk factor (p-value =0.000).

5.2.Conclusion

The study concluded that echocardiography evaluation cardiac disease is a rapid. . Ischemic heart disease was predominant over other types of cardiac disease, and the most common symptom was chest painwith percent.

The study concluded that male was most common of cardiac disease than female, The most common affected age group was above 60years andmost common risk factor causes of heart disease was hypertension.

There is significant correlation between the heart disease with age, also between the heart disease with symptoms andsignificant correlation between heart disease with risk factor.

5.3. Recommendations

- Ultrasound should be routinely used in the diagnosis, management and follow up of patients with any suspected or known cardiac disease.
- Ultrasound should be used routine in older patient or cases risk factor periodically.
- Further studies should be done in detection the cardiac disease in child patients using echocardiography.

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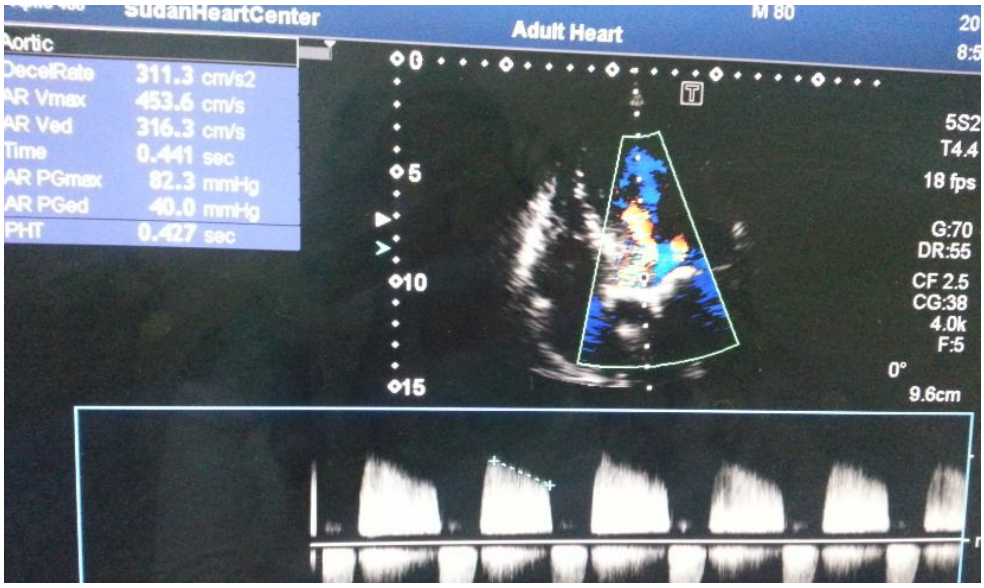
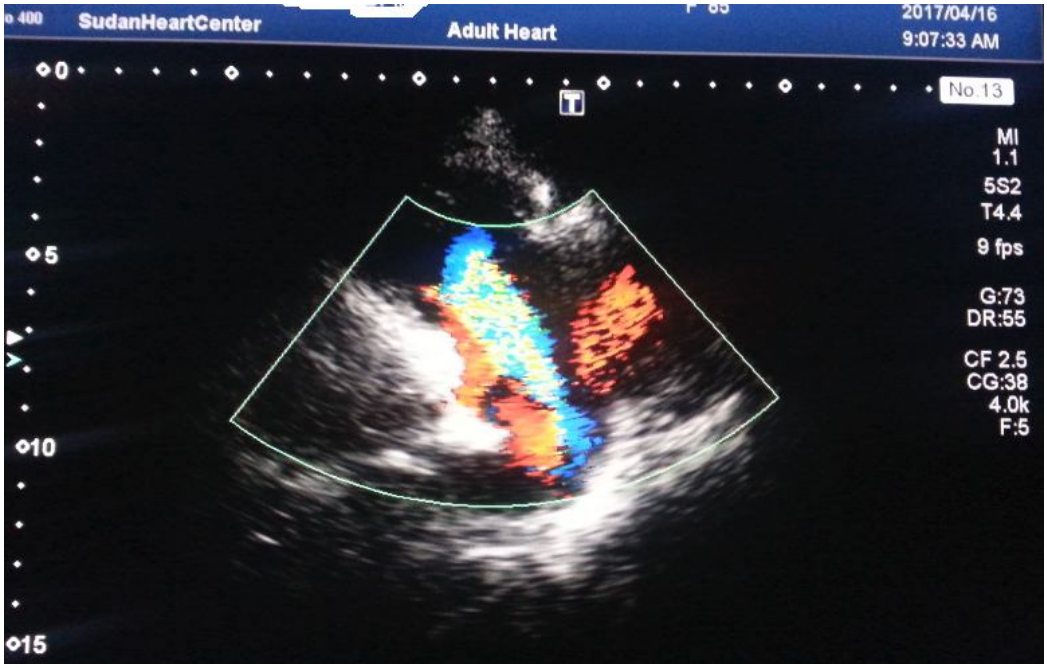
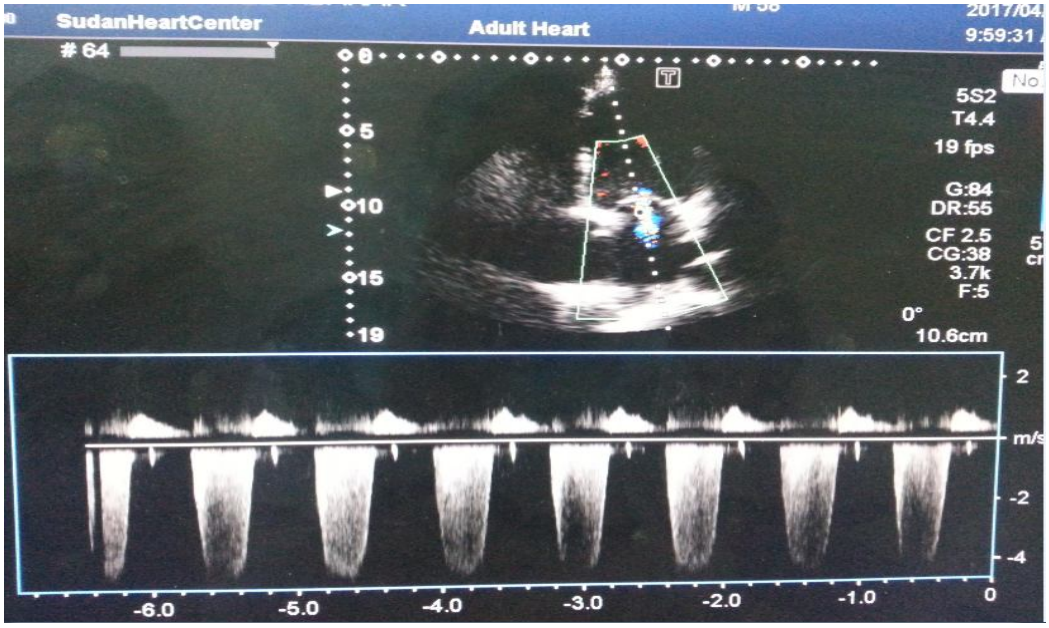
Appendix (A)



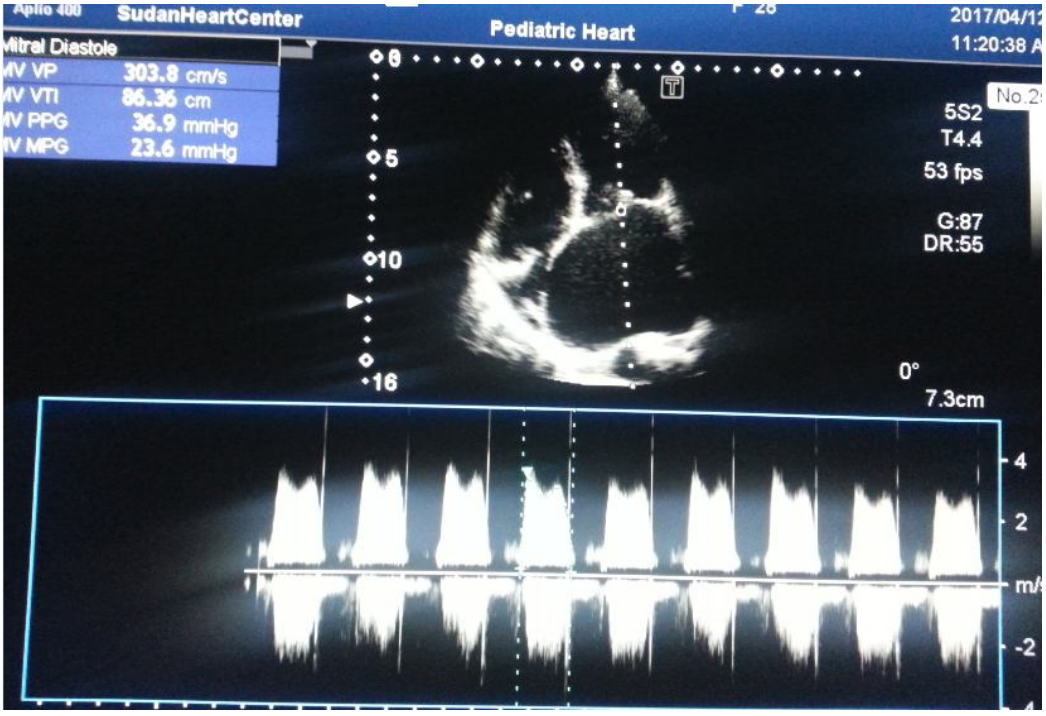
Appendix A. 1: 60 male patient shows The slope of the continuous wave Doppler signal of aortic regurgitation.



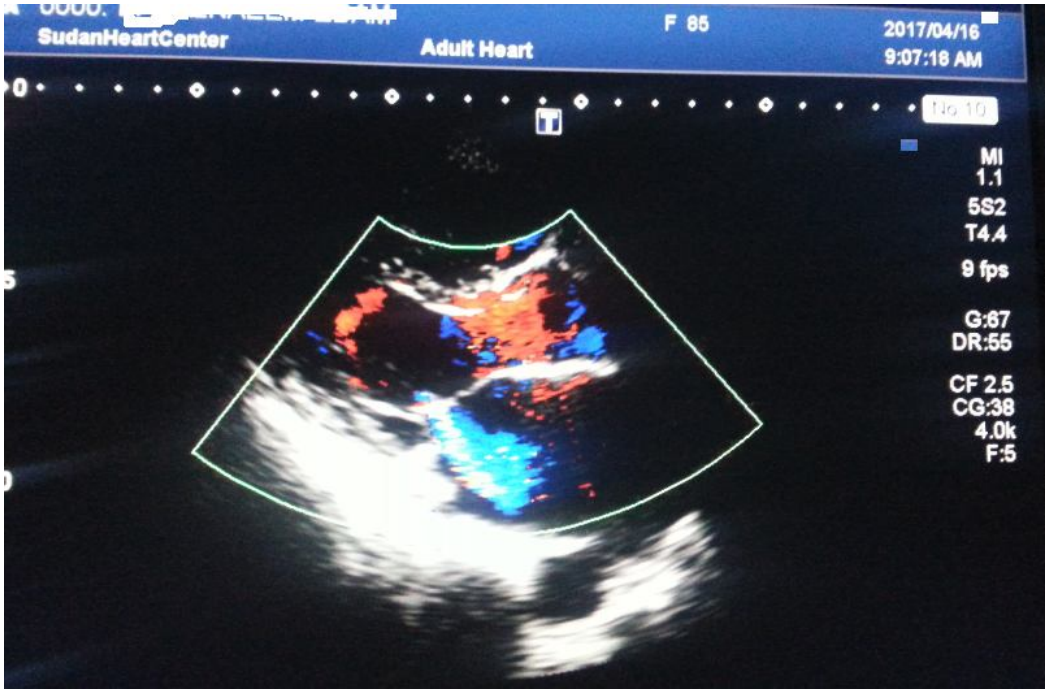
Appendix A. 2: 85 female patient shows suprasternal view of the color Doppler show aortic regurgitation.



Appendix A. 3: 58 male patient shows apical 4 chamber view with pulse Doppler showing severe mitral regurgitation



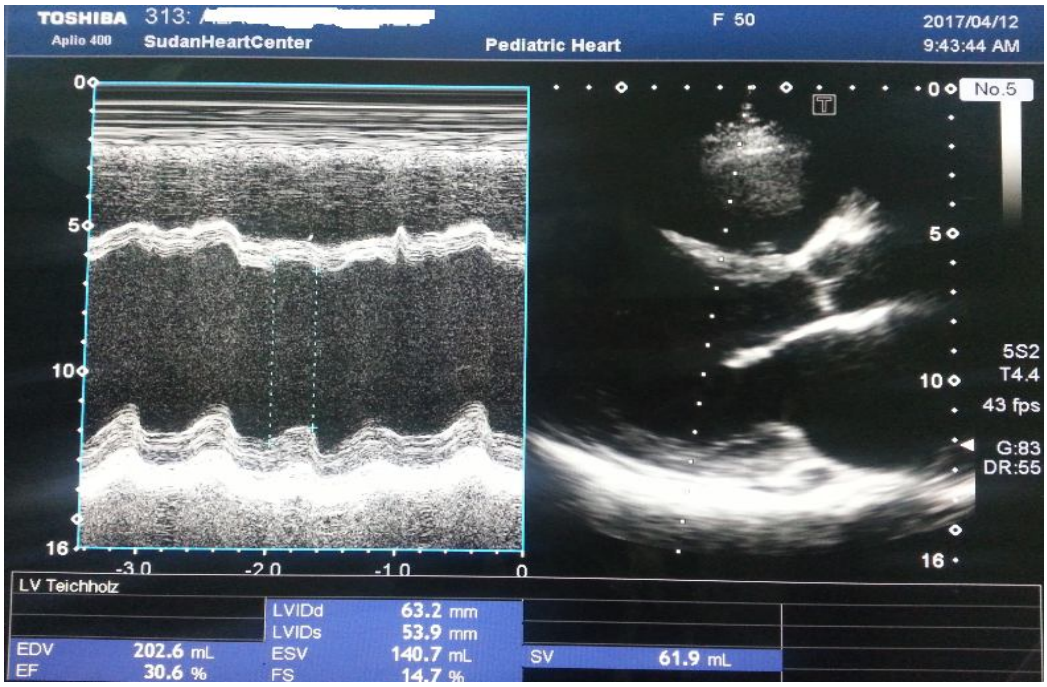
Appendix A. 4: 28 female patient shows Apical 4 chamber views with pulse Doppler show sever mitral stenosis.



Appendix A. 5: 85 female patient shows parasternal long axis view with color Doppler show mitral stenosis.

Appendix A. 6: 28 female patient shows parasternal long axis view show rheumatic heart disease.

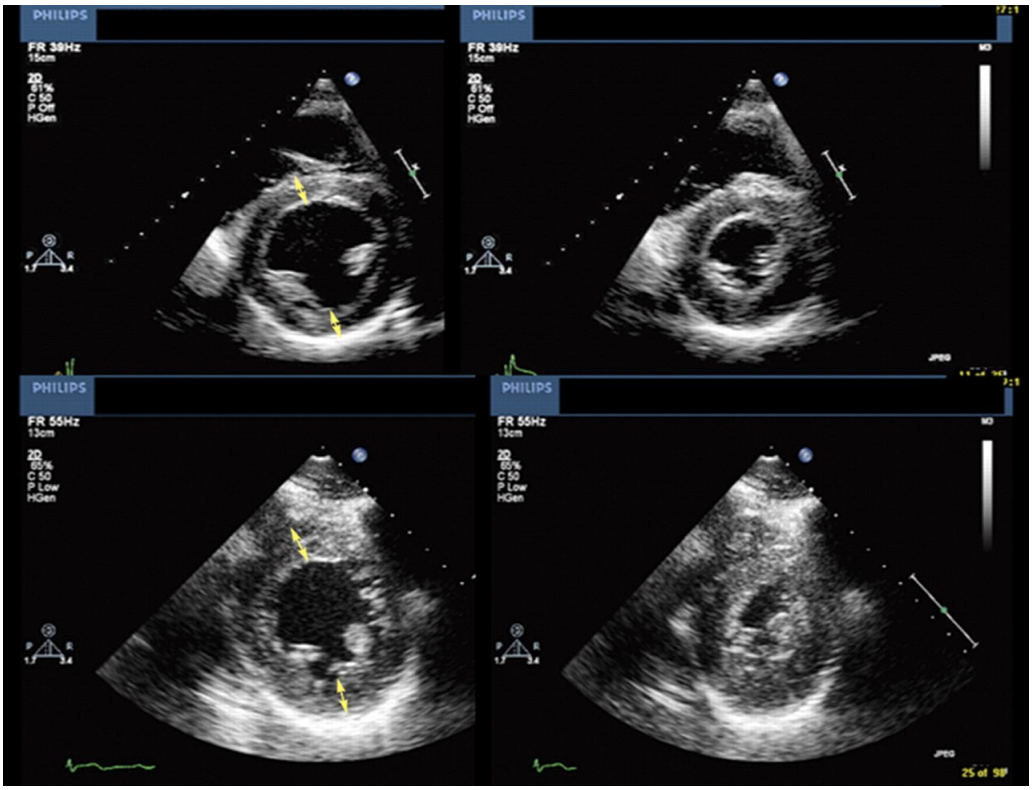
AppendixA.7: 28 female patient shows Apical 4 chamber views show rheumatic heart disease.



Appendix A. 8: 50 female patient shows parasternal long axis view show M- mode for ischemic heart disease.

Appendix A.9: 68 male patient showsParasternal short axis view showing posterior and inferior wall akinesis.

AppendixA.10: 80 male patient shows Parasternal long axis views with patient complain of left ventricular hypertrophy.



Appendix A.11: 60 male patient showsparasternal short axis view with patient complains of left ventricular hypertrophy.

Appendix A. 12: 70 female patient shows apical 4 chamber view show mitral prolapsed.

Appendix (B)

Sudan University of Science and Technology

College of Graduate Studies

Role of echocardiography in detection of the cardiac diseases in adult patients

Data collection sheet

- **Age ( )**
- **Gender**: female ( ) or male ( )
- **Weight** ( ) , Height( )

- **Symptom:**

Shortness of breath ( )
Chest pain ( )
Dyspnea ( )
Palpitation ( )
Other ( )

- **Risk factor:**

Smoker ( )
Hypertension ( )
Diabetes mellitus ( )
Obesity ( )
Other ( )

- **U/S finding:**

Ischemic heart disease ( )
Left ventricular hypertrophy ( )
Valvular disease ( )
Reumatic heart disease ( )
Other ( )