PREVALENCE AND CHARACTERISTICS OF ECHOCARDIOGRAPHICALLY DIAGNOSED PATIENTS WITH RHEUMATIC HEART DISEASE AT MUHIMBILI NATIONAL HOSPITAL, DAR-ES-SALAAM.

A HOSPITAL-BASED CROSS SECTIONAL DESCRIPTIVE STUDY

By

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied Sciences (MUIIAS)

APRIL, 2009

CERTIFICATION

The undersigned certify that he has read and hereby recommend for the examination of a dissertation entitled, "**Prevalence and characteristics of echocardiographically diagnosed patients with Rheumatic Heart Disease at Muhimbili National Hospital, Dar-Es-Salaam"** in fulfillment of the requirements for the degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied Sciences (MUHAS).

This Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Medicine (Internal Medicine) of the Muhimbili University of Health and Allied Sciences (MUHAS)

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DEDICATION

To my Parents, for their unprecedented belief in education.

To my Brothers and Sisters, for all the sacrifices.

ABSTRACT

Background: Rheumatic Heart Disease (RHD) affects mostly adolescents and young adults, accounting for morbidity, absenteeism in schools and workplaces of the most productive group of the society. Most of the studies on RHD in Tanzania were done in the pre-echocardiography era. This study is expected to provide information on the magnitude of RHD, elucidate the prevalence of pulmonary hypertension among RHD patients and determining the association between presenting clinical features and left atrial size in patients with rheumatic valvular disease, a subject whose literature is still scanty but evolving.

Objective: To establish the prevalence, and elucidate the clinical and echocardiographic characteristics of RHD patients referred for echocardiography at Muhimbili National Hospital (MNH).

Methods: A cross sectional descriptive study was done at MNH for a period of seven months. During this period patients referred for Echocardiography were screened for clinical features suggestive of Rheumatic Heart Disease. An echocardiogram was then performed to determine Echo features suggestive of RHD including details of the affected valves, type of lesions (i.e. regurgitant or stenotic), pulmonary arterial pressure and left atrial (LA) size .These variables were recorded and subsequently analyzed using SPSS version 15.

Results: A total of 2782 patients were referred for Echocardiography during the study period. Of these 150 (5.4%) were detected to have rheumatic valvular lesions. Female subjects were predominantly affected (70.7%) than males with a male to female ratio of 1:2.4. RHD was most prevalent (36%) in the Age-group 10 -19 years. The most common presenting symptom was dyspnoea on ordinary exertion (82.7%) whereas the most noted physical sign(excluding murmurs) was wasting (52.5%).Cardiac murmurs were present in 96.7%,Atrial fibrillation was noted in 9.3% and Congestive Cardiac Failure present in 48.3%. The commonest valvular lesion

among RHD patients was MR found in 126 (84.0%), followed by TR in 47(31.3%), MS in 37(24.7%) and AR in 33 (22.0%) patients respectively. Among different age groups, Mitral valve disease was the predominant valvular heart lesions. MR contributed for at least 40% of all RHD cases in each of the age groups.

The Prevalence of Pulmonary hypertension among RHD patients was found to be 44.7 % and severe pulmonary hypertension in 12%. The extent of Left atrial dilatation was associated with presence of more clinical features which portend Congestive cardiac failure.

Conclusion

This study has revealed that although the prevalence during pre- and post Echo era varies, the RHD patterns (e.g. peak age, preponderance to females, commonest RHD valvular lesion etc) have remained similar. Almost a quarter (23.7%) of patients referred for echo had normal echocardiographic findings. At the time of echocardiography, about half of RHD patients had developed pulmonary hypertension (12% of them severe) and about half were in congestive cardiac failure, signifying late presentation by our patients in seeking for specialized care. The study further revealed that left atrial (LA) dilatation is associated with presence of more clinical features among RHD patients some of which portend CCF.

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DEFINITION OF TERMS

Wasting - a combined subjective report from the patient of weight loss and loose fittings and an objective observation of the prominence of the zygomatic bones and loss of muscle mass by the investigator during physical examination.

Congestive Cardiac Failure- as defined according to the Framingham criteria (Annex 2c)

ABBREVIATIONS:

AF	Atrial Fibrillation
AR	Aortic Regurgitation
AS	Aortic Stenosis
BAE	Bilateral Ankle Edema
CCF	Congestive Cardiac Failure
CHD	Congenital Heart Disease
CMPs	Cardiomyopathies
DOE	Dyspnoea on Ordinary Exertion
ECHO	Echocardiography
ESR	Erythrocyte Sedimentation Rate
HACEK	Haemophilus, Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella species.
HLVH	Hypertensive Left Ventricular Hypertrophy
LA	Left Atrium
MNH	Muhimbili National Hospital
MOHSW	Ministry of Health and Social Welfare
MR	Mitral Regurgitation
MS	Mitral Stenosis
MUHAS	Muhimbili University of Health and Allied Sciences
MVLP	Mitral valve prolapsed
NBTE	Non Bacteria Thrombotic Endocarditis
PAH	Pulmonary Arterial Hypertension
PND	Paroxysmal Nocturnal Dyspnoea
RF	Rheumatic Fever
RHD	Rheumatic Heart Disease
SPSS	Statistical Package for Social Welfare
TEE	Trans Esophageal Echocardiography
TTE	Trans Thoracic Echocardiography
TR	Tricuspid Regurgitation
WHO	World Health Organization

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CHAPTER ONE

1.1: INTRODUCTION AND LITERATURE REVIEW

1.1.1: Epidemiology

Rheumatic heart disease is the most serious complication of rheumatic fever. Acute rheumatic fever follows 0.3% of cases of group A β-hemolytic streptococcal pharyngitis in children[1].

As many as 39% of patients with acute rheumatic fever may develop varying degrees of pancarditis(myocarditis, pericarditis, and endocarditis) with associated valve insufficiency, heart failure, pericarditis, and even death[1]

With chronic rheumatic heart disease, patients develop valve lesions with varying degrees of regurgitation, stenosis or a combination of atrial dilation, arrhythmias, and ventricular dysfunction.[1]

Valvular heart diseases (VHD) from rheumatic fever (RF) affecting children and young adults are the predominant form of VHD on the African continent [2, 3]

The WHO Expert panel on Rheumatic Fever (RF) and rheumatic heart disease (RHD) reviewed the global burden of these disorders and estimated that about 12 million people world wide in 1994 had RF and RHD, most of them in Developing countries.[3]

Chronic RHD is estimated to exist in 5-30 million children and young adults worldwide, 90,000 patients die from this disease each year with a mortality rate of 1-10%[1]

The highest prevalence of RHD is in sub-Saharan Africa with a prevalence of 5.7 per 1000, compared with 1.8 per 1000 in North Africa, and 0.3 per 1000 in economically developed countries with established market economies.

In economically developed countries, rheumatic fever and rheumatic heart disease have become uncommon health problems. In contrast, in Third World areas such as India, the Middle East, sub-Saharan Africa, and Latin America, rheumatic fever remains the leading cause of heart disease in children and young adults.

The decline of rheumatic fever in affluent populations occurred largely as a result of economic development and improved living conditions, with perhaps a small contribution from antibiotics and the possibly altered virulence of circulating group-A streptococcal strains[4]

Conversely, socially and economically disadvantaged populations worldwide, including some indigenous and minority populations living in affluent countries, continue to have high rates of rheumatic fever and rheumatic heart disease.

The progression from an episode of Acute Rheumatic fever is more rapid among Blacks as compared to Caucasians of a comparable age group. This fact is evidenced by the age when RHD diagnosis is first made in which case it is around mid teens in most Blacks whereas most of the Caucasians are diagnosed when they are well in their twenties.

Whether there is a genetically explanation for this difference, it remains to be explored, but other explanations could include that; blacks are more prone to recurrent episodes of Streptococcal pharyngitis infections and re-infections due to poverty and overcrowding ,so that at any point in time the number of patients harboring Streptococcal pharyngitis who act as reservoirs(potential transmitters of infection) is higher than in a typical affluent Caucasians community and second blacks (unlike Caucasians) are less likely to use Penicillins (due to unavailability or unaffordability) for other infections which could incidentally confer protection against RF which if inadequately or untimely attended leads to Chronic RHD.

Consistent with observations elsewhere in the world, a few studies in Africa have shown that the distribution of RF and RHD is shifted towards the poor, and is more common in rural than urban areas, except in slum conditions [4]

In a survey of RHD in school children of Kinshasa town in the Democratic Republic of Congo, 4848 school children aged 5–16 years were screened. The prevalence of RHD was 14.03 per 1000, but the prevalence was significantly higher in slum schools (22.2 per 1000) than in urban schools (4 per 1000)[5]

Other risk factors that predicted RHD were low birth weight, low socioeconomic status and household overcrowding. The prevalence of RHD confirmed by echocardiography in school children attending grades 7 and 8 in Addis Ababa, Ethiopia, was 6.4 per 1000, but was distributed unevenly between those in lower socioeconomic groups (7.1 per 1000) and high socioeconomic groups (1 per 1000) [6]

In Sub- Saharan Africa cardiovascular diseases accounts for 7 – 10 % of all medical admissions, RHD accounts for about 30% of hospital admissions for cardiovascular disease [7]

In a hospital based study involving 91 consecutive patients with heart failure admitted at Kenyatta National Hospital in Nairobi, Kenya, RHD was found to be the main etiology (accounting for 32%) of heart failure [8].

In the pre- Echocardiography era, groundwork on RHD in Tanzania has been done by several authors; Nhonoli [9] reported rheumatic heart disease to constitute 9.7% of 226 cardiac admissions during 1965 and 1966. In a study entitled "Rheumatic heart disease in Tanzania" S.S.Spenser and W.J. Makene [10] analysed 143 cases of chronic RHD aged seven years and above and found that Mitral insufficiency was far the most common valve lesion occurring in 39% of RHD patients, and was twice as frequent in females as in males.

In a subsequent study entitled "Prevalence and significance of cardiac murmurs in school children" the prevalence of RHD in Tanzania was found to be 0.2 per 1000. This prevalence was lesser than what was found in other African countries e.g. Morocco (3.3/1000), Johannesburg (6.9/1000), Nigeria (3/1000), Ghana (2/1000) and Ivory Coast (1.4/1000)[11]

In the same year a retrospective analysis entitled "Cardiac Disorders among children aged 1 - month to 15 yrs at Muhimbili Medical Centre; Diagnosis, Management and course of disease" in which the author found the prevalence of RHD to be 16.8% [12]

1.1.2: Echocardiographic diagnosis of RHD

The advent of Echocardiography has revolutionized the diagnosis of RHD in terms of accuracy and reproducibility. Echocardiography is the gold standard for the diagnosis of valvular heart diseases. Systematic screening with echocardiography, as compared with clinical screening, reveals a much higher prevalence of rheumatic heart disease (approximately 10 times as great) as. revealed in a study done in Mozambique and Cambodia [13,14,15]

Regionally, a hospital based study using at Mulago, Kampala, Uganda revealed that out of 500 consecutive patients who were echocardiographically reviewed and evaluated, the proportion with RHD was found to be 11%.[16]

1.1.3: Age and Sex of the most affected

RHD is mostly detected among adolescents and young adults. An epidemiological study among students in West Sichuan province China found RHD to be more prevalent among students aged 9 – 15 years [17]. The Kenyatta National Hospital study revealed that 79% of patients with RHD were below the age of 30 years [8] while Spencer and Makene [10] in their Dar es Salaam series noted that 45% of chronic RHD cases were under the age of 20 years.

In assessing the spectrum of RHD in the southeastern Anatolia endemic region of Turkey which involved 1900 patients 72% were female.[18] A female preponderance of 6:1 was reported in the Soweto school survey of South Africa [19]

Several other studies have as well shown similar trends of female preponderance [12, 20]

Being housebound and living in overcrowding conditions were cited as the main reasons for observed female preponderance among girls and women in the Indian study [21].

1.1.4: Pathophysiology

Rheumatic fever develops in children and adolescents following pharyngitis with group A beta-hemolytic *Streptococcus* (i.e., *Streptococcus pyogenes*). The organisms attach to the epithelial cells of the upper respiratory tract and produce a battery of enzymes allowing them to damage and invade human tissues. After an incubation period of 2-4 days, the invading organisms elicit an acute inflammatory response with 3-5 days of sore throat, fever, malaise, headache, and an elevated leukocyte count.

In 0.3-3% of cases, infection leads to rheumatic fever several weeks after the sore throat has resolved. Only infections of the pharynx initiate or reactivate rheumatic fever. The organism spreads by direct contact with oral or respiratory secretions, and spread is enhanced by crowded living conditions. Patients remain infected for weeks after symptomatic resolution of pharyngitis and may serve as a reservoir for infecting others.

Group A *Streptococcus* is a gram-positive coccus that frequently colonizes the skin and oropharynx. This organism may cause suppurative disease, such as pharyngitis, impetigo, cellulitis, myositis, pneumonia, and puerperal sepsis. It also may be associated with nonsuppurative disease, such as rheumatic fever and acute post-streptococcal glomerulonephritis. Group A streptococci elaborate the cytolytic toxins streptolysins S and O. Of these, streptolysin O induces persistently high antibody titers that provide a useful marker of group A streptococcal infection and its nonsuppurative complications.

Rheumatogenic strains often are encapsulated mucoid strains rich in M proteins and resistant to phagocytosis. These strains are strongly immunogenic, and anti–M antibodies against the streptococcal infection may cross-react with heart tissue. Streptococcal antigens that are structurally similar to those in the heart include hyaluronate in the bacterial capsule, cell wall

polysaccharides (similar to glycoproteins in heart valves), and membrane antigens that share epitopes with the sarcolemma and smooth muscle.[22]

During the acute phase of RF there are disseminated focal inflammatory lesions in different tissues, most evident in the heart where they are called Aschoff bodies and may be found in any of the heart tissues thus a pancarditis.

Rheumatic heart disease is the most severe sequelae of acute rheumatic fever. It usually occurs 10 to 20 years after the original attack and is the major cause of acquired valvular disease in the world.[22]

1.1.5: Chronic valvular lesions

The mitral valve is a complex structure formed by four elements.

1. The **annulus** is asymmetrical, with a fixed portion (corresponding to the anterior leaflet) shared with the aortic annulus and a dynamic portion (corresponding to the posterior leaflet) that represents most of the circumference of the annulus.
2. The **two leaflets** are asymmetrical; the anterior has the greater length of tissue but occupies a smaller portion of the circumference of the annulus than does the posterior portion.
3. The **chordae join** each papillary muscle to the corresponding commissure and the adjoining halves of both leaflets and maintain the two leaflets in a position allowing coaptation.
4. The **two papillary muscles** and the adjacent wall attach the mitral apparatus to the left ventricle. Mitral valve closing during systole is normally ensured, first by a large area of coaptation between leaflets allowing high-friction resistance to abnormal valve movement, and second by the systolic position to the anterior leaflet parallel to the direction of blood flow.

Acute rheumatic heart disease often produces a pancarditis characterized by endocarditis, myocarditis, and pericarditis.

In the endocardium the inflammatory foci consist of fibrinoid necrosis within the valve cusps or along the cords on which small vegetation are thought to form along the valve closure. The vegetation results from precipitation of fibrin at eroded points due to inflammation, however, these acute valvular changes do not cause much disturbance in cardiac function. In chronic RHD the acute inflammation undergoes organization with subsequent deforming fibrosis; the valvular leaflets become thick and retracted leading to permanent deformity [22]

Mitral valve is involved most commonly in RHD[23], and the aortic valve is second. The tricuspid valve is deformed in only 10% of patients and is almost always secondary to aortic and mitral lesions. The pulmonary valve is rarely affected. Continous fibrosis and scarring leads to valve deformity, which manifests as regurgitation and/or stenosis.

1.1.6: Clinical features

The signs and symptoms of valvular heart disease depend on the affected valve(s).They may include cardiac murmurs,arrthymias,heart failure,thromboembolic complications and infective endocarditis.There may also be physical evidence of cardiac hypertrophy or dilatation [22].

The symptoms of heart failure may be precipitated by a superimposed hemodynamic stress e.g. pregnancy, anaemia or infection [23]

In the study entitled "Interface of Heart Disease and Reproductive Health: An Explanatory Study of Gender Dimensions" [24], the most commonly reported problem was dyspnoea on ordinary exertion (83 %) such as climbing stairs.

1.1.7: Infective Endocarditis

RHD and Infective Endocarditis are closely interlinked. Infective Endocarditis results from proliferation of microorganisms on the endothelium of the heart. The prototypic lesion at the site of infection is a mass of platelet fibrin, microcolonies of microorganisms and scanty inflammatory cells. Infection most commonly involves heart valves (either native or prosthetic).

The oral cavity, skin and upper respiratory tract are the respective portals of viridians streptococci,staphylococci and HACEK(Haemophilus,Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, and Kingella)organisms causing community–acquired native endocarditis.

Unless it is injured, the normal endothelium is resistant to infection by most bacteria and thrombus formation. Endothelial injury causes aberrant flow and allows direct infection by virulent organism or causation of Non-Bacterial Thrombotic Endocarditis (NBTE). The cardiac lesions most commonly resulting in NBTE are Mitral Regurgitation, Aortic Stenosis, and Aortic Regurgitation among others, these lesions result from RHD.

A 3-year (1997–2000) prospective epidemiological study of infective endocarditis was carried out at the University of Stellenbosch and Tygerberg Academic Hospital, Cape Town, South Africa. The study included 92 patients referred with probable infective endocarditis, but only patients with an audible murmur were included. Duke criteria were used to diagnose endocarditis and Transoesophageal echocardiography was used to complement Transthoracic echocardiographic findings. Definite infective endocarditis was present in 47 (51.1%) patients, RHD was the major predisposing underlying condition present in 36 (76.6%).[25]

1.1.8: Diagnosis

A clinical diagnosis of rheumatic heart disease is made after confirming antecedent rheumatic fever. The modified Jones criteria (revised in 1992) provide guidelines for the diagnosis of rheumatic fever. The Jones criteria require the presence of 2 major or 1 major and 2 minor criteria for the diagnosis of rheumatic fever.

The major diagnostic criteria include carditis, polyarthritis, chorea, subcutaneous nodules, and erythema marginatum.

The minor diagnostic criteria include fever, arthralgia, prolonged PR interval on the electrocardiogram, elevated acute phase reactants (increased erythrocyte sedimentation rate [ESR]), presence of C-reactive protein, and leukocytosis).

Additional evidence of previous group A streptococcal pharyngitis is required to diagnose rheumatic fever. One of the following must be present:

- Positive throat culture or rapid streptococcal antigen test
- Elevated or rising streptococcal antibody titer
- History of previous rheumatic fever or rheumatic heart disease

NB; These criteria are not absolute; the diagnosis of rheumatic fever can be made in a patient with chorea alone if the patient has had documented group A streptococcal pharyngitis.

After a diagnosis of rheumatic fever is made, symptoms consistent with heart failure, such as difficulty breathing, exercise intolerance, and a rapid heart rate out of proportion to fever, may be indications of carditis and rheumatic heart disease.

Physical findings in a patient with rheumatic heart disease include cardiac and non cardiac manifestations of acute rheumatic fever. Some patients develop cardiac manifestations of chronic rheumatic heart disease.

Cardiac manifestations of acute rheumatic fever;

Pancarditis is the most serious complication of rheumatic fever. In advanced cases, patients may complain of dyspnea, mild-to-moderate chest discomfort, pleuritic chest pain, edema, cough, or orthopnea.

On physical examination, carditis is most commonly detected by a new murmur and tachycardia out of proportion to fever. New or changing murmurs are considered necessary for a diagnosis of rheumatic valvulitis. Other cardiac manifestations include congestive heart failure and pericarditis.

Patients in whom the diagnosis of acute rheumatic fever is made should be examined frequently because of the progressive nature of the disease.

New or changing murmurs: The murmurs of acute rheumatic fever are typically from valve insufficiency. The following murmurs are most commonly observed during acute rheumatic fever:

Apical pansystolic murmur is a high-pitched, blowing-quality murmur of mitral regurgitation that radiates to the left axilla. The murmur is unaffected by respiration or position. Intensity varies but is grade 2/6 or greater. The mitral insufficiency is related to dysfunction of the valve, chordae, and papillary muscles.

Apical diastolic murmur (also known as a Carey-Coombs murmur) is heard with active carditis and accompanies severe mitral insufficiency. It is related to relative mitral stenosis, as the large volume of regurgitant flow crosses the mitral valve during ventricular filling. It is heard best with the bell of the stethoscope, while the patient is in the left lateral position and the breath held in expiration. This murmur is low pitched, rumbling, and resembles the roll of a distant drum.

Basal diastolic murmur is an early diastolic murmur of aortic regurgitation and is high-pitched, blowing, decrescendo, and heard best along the right upper sternal border after deep expiration while the patient is leaning forward.

Echocardiogram-Allows for accurate evaluation for presence or absence, and severity of the valvular lesions. It is indicated in patients with murmurs and any cardiac symptoms, a loud murmur or other cardiac findings on physical examination. It will reveal evidence of regurgitation, stenosis and chamber changes-the quantitation of right and left ventricular systolic performance can be established by determining the fractional shortening and ejection fraction [26]

1.1.9: Complications

Congestive heart failure; Heart failure may develop secondary to severe valve insufficiency or myocarditis. The physical findings associated with heart failure include tachypnea, orthopnea, jugular venous distention, rales, hepatomegaly, a gallop rhythm, and peripheral swelling and edema.

In a Cross sectional descriptive study to analyze the underlying etiology, precipitating factors and certain socio-demographic determinants in patient with congestive heart failure admitted at Kenyatta National Hospital, Nairobi Almost 32% had rheumatic heart disease, 25.2% had cardiomyopathy, 17.6% hypertensive heart disease, 13.2% had pericardial disease while 2.2% had ischemic heart disease and it was concluded that Rheumatic heart disease is the commonest cause of congestive heart failure in their set-up [8]

Valve deformities, embolization with its cardiac (Myocardial infarction) and neurological (Stroke) sequelae, cardiac hemolytic anemia, and atrial arrhythmias are the most common cardiac manifestations of chronic rheumatic heart disease.

1.1.10: Treatment

No known medical therapies directly affect the disease process in the valve leaflets due to RHD. Medical treatment is mainly directed at treating the complications and prevention of Infective Endocarditis.[27] Effective management during the acute phase is geared towards eradication of the streptococcal infection, relieving symptoms, and preventing recurrence, reducing the chance of permanent cardiac damage. Treatment includes penicillin, sulfadiazine, or erythromycin.

After the acute phase subsides, low-dose antibiotics (commonly intramuscular Benzathine Penicillin or Erythromycin for those with Penicillin hypersensitivity) may be used to prevent recurrence. Such preventive treatment usually continues for 5 years or until age 21 (whichever is longer). Heart failure necessitates continued bed rest and diuretics.

Severe mitral or aortic valve dysfunction that causes persistent heart failure requires corrective valvular surgery, including commissurotomy (separation of the adherent, thickened leaflets of the mitral valve), valvuloplasty (inflation of a balloon within a valve), or valve replacement (with prosthetic valve). Such surgery is seldom necessary before late adolescence.

1.1.11: Prevention

Because recurrent episodes of Rheumatic Fever (RF) cause increasingly severe complications, secondary prevention is the most crucial feature of an effective RHD control program [28]

The WHO has instituted a trial of RF prevention in 16 Third World countries (including three in Africa namely Mali, Zambia and Zimbabwe).These programs involve early detection of RF and RHD, Secondary prevention and education of the population and health care providers. Preliminary results from this cooperative study have shown a decrease in RF recurrence among patients maintained on secondary prevention with monthly injections of Benzathine penicillin G [29] . The proportion of RHD patients who are on secondary prevention among those eligible vary diversely. In one extreme it was found that among patients registered in the India RHD registry from 1980 to 1992 there was a 92% compliance rate for secondary prevention [30] .In another extreme, only 8% of the RHD Patients were receiving secondary prevention [31]

In a study done in Nigeria, secondary prevention in repeated attacks of RF was documented in only 50% of patients with RHD [32]

1.1.12: Pulmonary Hypertension

Pulmonary hypertension is an elevation in pulmonary vascular pressure that can be caused by an isolated increase in pulmonary arterial pressure or by increases in both pulmonary arterial and pulmonary venous pressures.

The term *pulmonary arterial hypertension* refers to conditions that share common isolated elevations in pulmonary arterial pressure including Left-sided valvular heart disease, hemodynamically defined as a resting mean pulmonary arterial pressure greater than 25 mmHg with a normal pulmonary capillary or left atrial pressure.

The echocardiogram is the most important diagnostic test in Pulmonary Arterial Hypertension (PAH) patients. Pulmonary artery systolic pressure is estimated by measuring the Doppler systolic tricuspid regurgitant flow velocity and applying the Bernoulli equation; the sensitivity of this method in estimating the pulmonary artery systolic pressure ranges between 0.79 and 1.00, and the specificity ranges from 0.60 to 0.98 [33]

Severe Pulmonary Hypertension is associated with worsening of the prognosis of RHD and increasing the peri-operative mortality of involved valvular surgeries [26, 34]

Patients with severe PAH are especially prone to vasovagal events leading to syncope, cardiopulmonary arrest, and death. Cardiac output is particularly dependent on heart rate in this setting, and the bradycardia and systemic vasodilatation accompanying a vasovagal event can result in pump failure and shock.

Anesthesia and intubation can be particularly problematic because they can induce vasovagal events, hypoxemia, hypercarbia, and shifts in intrathoracic pressure and associated changes in cardiac filling pressures.

Hence determining levels of Pulmonary Pressure in patients with chronic RHD helps in predicting peri-operative outcomes and in fewer instances decisions on whether the operation should be done at that particular moment or postponed until the pulmonary hypertension is managed first.

1.1.13: Left Atrial Size

The Left Atrium (LA) dilates and hypertrophies in patients with rheumatic mitral stenosis (MS) and occasionally the LA reaches extreme sizes. In these cases, MS may present alone or with mitral insufficiency, or it may present as mixed mitral disease with predominant rheumatic mitral stenosis.Transthoracic Echocardiography (TTE) is the easiest and least expensive method for diagnosing and monitoring the disease.Intraoperatively, Transesophageal Echo (TEE) helps the surgical team to evaluate the effectiveness of artificial valve [35]. The standard parasternal M-mode image yields the anterior-to-posterior dimension of the LA, typically the smallest, perhaps because of confinement between the sternum and the spine. This dimension is the least sensitive to enlargement but, when increased, is highly specific.

The left atrial diameter of 18.7 cm (giant Left Atrium) is the largest reported to date[35]. In a study to assess the use of Echo in predicting the clinical courses and surgical outcomes of Mitral Regurgitation, it was found that Left Atrial Diameter was less in Mitral Valve Prolapse(MVP) than in rheumatic Mitral Rergugitation, that congestive cardiac failure didn't become prominent

until LA size were markedly enlarged, that patients with LA diameter of more than 5 cm took clinical downhill courses under medical treatment and were referred for surgery and that the risk of death was higher in patients with left atrial diameter of more than 7 cm ($p < 0.001$)[36].

Left Atrial Diameter was determined to be a good predictor of 2 years mortality among patients with Heart failure[36].

1.2: PROBLEM STATEMENT

Valvular heart diseases in Africa affect mainly children and young adults and are a result of rheumatic fever. Rheumatic fever is a preventable disease, but in Africa the combination of a lack of resources, social and economic instability, poverty, overcrowding and malnutrition among other factors contribute to the persistence of a high burden of rheumatic fever, rheumatic valvular heart diseases and infective endocarditis[5].

Combating and eradicating rheumatic fever and rheumatic heart diseases requires economic development and implementation of best practices of primary and secondary prevention measures. The barriers to achieving this goal in Africa are numerous, but not insurmountable[37].

The WHO estimates that Rheumatic Heart Disease accounts for 332,003 deaths annually which is equivalent to 0.6% of the total 55,694,041 of the total worldwide annual deaths [38].

Data from the MOHSW shows that acquired heart diseases (mainly RHD) accounts for more than 40% of annual referrals to India.

1.3: RATIONALE

Morbidity caused by Chronic rheumatic heart diseases(RHD) accounts for high costs of treatment due to prolonged hospitalization, high costs of medication, loss of working hours , reduced school attendance and even loss of life at a tender age. In turn, all these increase the economic burden to patient, family and the nation at large.

For many years the diagnosis of RHD relied largely on the clinical skills of the attending clinician. Echocardiography (ECHO) (introduced at our centre in the mid 1990s) is known to be more sensitive than auscultation for the detection of pathologic valve disease and is now the gold standard for diagnosing valvular heart disease. ECHO has improved RHD case detection including picking up the subclinical cases. ECHO has as well improved the early detection of associated RHD complications and is the best tool for predicting the right timing for appropriate valvular surgery.

The WHO Expert Consultation Report (2004) states that echocardiographically diagnosed but clinically silent rheumatic valve involvement should be managed as rheumatic heart disease until proved otherwise. Developing countries face many challenges, and the problems of rheumatic fever and rheumatic heart disease will have to compete for limited resources with other more immediate and urgent health concerns such as malnutrition, diarrheal diseases, tuberculosis, and infection with human immunodeficiency virus[39].

In 2008 Muhimbili National Hospital embarked on a historical milestone of starting Open Heart Surgery at the centre. Among other cardiac operations, valvular repair and valvular replacement surgeries are high on the list.

This study is therefore timely and is expected to provide information on the magnitude of RHD at our centre including providing some vital information such as determining the association between presenting clinical features and atrial size in patients with Rheumatic valvular disease, a subject whose literature is still scanty but evolving . The study will also elucidate the prevalence of pulmonary hypertension among RHD patients. Pulmonary hypertension has a prognostic value in the peri-operative outcome of valvular heart surgeries.

1.4: OBJECTIVES

Broad objective

To determine the prevalence and characteristics of echocardiographically diagnosed patients with Rheumatic Heart Disease at Muhimbili National Hospital, Dar-es-salaam.

Specific objectives

1. To determine the prevalence of RHD by age and sex among patients referred for Echo studies at MNH.
2. To determine the clinical presentations of patients diagnosed with RHD at MNH.
3. To determine the distribution of affected heart valves among patients diagnosed with RHD at MNH.
4. To determine the prevalence of pulmonary hypertension among patients diagnosed with RHD at MNH.
5. To determine the association between left atrial (LA) size and presenting clinical features among Rheumatic Mitral Disease patients.

CHAPTER TWO

2.0: METHODOLOGY

2.1: Study design

The study was a hospital-based cross-sectional descriptive study.

2.2: Study setting

The study was conducted in the Echocardiography Room at Muhimbili National Hospital (MNH).

MNH is a tertiary referral and teaching hospital, situated in the middle of the City of Dar es Salaam. It also serves as a regional hospital for Ilala, Temeke and Kinondoni municipality hospitals. It serves about 1000 outpatients per day and has a bed occupancy rate of about 215 admitted patients per day.

The Department of Internal medicine runs among other clinics, a specialized cardiac clinic every Friday afternoon and perform Echocardiography on patients every Monday, Wednesday and Thursday and emergency Echocardiography on any day of the week.

2.3: Study population

Patients were from the Inpatient and Outpatient departments at MNH who were referred for Echocardiography due to various cardiovascular indications. The inpatients came from various departments (Internal Medicine, Surgery, Pediatrics and Child Health, Obstetrics & Gynecology, Orthopedic and Trauma, Surgical Specialties etc).

Outpatients were referred from the three municipal hospitals, upcountry regional and district hospitals as well as faith-based and private hospitals.

Inclusion criteria;

All patients referred for Echocardiography at MNH who gave consent/implied consent to take part in the study.

Exclusion criteria

Patients who had undergone valvular heart surgery were excluded.

2.4: Enrollment of subjects;

All eligible study subjects were consecutively enrolled during the study period.

2.5: Sample size;

To determine the minimum sample size required, the following formula was applied;

$$n = Z^2 p (100-p)/\epsilon^2$$

Whereas;

n = minimum sample size

Z = Standard deviation of normal distribution = 1.96.

ϵ = Maximum tolerable error = 5%.

p = proportion of patients

Using the prevalence of RHD in the Mulago Hospital Series (Freers, 1997), p=11%.

Therefore sample size was 150 patients

2.6: Study procedures

All patients referred for Echo-studies at MNH were interrogated and examined by the investigator to discern their presenting symptoms and signs (i.e. clinical features) including presence of a pathological murmur. The investigator then performed Echocardiograms on patients under the supervision of a Senior Cardiologist at Muhimbili National Hospital.

Echocardiograms were done using a PHILIPS, HP 7550 Echocardiography machine with a 2.5 MHz transducer for adults and 5.0 and 8.0 MHz for children. Echo images of all patients were printed on papers and recorded on video tapes. Standard views and measurements were done during M-mode, 2D and Doppler studies to determine echocardiographic diagnosis.

Different ECHO diagnoses of the study population were noted down. Echo diagnosis of RHD on valves was based on American Society of Echocardiography standards and guidelines using M-mode, 2D views. Doppler studies were used to assess the nature and extent of valve involvement for stenosis or regurgitation.

Left atrial (LA) sizes were determined using M-mode measurements in all patients diagnosed to have RHD. Pulmonary artery systolic pressures were estimated by measuring the Doppler systolic tricuspid regurgitant flow velocity.

An in-depth re-assessment of patients found to have RHD was done and categorization of whether they were in heart failure or not was based on the Framingham Criteria for heart failure.

A coded-structured Questionnaire was used in data collection.

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Patients were then referred back with an ECHO-report to their referring doctors to continue with management and/or new recommendation on management from the investigator/Cardiologist.

Patients assessed to have operable lesions were referred to the Cardiac Surgery Team of MNH for further management.

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2.7: Data entry & analysis;

All questionnaires were daily checked for completeness and consistencies by the investigator Pre-coded data were entered into computer using SPSS version 15 for further cleaning, categorizing of continuous variables and eventual analyses. The data was compared for consistency and discrepancies rectified. Data were then summarized into frequency distribution tables and cross tabulations. Associations were tested using χ^2 test especially when comparing different proportions. The cut-off point for rejecting the null hypotheses was when p-values were less than 5%.

2.8: Ethical consideration:

The study received ethical clearance from the Research and Publication committee of MUHAS and the Ethics department of MNH. Patients were included after informed verbal and written consent. Confidentiality was adhered to when filling the data collection sheets by using codes instead of names for identifying patients. Physical examinations were conducted in privacy and whenever needed in presence of a nurse (chaperone). For those who were under 18 years of age, their caretakers were requested to give written/verbal consent. Those who declined consent were not in any way deprived their right to receive medical attention and advice.

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3.0: RESULTS

3.1: Demographic characteristics

Between July 2008 and February 2009 a total of 2782 patients were referred for Echocardiography at Muhimbili National Hospital.

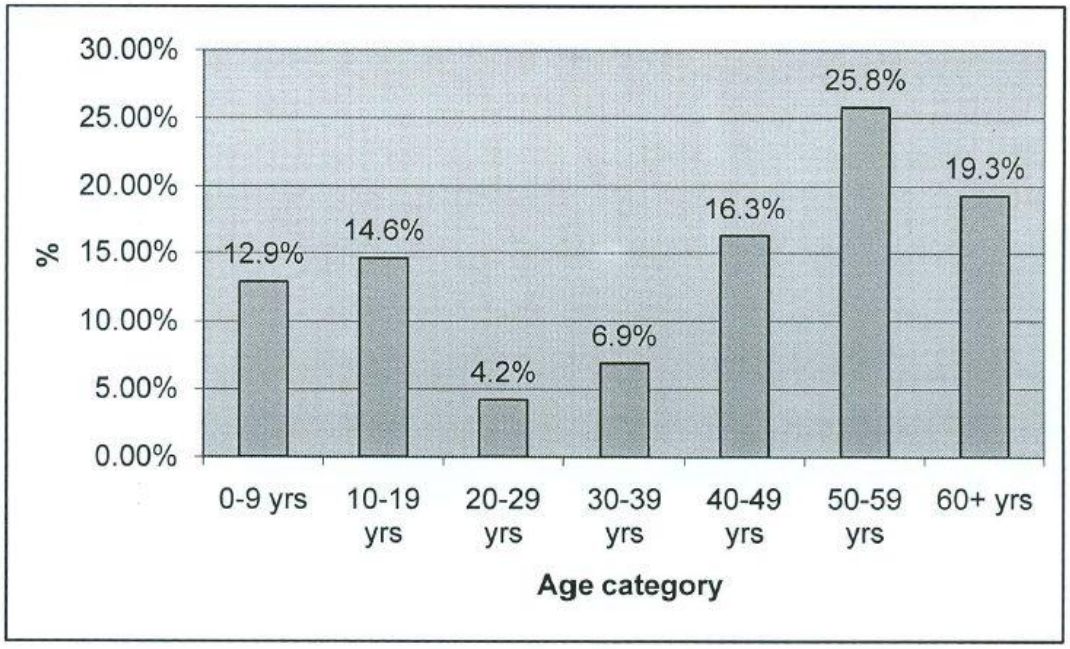
Of these 1065 (38.3%) were males and 1717 (61.7%) were females. Their ages ranged between 1 and 86 years with a median age (±SD) of 52.5± 15.6 years. (Table 1).

Table 1: Baseline Characteristics of Patients referred for Echocardiography (n = 2782)

Patients Characteristics	Numbers (%)
Age of the patients (years)	
Range	1 - 86
Median (±SD)	52.5 ± 15.6
Sex	
Males	1065 (38.3%)
Females	1717 (61.7%)

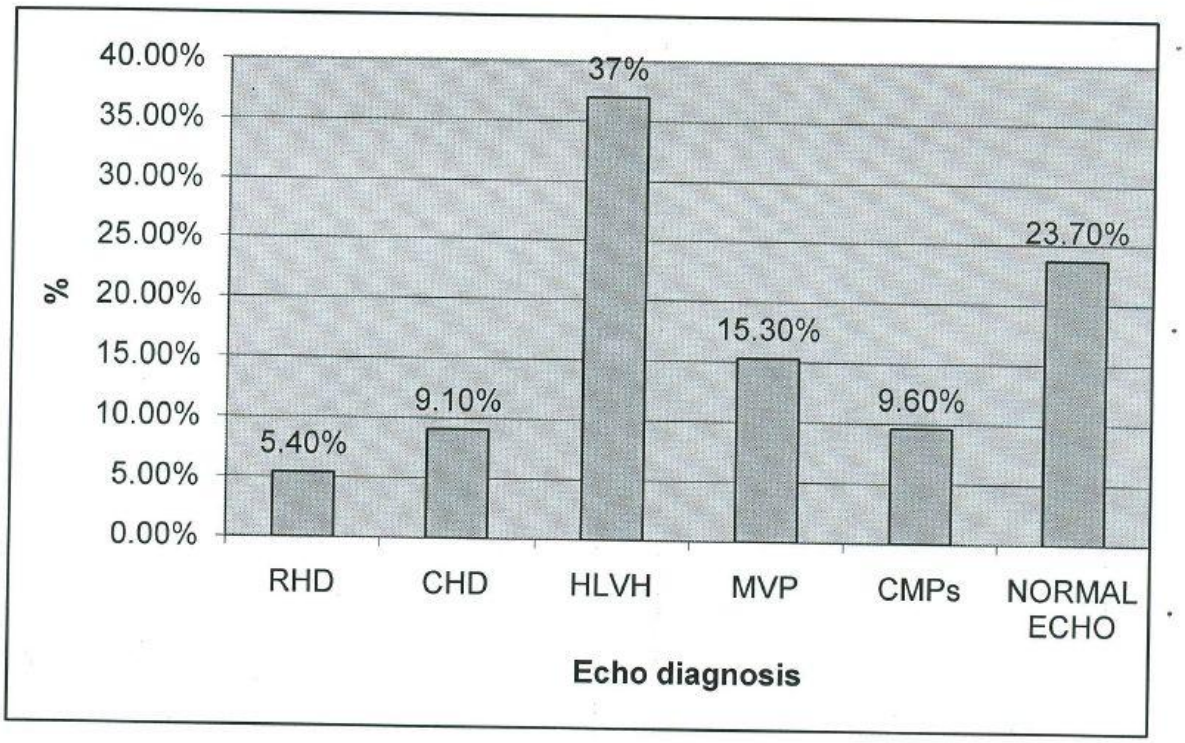
The age group of most subjects referred for Echo was 50-59 years constituting more than a quarter (25.8%) of all echocardiographed subjects. The age group 20-29 years was the least common age group of subjects referred for Echocardiography at MNH (4.2%). (Fig 1)

Fig 1: Distribution of patients referred for Echocardiography by age group (n = 2782).



Out of these 2782 echocardiographed individuals 150 (5.4%) were found to have Rheumatic Heart Disease (RHD). Almost a fourth (23.7%) had normal echo. Other echo findings are as shown in figure 2.

Fig 2: Distribution of Echo diagnoses among Echocardiographed patients (n =2782)



Key; RHD – Rheumatic Heart Disease, CHD-Congenital Heart Disease, HLVH- Hypertensive Left Ventricular Hypertrophy, MVP – Mitral Valve Prolapse, CMPs- Cardiomyopathies (NB; including Pericardial diseases)

3.2: Distribution of Echo Diagnosis among patients referred by Age Groups.

Congenital Heart Diseases prevailed among those below the age of 10 years; Mitral Valve Leaflet Prolapse was more of a teenage problem .Hypertensive Left Ventricular Hypertrophy and Cardiomyopathies prevailed mostly among those above 40 years of age (Table 2).

Table 2: Echo Diagnosis of referred patients by age groups (n=2782)

		0-9 yrs	10-19 yrs	20-29 yrs	30-39 yrs	40-49 yrs	50-59 yrs	≥ 60 yrs	TOTAL (%)
ECHOCARDIOGRAPHICAL DIAGNOSIS	**RHD**	14	53	40	15	15	8	5	**150 (5.4)**
	CHD	197	19	7	12	10	3	5	**253 (9.1)**
	LVH	0	20	4	35	146	458	365	**1028 (37)**
	MVP	7	155	46	73	73	46	26	**426 (15.3)**
	CMPs	16	36	10	16	70	69	49	**266 (9.6)**
	Normal ECHO	126	123	10	40	140	133	87	**659 (23.7)**
	TOTAL (%)	**360 (12.9)**	**406 (14.6)**	**117 (4.2)**	**191 (6.9)**	**454 (16.3)**	**717 (25.8)**	**537 (19.3)**	**2782**

Key; CHD: Congenital Heart Disease

LVH: Left Ventricular Hypertrophy

HHD; Hypertensive Heart Disease

M.V.P; Mitral Valve Prolapse

CMPs – Cardiomyopathies

3.3: Sex and Age- group distribution among RHD patients.

Out of 150 patients found to have RHD, 44 (29.3%) were males whereas 106 (70.1%) were females. The female to male ratio was 2.4:1. The prevalence of RHD among males was 4.1 % (44/1065) whilst the prevalence of RHD among females was 6.2 % (106/1717). (p-value = 0.02)

The age of RHD patients ranged from 4 to 69 years. The overall median age (± SD) was 21.5 ± 14.5 years.

The age of male subjects found to have RHD ranged from 7 to 54 years with median age (± SD) 21.7±10.92 years. The age of female subjects found to have RHD ranged from 4 to 69 years with median age (± SD) 26.8±15.6 years. There was no difference in mean age among sexes (p=0.05)

RHD was most prevalent in the age group 10 - 19 years (36%) for both sexes and least prevalent (5.3%) in the age group 50 - 59 years. (Table 3).

Table 3: Sex and Age- group distribution among RHD patients (n=150)

	Sex		
Age-group (yrs)	**Male (%) (n = 44)**	**Female (%) (n = 106)**	**Overall p-value**
0-9	3 (6.8)	10 (9.4)	
10-19	21 (47.7)	33 (31.1)	
20-29	12 (27.3)	28 (26.4)	
30-39	4 (9.1)	11 (10.4)	0.371
40-49	3 (6.8)	12 (11.3)	
50-59	1 (2.3)	7 (6.6)	
60 +	0 (0.0)	5 (4.7)	

3.4: Presenting clinical features

Among 150 RHD patients, the most common presenting symptom was dyspnea on ordinary exertion accounting for 82.7% of the complaints. On physical examination 52.5% of patients were wasted. Only 3.3% of patients with RHD had no murmur.

By categorization of patients according to Framingham criteria for Congestive Cardiac Failure, 48.3% of the subjects had congestive heart failure. Only 9.3% had atrial fibrillation (AF).

Fifteen (10%) of patients were asymptomatic whilst 28.7% of patients had no abnormal physical sign excluding presence of a murmur (Table 4).

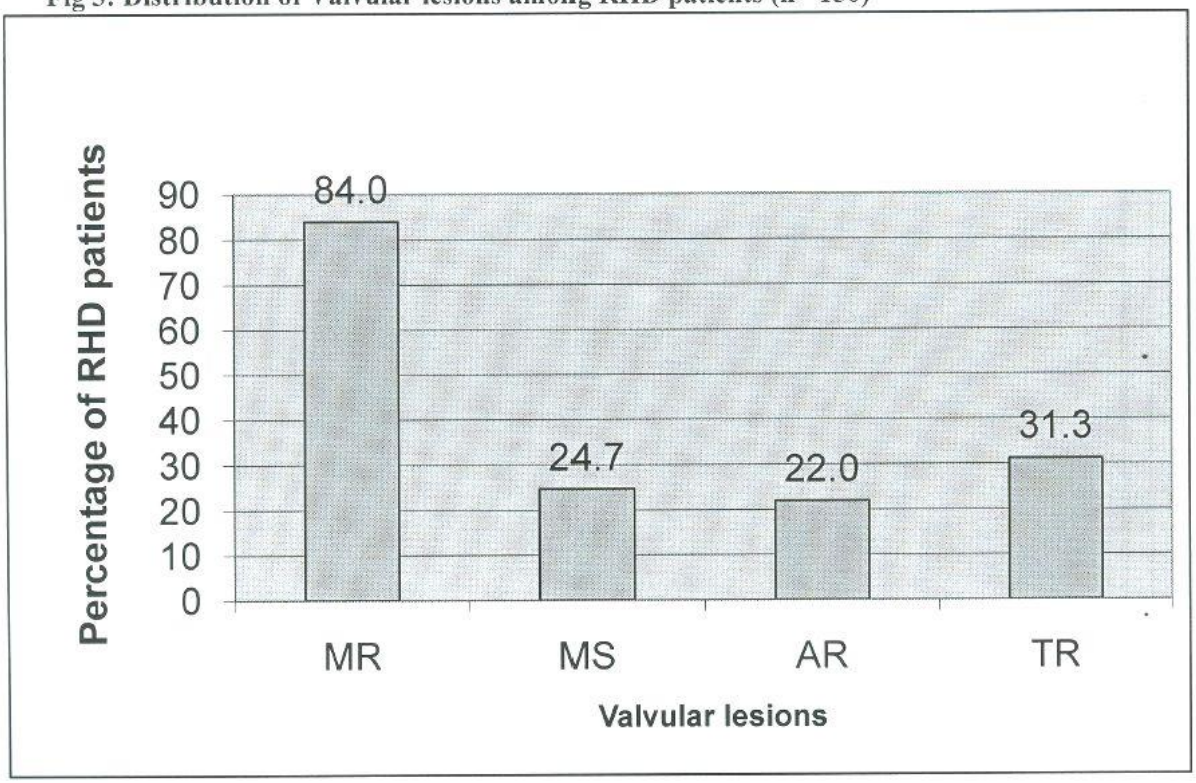
Table 4: Distribution of Clinical Characteristics among ECHO-confirmed RHD patients. (n=150).

Clinical Feature	Frequency (%)
Paroxysmal Nocturnal dyspnea	20 (13.3%)
Bilateral Ankle Edema	22 (14.7%)
Nocturnal cough	17 (11.3%)
Dyspnea on ordinary exertion	124 (82.7%)
Wasting	78 (52.0%)
Jaundice	15 (10.0%)
Tachypnea	34 (22.7%)
Finger clubbing	2 (1.3%)
Atrial Fibrillation	14 (9.3%)
Cardiac murmur	145(96.7%)
CCF (by Framingham Criteria)	73 (48.3%)
Asymptomatic	15 (10.0%)
No abnormal signs	43 (28.7%)

3.5: Distribution of valvular lesions among RHD patients.

The commonest valvular lesion was mitral regurgitation found in126 patients (84.0%), followed by tricuspid regurgitation 47 (31.3%), mitral stenosis 37 (24.7%) and aortic regurgitation in 33 (22.0%) respectively. (Fig 3)

Fig 3: Distribution of Valvular lesions among RHD patients (n =150)



Over one half (50.7%) of patients had isolated (pure) valvular lesions. Isolated MR was found in 63 (42.0%) of patients, isolated MS in 10 (6.7%) patients, isolated AR in 2 (1.3%) patients and isolated TR in only 1(0.7%) patient.

Of the 150 RHD patients, only three patients (one with pure TR and two with pure AR) did not have their mitral valve involved in one way or the other .That is to say, 147 patients had mitral valve involvement, be it stenosis or regurgitation, occurring in isolation or as part of a combined valvular disease. These 147 patients are referred throughout this study as suffering from Rheumatic **Mitral** disease; this was the result of the mitral valve being predominantly involved.

3.6: Distribution of valvular heart lesions by sex

MR, AR and TR were found to be more prevalent in male RHD patients whereas MS was found to be more in females than males. However these differences in valvular lesions observed between sexes were not statistically significant (p-value 0.49)(Table 5).

Table 5. Distribution of valvular heart lesions by Sex (n=150)

	Sex		
Valvular lesions	**Male (%) (n=44)**	**Female (%) (n = 106)**	**Overall p-value**
MR	38 (86.4)	88(83.0)	
MS	9(20.5)	28(26.4)	
AR	13(29.6)	20(18.9)	0.49
TR	17(38.6)	30(28.3)	

3.7: Distribution of Valvular heart lesions by Age groups.

Among different age groups, Mitral valve disease was the predominant valvular heart lesions. MR contributed for at least 40% of all RHD cases in each of the age groups. Notably, none of the RHD patients aged 60 years or more had MS.

In general, there was no significant difference between the combined valvular heart lesions when assessed across the age- groups.

During analysis two categories of age groups were compared, those below the age of 40yrs (i.e. mainly adolescents and young adults) and those above 40 yrs of age. The proportions of MR,

MS, TR, and AR were comparable between the two sexes and the differences observed were not statistically significant. (Table 6)

Table 6. Distribution of valvular heart lesions by Age-group (n=150)

	Age –groups(yrs)		
Valvular Lesion	**< 40 yrs (%) (n=122)**	**≥ 40 yrs (%) (n=28)**	**p-value**
MR	102 (83.6)	24 (85.7)	0.79
MS	29 (23.8)	8 (28.6)	0.60
AR	27 (22.1)	6(21.4)	0.94
TR	38 (31.1)	9(32.1)	0.92

3.8: Presenting clinical features according to type of valve lesion

Dyspnea on Ordinary Exertion (DOE) was the most predominant symptom among patients with MS than in patients with other valvular lesions (p=0.02) .Nocturnal cough and Bilateral Ankle Edema were more predominant in patients with AR (p=0.02 and 0.03 respectively) than in patients with other valvular lesions. (Table 7).

Table 7: Distribution of presenting symptoms among RHD valvular lesions (n= 150)

Symptom	Valvular lesions				p-value
	MR (n = 126)	MS (n = 37)	AR (n=43)	TR (n=47)	
PND	28(22.2)	4(10.8)	10(23.3)	14(29.8)	0.22
BAE	2(1.6)	0(0.0)	4(9.3)	1(2.1)	0.03
Nocturnal cough	6(4.8)	0(0.0)	7(16.3)	3(6.4)	0.02
DOE	76(60.3)	29(78.4))	19(44.2)	30(63.8)	0.02

KEY; **PND**-Paroxysmal Nocturnal Dyspnea, **BAE**-Bilateral Ankle Edema, **DOE**-Dyspnea on Ordinary Exertion.

3.9: Prevalence of Pulmonary Hypertension among RHD patients

Prevalence of Pulmonary Hypertension among RHD patients was found to be 44.7 %.

Severe Pulmonary hypertension was noted in 12% of RHD patients. (Table 8)

Table 8: Distribution of Pulmonary Mean Arterial Pressure among Echo-diagnosed RHD patients (n=150)

Category of Pulmonary Pressure	Frequency (%)
Normal	83 (55.3%)
Mildly Elevated	19 (12.7%)
Moderately Elevated	30 (20.0%)
Grossly Elevated	18 (12.0%)
TOTAL	150(100%)

Key; Pulmonary Mean Arterial Pressure Levels;

; < 25mmHg	normal
; 25-50 mmHg	mildly elevated
; 50-75 mmHg	moderately elevated
; > 75 mmHg	grossly elevated

3.10: Association between LA Size and presenting clinical features in patients with Rheumatic Mitral disease.

The distribution and categorization of Left Atrial size (LA size) among 147 patients with rheumatic mitral disease is as shown (Table 9).

Table 9: Distribution of LA size among patients with Rheumatic Mitral disease (n = 147)

		Frequency	%
LA Size	Normal	43	29.3%
	Mildly Dilated	21	14.3%
	Moderate Dilated	46	31.3 %
	Severely Dilated	37	25.2%
	Total	147	100%

Key; Left Atrial Size

1.9 - 4.0 cm	-	Normal
4.1 - 4.6 cm	-	Mildly Dilated
4.7 - 5.2 cm	-	Moderately Dilated
5.3 cm and Above	-	Severely Dilated.

Association between Left Atrial size and presenting clinical features

RHD patients who had moderate to severely dilated Left Atrial size presented with more clinical features as compared to their counterparts who had normal to mildly dilated LA size, this finding was particularly statistically significant for wasting and edema (p=0.02 and 0.01 respectively) which are among features which portend congestive cardiac failure as re-iterated in the Framingham study. (Table 10).

Table 10: Association between LA size and presenting Clinical features among Rheumatic Mitral disease patients (n = 147).

CLINICAL FEATURE		LA size category		
		Normal to Mildly dilated (%) (n= 64)	Moderate to Severe dilated (%) (n= 83)	p-value
PND	Yes	5 (7.8%)	15 (18.1%)	0.07
	No	59 (92.2%)	68 (81.9%)	
Bilateral Ankle edema	Yes	4 (6.3%)	12 (14.5%)	0.11
	No	60 (93.8%)	71 (85.5%)	
Nocturnal Cough	Yes	4 (6.3%)	11 (13.3%)	0.16
	No	60 (93.7%)	72 (86.7%)	
Dyspnea on Ordinary Exertion	Yes	46 (71.9%)	66 (79.5%)	0.28
	No	18 (28.1%)	17 (20.5%)	

Cont……..

Table 10: Association between LA size and presenting Clinical features among Rheumatic Mitral disease patients (n = 147)

CLINICAL FEATURE		Normal to Mildly dilated LA (%) (n=64)	Moderate to Severe dilated LA (%) (n=83)	p-value
Wasting	Yes	27 (42.2%)	51 (61.5%)	**0.02**
	No	37 (57.8%)	32 (38.6%)	
Edema	Yes	5 (7.8%)	21 (25.3%)	**0.01**
	No	59 (92.2%)	62 (74.7%)	
Jaundice	Yes	3 (4.7%)	12 (14.5%)	**0.05**
	No	61 (95.3%)	71 (85.5%)	
Tachypnea	Yes	10 (15.6%)	23 (27.7%)	**0.08**
	No	54 (1.6%)	60 (72.3%)	
Finger Clubbing	Yes	1 (1.6%)	2 (2.4%)	**0.72**
	No	63 (98.4%)	81 (97.6%)	

CHAPTER FOUR

4.0: DISCUSSION

4.1: Study Population;

In a period of seven months a total of 2782 patients were referred for Echo due to various clinical indications. Of all Echos done during study period, 76.3% revealed or confirmed various cardiac abnormalities whereas 23.7 % were concluded to be Normal Echo findings. A comparable distribution was found by Hakim JG and Manyemba J [40] in assessing Cardiac disease distribution among patients referred for echocardiography in Harare, Zimbabwe where they found 76.5 % of the Echos were abnormal and 23.5% were found to be normal Echos.

4.2: Prevalence of RHD by Age and Sex

Of various Echo diagnoses detected, RHD was found in 5.4 % of the study subjects. This is about half the prevalence noted by Freers et al [16] at Mulago who detected RHD in 11% of the echocardiographed patients. The prevalence of RHD (5.4%) detected in this study is lower than those reported by Nhonoli[9] (9.7%) and Kazimoto[12] (16.8%) in 1968 and 1989 respectively. This diferrence in prevalence can be theorized to stem from four possibilities.

First, clinical diagnosis of RHD depends on detection of murmurs using a stethoscope. The accuracy and reliability of this method is at times doubtful as murmurs may herald other cardiac pathologies (e.g congenital heart diseases, valvular prolapses etc) leading to overdiagnosis and consequently increased prevalence.

On the other hand, Echocardiography is the gold standard in detecting valvular heart pathologies as it involves direct visualization of the valve apparatus anatomy.Henceforth, the chances of excluding non-rheumatic pathologies on the valves during echocardiography is much higher compared to auscultation leading to the observed decreased prevalence in this study

Second, is the fact that Echocardiography is an expensive procedure which cannot be afforded by many patients henceforth patients detected to have RHD by Echo in this study may not be a representative sample and a true reflection of RHD in the community.

Third, the Nhonoli study was conducted about forty years ago while the Kazimoto study was conducted about twenty years ago. The prevalence has consistently declined (almost halving) between these studies to this study. The possible explanation for this could be decrease in RF due to improved housing as a result of improved socioeconomic status of our community with time as was shown in the Longo-Mbenza study [5].

Fourth, the use of penicillins by during the time of the clinical-based studies was assumably not as widespread as today (due to availability or affordability). Penicillins even when taken for other medical ailments would automatically confer protection against RF and consequently reduce the number of patients who would likely end up with RHD.

Females constituted the majority of subjects with RHD (70.1%) with female to male ratio of 2.4:1 which is comparable to studies done elsewhere[41, 42, 43]. RHD among females was found to be more prevalent than males (6.2% vs 4.1%, p-value 0.02).This fact is generalizable and numerous studies done at various centres have attested preponderance of females among RHD patients. Whether there is underlying inherent genetical explanation for this female sex predilection is yet to be established. Some authors have theorized that females are more likely to be housebound than males and hence this could account for their increased likelihood of acquiring repeated sore throat and eventual RHD as overcrowded housing is an established risk factor in RHD[6,21].

In this study RHD was most prevalent in age groups 10 – 29 years (62%). In Kenyatta hospital study in Kenya, Oyoo and Ogola [8] found that 79% of their RHD patients were below 30 years of age.

The median age for males was 21.7±10.92 years and for females was age 26.8±15.6 years. There was no difference in median age among sexes (p=0.05). This median age is comparable to the median age 24.02 ± 12.75 years reported by Sani MU [20] et al in his Nigerian study. Again, the comparable median ages of RHD patients observed in different studies underscores the established fact that RHD is most prevalent among adolescents and young adults.

4.3: Presenting clinical features

The most common presenting symptom was dyspnea on ordinary exertion (82.7%). This finding bears a striking similarity to 83% of patients presenting with dsypnoea ordinary exertion from a cross-sectional hospital based descriptive study by R Sukanya and S Sivasankaran [24] in India which aimed at determining whether there were any differences between men and women attending tertiary care hospital.

Cardiac murmur(s) were found in 96.7% of patients who subsequently were ECHO-confirmed to have RHD. This proportion is comparable to that found by Danbauchi [44] in Zaria, Northern Nigeria who noted that nearly 90% of the referring physician made the correct diagnosis of RHD (mainly based on auscultable murmurs). Bearing in mind the cost implicated in purchasing and maintaining of the echo machines, it will take long time before Echo machines reach the bulk of patients in our healthcare level hierarchy (i.e. District hospitals).But this study among others [45] has underlined the accuracy of traditional cardiac auscultation in provisionally diagnosing RHD.

Congestive Cardiac Failure as defined by Framingham criteria was found in 48.3% of the study subjects. This was more than what R Sukanya and S Sivasankaran [24] found in their series in which congestive cardiac failure was diagnosed in 38% of RHD patients. In their study to determine the clinical and socio demographic aspects of congestive heart failure patients at Kenyatta National Hospital, Nairobi, Oyoo and Ogola [8] found that chronic RHD was the main underlying etiology (32%) among all causes of Congestive heart failure. Poverty and ignorance have been blamed as factors for late health seeking behavior among many patients in the developing countries. A community based study taking into account the socio-economic-demographic paradigms is a better study to discern how much of the factors contribute to development of Congestive Cardiac Failure among RHD patients.

In this study, the overall prevalence of atrial fibrillation (AF) among RHD patients was found to be 9.3%. It was mostly picked among patients who subsequently were found to have isolated MS (40%) than those with other valvular afflictions.

In a study by Diker E et al [45] on prevalence and predictors of atrial fibrillation in rheumatic valvular heart disease conducted in Ankara Turkey, it was found that highest frequency of AF in RHD occurs in those with MS, MR, and TR in combination. In his series AF occurred in 29%

of patients with isolated MS and in 16% with isolated MR, and was infrequent finding (1%) in patients with aortic valvular disease. AF occurring in the background of an underlying cardiac disease is associated with increased morbidity, intracardiac embolization, and complicate perioperative outcome and increases mortality. It is therefore imperative to detect and treat AF among RHD to avert these undesirable outcomes.

4.4: Valvular lesions among RHD patients by Sex.

Proportionally more males had MR, AR and TR than females whereas more females had more MS than males (not statistically significant)

The commonest valvular lesion was mitral regurgitation found in 84.0%, followed by tricuspid regurgitation 31.3%, mitral stenosis 24.7% and aortic regurgitation 22.0% respectively. The same order of frequency was reported by Ashwin Redy et al [14] in his study on clinical evaluation versus Echocardiography in the assessment of RHD where he found MR in 84%, TR in 56%, MS in 50% and AR in 26% of his study subjects.

Pure MR was found in 42.0% patients, pure MS in 6.7%, pure AR in 1.3%, and pure TR in only 0.7 %.

Mitral disease (i.e. MS + MR) was found in 4.7% patients, which is in contrast to 27.9% in the Nigerian study by Sani MU et al [44].

Combined Mitral and Aortic disease (i.e. MS± MR with AR) was found in 20.7% .This frequency is proportionally comparable to what was found by Deshpande[46] in his autopsy study in Mumbai India where he found a proportion of 21% for combined mitral and aortic valve disease.

Age group wise, Mitral valve disease was the predominant valvular heart lesions across different age groups. Danbauchi [45] noted that Mitral valve disease whether pure regurgitation, stenosis or combined disease was more common in patients below the age of 25 years.

4.5: Pulmonary Hypertension among RHD patients

Pulmonary hypertension (PHT) influences the natural history of especially mitral valve disease, affecting the response to treatments and also the post intervention prognosis[47, 48].

In this study, the prevalence of pulmonary arterial pressure among RHD patients was found to be 44.7 %. PHT was found to be severely elevated (i.e. > 75mmHg) in 12% of RHD patients. Different studies reports different prevalence of PHT among their RHD patients. Pulmonary hypertension was diagnosed in 57 % of all patients in the Indian study[24].

4.7: LA Size and presenting clinical features in pts with Rheumatic Mitral disease.

In this study, RHD patients who had moderate to severely dilated left atrium presented with more clinical features which portends to CCF as compared to those who had normal to mildly dilated Left Atrium . This is in line with the finding that Left Atrial diameter was found to be a good predictor of Heart failure among RHD patients [36]

CHAPTER FIVE

5.0: CONCLUSION AND RECOMMENDATIONS

5.1: Conclusion.

- This study has revealed that although the prevalence during pre- and post Echo era varies, the RHD patterns (e.g. peak age, preponderance to females, commonest RHD valvular lesion etc) have remained similar.

- Almost a quarter (23.7%) of patients referred for echo had normal echocardiographic findings.

- -At the time of echocardiography, about half of RHD patients had developed pulmonary hypertension (12% of them severe) and about half were in congestive cardiac failure, signifying late presentation by our patients in seeking for specialized care.

- -The study further revealed that left atrial (LA) dilatation is associated with presence of more clinical features among RHD patients some of which portend CCF.

5.2: Recommendations

1. More referral and regional hospitals should be equipped with Echocardiographic facilities to improve RHD diagnostic accuracy at these hospitals.

2. Further studies are recommended to determine how left atrial size can be related to severity of presenting symptoms among cardiac disease patients.

5.3: Study limitation

- The LA size can be measured in more than one ways, however in this study only the M-(motion) mode was used.

IMAGES

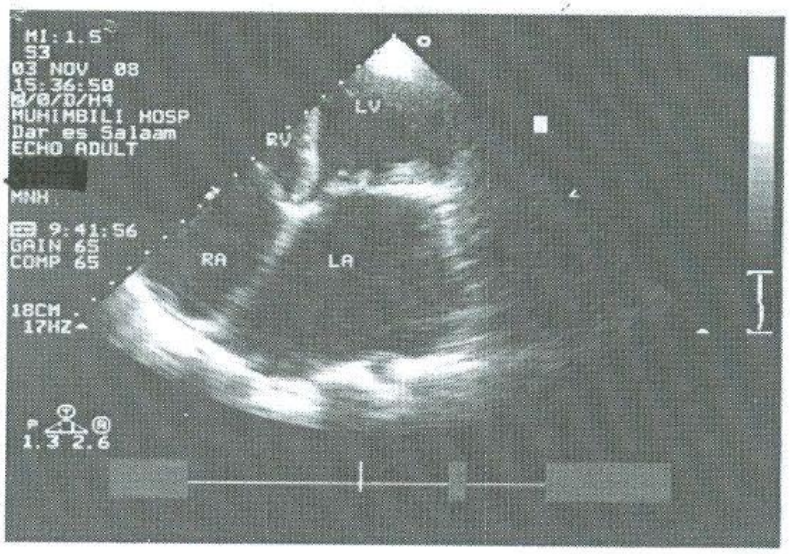


IMAGE 1; a 2D-4 Chamber view showing a large Left Atrial size (LA=7.8 cm) in a patient with severe Mitral stenosis.

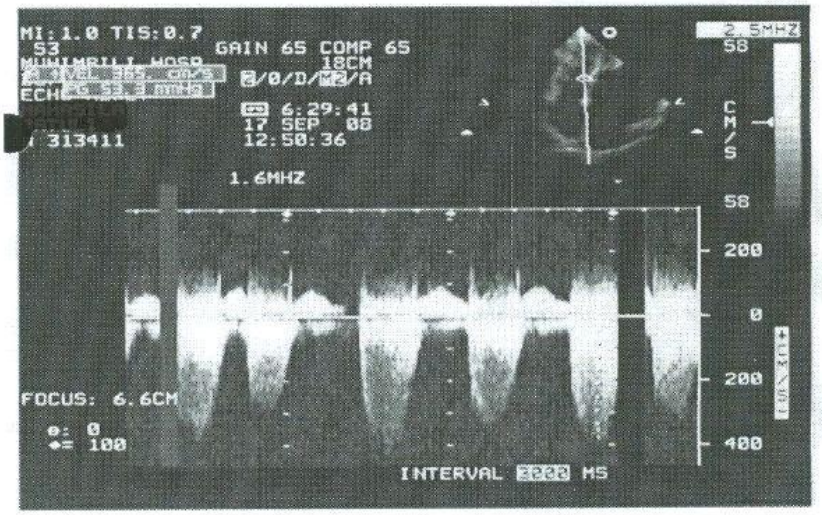


IMAGE 2; a Continous Wave(CW) image showing a regurgitant TR-jet corresponding to a Severe pulmonary Hypertension in a patient with severe rheumatic Mitral stenosis and regurgitation.

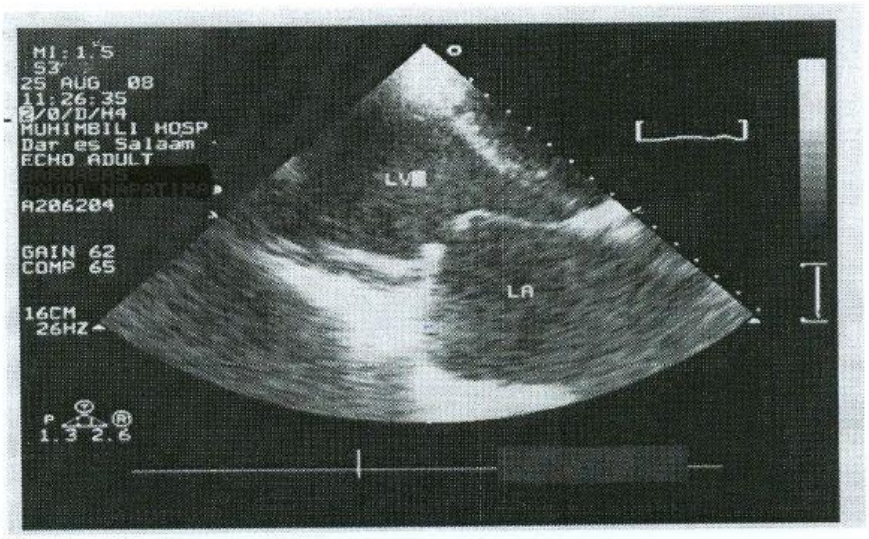


IMAGE 3; a 2D- view showing both rheumatic and prolapsing anterior and posterior mitral valve leaflets.

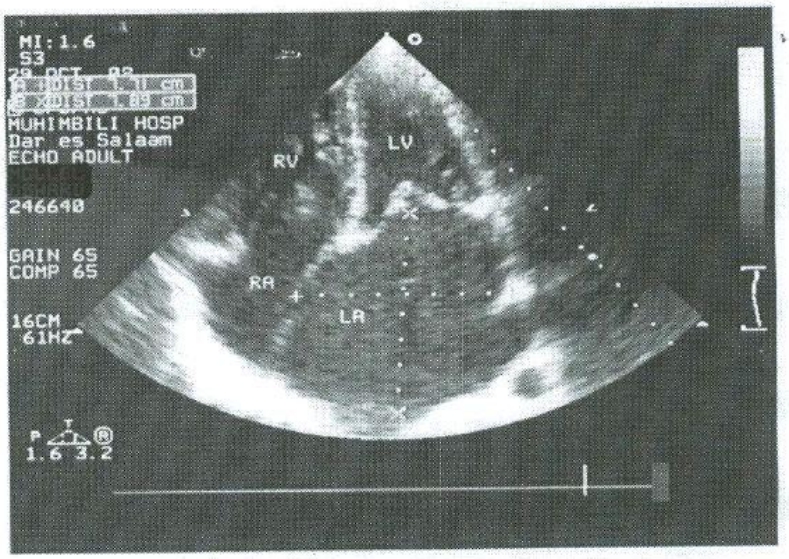


IMAGE 4; a 2D-view showing a severely deformed mitral valve apparatus due to a rheumatic process. (N.B; compare the LA and LV chamber sizes).

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ANNEXES

Annex 1: QUESTIONNAIRE

TITLE: PREVALENCE AND CHARACTERISTICS OF ECHOCARDIOGRAPHICALLY DIAGNOSED PATIENTS WITH RHEUMATIC HEART DISEASE AT MUHIMBILI NATIONAL HOSPITAL, DAR-ES-SALAAM.

1. DEMOGRAPHIC CHARACTERISTICS:

Date of interview.....

Serial Number.....

File No.....

Tel No; .....

Name.....

1. Sex;	Male	0
	Female	1
2. Age.....yrs		
	Below 5 yrs	0
	5 – 10 yrs	1
	10 – 15 yrs	2
	15 – 20 yrs	3
	Above 20 yrs	4

Weight (Kg).....

Height (m).....

3. BMI (Kg/m^2).....

Underweight	0
Normal	1
Overweight	2
Obese	3

2. HISTORY

4. Have you been **previously diagnosed** to have heart disease?

Yes	0
No	1

5. Where were you diagnosed?

Health Centre	0
District Hospital	1
Regional Hospital	2
Private Hospital	3
Other (mention).....	4

6. Are you on **any treatment** for heart disease?

Currently on Treatment	0
Left treatment within the last 6 months	1

Left treatment beyond 6 months ago 2

Not on treatment 3

7. Do you receive monthly prophylaxis jab?

Yes 0

No 1

8. Are you currently experiencing any of the following?

Paroxysmal Nocturnal Dyspnoea 0

Bilateral ankle edema 1

Nocturnal cough 2

Dyspnoea on ordinary exertion

3. **PHYSICAL EXAMINATION**

9. Presence of signs of cardiac failure;

(i) Wasting 0

(ii) Edema 1

(iii) Jaundice 2

(iv) Dyspnoea 3

(v) Finger clubbing 4

(vi) Cyanosis 5

10 (a) Radial Pulse rate

Normal 0

Tachycardia 1

Bradycardia 2

(b) Radial Pulse rhythm

Regular 0

Atrial Fibrillation 1

Ectopic beats 2

(c) Radial Pulse character

Collapsing Pulse 0

Small Volume Pulse 1

Other (mention)..... 2

11. Blood Pressure

Normal 0

High 1

Low 2

Wide pulse pressure 3

12. Jugular Venous Pressure

Not Raised 0

Raised 1

13. Hepatojugular Reflux

Positive 0

Negative 1

14. Apex beat

	Displaced	0
	Not Displaced	1
15.	Heart Sounds	
	Normal	0
	Distant	1
16.	Murmur of;	
	(i) MR	0
	(ii) MS	1
	(iii) AR	2
	(iv) AS	3
	(v) TR	4
	(vi) ASD	5
	(vii) VSD	6
	(viii) Other……..	7
17.	Respiratory Rate	
	Normal	0
	Tachypnoeic	1
18.	Basal Crackles	
	Present	0
	Absent	1
19.	Congested Liver	
	Present	0
	Absent	1
20.	Ascites	
	Present	0
	Absent	1

21. Edema of extremities

Present	0
Absent	1

22. Final Clinical diagnosis .....

4.ECHOCARDIOGRAPHY(Sub-annexed overleaf)

23. Rheumatic Valvular Lesions

Mitral Regurgitation	0
Mitral Stenosis	1
Aortic Regurgitation	2
Aortic Stenosis	3
Tricuspid Regurgitation	4
Combined(Mention).....	5
Other(Mention).....	6

24. Heart Chambers

Normal size	0
Lt Ventricular Hypertrophy	1
Lt Ventricular Dilatation	2
Rt Ventricular Hypertrophy	3
Rt Ventricular Dilatation	4
Rt Atrial Dilatation	5
Lt Atrial Dilation	**6**

25. **Left Atrial size**

Normal	0
Midly Dilated	1
Moderately Dilated	2
Severely Dilated	3

26. **Pulmonary Arterial Pressure**

Normal	0
Midly Elevated	1
Moderately Elevated	2
Severely Elevated	3

27. Thrombus

Absent	0
Present	1

28. Vegetation

Absent	0
Present	1

29. ECHO Conclusion.....

Annex 2a: CONSENT FORM (ENGLISH VERSION)

CONSENT FORM TO PARTICIPATE IN THE STUDY.

TITLE; PREVALENCE AND CHARACTERISTICS OF ECHOCARDIOGRAPHICALLY DIAGNOSED PATIENTS WITH RHEUMATIC HEART DISEASE AT MUHIMBILI NATIONAL HOSPITAL, DAR-ES-SALAAM.

Greetings! My name is Dr.Paschal Luggajo, a senior resident in the department of Internal Medicine. I would like to conduct a study mentioned above for my dissertation.

Purpose of the study.

The aim of the study is to determine the clinical and echocardiographical characteristics of patients with rheumatic heart disease. This will help in improving future management of other patients with RHD.

How to participate.

Patients who meet the inclusion criteria will be recruited into the study.

They will be interviewed using a questionnaire, which will include their social demographic characteristics, medical history, clinical examination and

Echocardiographic measurements.

Risks.

There are no risks associated with taking these measurements.

Benefits:

Patients found to have decompensated RHD will be counseled and followed up appropriately through our Cardiac Clinics.

Confidentiality:

Any patient's results will not be revealed to anybody except attending doctors and person himself.

Cost.

No payment is requested from you as a fee to participate in the study.

Person to contact in questions or problems:

Prof.E.Lyamuya (Tel; 255 22 2152489, Mobile; 0754 49 59 33) Director of Research and Publications, MUHAS.

Dr. J.Lwakatare (Tel: 0754 26 26 48) Department of Internal Medicine, MUHAS.

I..... have read/been told of the contents of this form and understood its meaning. I agree to participate in this study.

Signature..... (Participant) Date.....

Signature..... (Researcher) Date.....

Annex 2b; CONSENT FORM (SWAHILI VERSION)

IDHINI YA KUSHIRIKI KATIKA UTAFITI

Nambari ya Usaili.....

Ndugu, hujambo?

Mimi naitwa Dr Paschal Luggajo, mwanafunzi wa shahada ya uzamili Chuo Kikuu cha Tiba Muhimbili. Nafanya utafiti kuhusu " **KIWANGO NA TATHMINI YA KIPIMO CHA EKOKADIOGRAFIA KWA WATU WENYE MAGONJWA YA VIWAMBO VYA MOYO KATIKA HOSPITALI YA TAIFA YA MUHIMBILI".**

Madhumuni ya Utafiti

Katika utafiti huu, lengo ni wagonjwa watakaofanyiwa kipimo cha ECHOCARDIOGRAPHY kwa matatizo anuai ya moyo na kubainika kuwa na matatizo(yasiyo ya kuzaliwa nayo) ya viwambo vya moyo watasailiwa na kupimwa kitabibu ili kutathmini dalili walizokuja nazo ikilinganishwa na majibu yaliyopatikana ya kipimo cha Echocardiography. Utafiti huu utasaidia kuboresha matibabu ya Ugonjwa wa viwambo vya moyo.

Ushiriki wa wagonjwa

Kama unakubali kushiriki katika utafiti huu utaombwa kujibu maswali kadhaa na kupimwa kitabibu mfumo wa moyo wako baada ya kufanyiwa kipimo cha Echocardiography.

Utunzaji wa siri

Taarifa zote zitatunzwa kwa siri na mtafiti.

Madhara na athari

Hakuna madhara yoyote yanayotegemewa kutokana na ushiriki kwenye utafiti huu.Kipimo hiki ni salama kwa afya ya mgonjwa na wala hakitoi mionzi inayohatarisha afya..

Uhuru wa kushiriki

Ni hiari ya mgonjwa kushiriki kwenye utafiti huu na pia anaweza kujitoa wakati wowote. Hata hivyo kutoshiriki au kujitoa kwenye utafiti hakumnyimi mgonjwa haki yake ya kupata huduma za matibabu. Mgonjwa aliyejitoa kushiriki utafiti akiamua kurudi atapokelewa na kuendelea kupata huduma zote kwa mujibu wa utaratibu uliopo.

Faida za utafiti

Mgonjwa atafaidika kwa kupimwa na mtafiti na taarifa za vipimo vya kitabibu na Echocardiography zitarudishwa kwa Daktari wake wa awali ikiwa ni pamoja na ushauri wa kitaalamu wa uboreshaji wa matibabu ya mgonjwa.

Ni matumaini kwamba taarifa za utafiti huu zitasaidia kuboresha tiba kwa wagonjwa wengine siku za baadaye.Kuna kamati ya kusimamia udhibiti wa utafiti

Kamati hii hutoa taarifa za matokeo ya utafiti ambayo hutoa elimu kubwa kuhusu tatizo hili.

Taarifa

Endapo utahitaji kupata maelezo kuhusu haki zako au kutoa taarifa ya madhara ambayo unahisi yametokana na kipimo hiki cha moyo, wasiliana na Prof E.Lyamuya, Mwenyekiti wa kamati ya Maadili na Utafiti,S.L.P 655001, Dar es Salaam. Namba ya simu: Ofisi; 255222152489, Binafsi;0754495933. Na/au Dr J.Lwakatare,Idara ya Tiba,MUHAS,Namba ya simu,Binafsi;0754 26 26 48.

Je unakubali kushiriki kwenye utafiti? (weka alama) Ndiyo.....

Hapana.....

Mimi.....nimeelezwa/nimesoma maelezo haya.Maswali yangu yamejibiwa.

Nimekubali kushiriki kwenye utafiti huu

Sahihi ya mgonjwa.....

Sahihi ya ndugu/shahidi.....

Sahihi ya Mtafiti.....

Tarehe.....

Annex 2c

Framingham Criteria for Congestive Heart Failure

Diagnosis of CHF requires the simultaneous presence of at least 2 major criteria or 1 major criterion in conjunction with 2 minor criteria.

Major criteria:

- Paroxysmal nocturnal dyspnea
- Neck vein distention
- Rales
- Radiographic cardiomegaly (increasing heart size on chest radiography)
- Acute pulmonary edema
- S3 gallop
- Increased central venous pressure (>16 cm H2O at right atrium)
- Hepatojugular reflux
- Weight loss >4.5 kg in 5 days in response to treatment

Minor criteria:

- Bilateral ankle edema
- Nocturnal cough
- Dyspnea on ordinary exertion
- Hepatomegaly
- Pleural effusion
- Decrease in vital capacity by one third from maximum recorded
- Tachycardia (heart rate>120 beats/min.)

Minor criteria are acceptable only if they can not be attributed to another medical condition (such as pulmonary hypertension, chronic lung disease, cirrhosis, ascites, or the nephrotic syndrome).

The Framingham Heart Study criteria are 100% sensitive and 78% specific for identifying persons with definite congestive heart failure.

NYHA Functional Classification for Congestive Heart Failure

The New York Heart Association (NYHA) Functional Classification provides a simple way of classifying heart disease (originally cardiac failure), useful for preoperative assessment. It places patients in one of four categories, based on how much they are limited during physical activity:

Class I: patients with no limitation of activities; they suffer no symptoms from ordinary activities.

Class II: patients with slight, mild limitation of activity; they are comfortable with rest or with mild exertion.

Class III: patients with marked limitation of activity; they are comfortable only at rest.

Class IV: patients who should be at complete rest, confined to bed or chair; any physical activity brings on discomfort and symptoms occur at rest.