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Rheumatic Heart Disease: Diagnosis and prevention

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Abstract

Rheumatic heart disease, often neglected by media and policy makers, is a major burden in developing countries where it causes most of the cardiovascular morbidity and mortality in young people, leading to about 250 000 deaths per year worldwide. The disease results from an abnormal autoimmune response to a group A streptococcal infection in a genetically susceptible host. Acute rheumatic fever, the precursor to rheumatic heart disease, can affect different organs and lead to irreversible valve damage and heart failure. Although penicillin is effective in the prevention of the disease, treatment of advanced stages uses up a vast amount of resources, which makes disease management especially challenging in emerging nations. Guidelines have therefore emphasized antibiotic prophylaxis against recurrent episodes of acute rheumatic fever, which seems feasible and cost effective. Early detection and targeted treatment might be possible if populations at risk for rheumatic heart disease in endemic areas are screened. In this setting, active surveillance with echocardiography-based screening might become very important.

Keywords: Rheumatic Heart Disease, Cardiovascular, Acute rheumatic fever.

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1. Introduction

Acute rheumatic fever (ARF) is a post infectious, nonsuppurative sequela of pharyngeal infection with streptococcus pyogenes, or Group A B hemolytic streptococcus that occurs 2 -3 weeks following group A ***streptococcus*** pharyngitis. The bacterium Streptococcus pyogenes (group a streptococcus) can pass easily from person to person in the same way as other upper respiratory tract infections. These infections are most common in childhood. In some cases, repeated strep infections can lead to rheumatic fever, which occurs when the immune system reacts against the tissues of the body present with various manifestation that may include arthritis, carditis, chorea, erythema marginatum, and subcutaneous nodules. Also can damage valves tissue of heart, cuses rheumatic heart disease (RHD), can become chronic condition leading to congestive heart failure, strokes, endocarditis, and death [1]. In low -resource areas of the world ,sever disease caused by group A streptococcus eg(GAS, ,ARF ,rheumatic heart disease ,glomerulonephritis ,and invasive infections) is estimated to effect over 33 million people, and rheumatic heart disease is the leading cause of cardiovascular death during the first five decades of life.

ARF in most cases occur in children 5 to 15 years of age worldwide, there are 470,000 new cases or ARF and 233,000 deaths attributable to RHD each year, The mean incidence of ARF is 19 per 100,000 worldwide [2] but is lower(2-14 case per 100,000)in the united states and other developed country (Bradley-Hewitt and Tyler,2019). It is estimated that there are over 15 million cases of RHD worldwide, with 282,000 new cases and 233,000 death annually [3]. The lower incidence in developed countries is probably primarily due to improvement hygienic standard (e.g., improved housing, better education, employment, less crowding) an in smaller part due to use routine of antibiotics for acute pharyngitis [4]. While the incidence and prevalence of ARF and RHD have been decreasing in developed nations since the early 1990s, continue to be major causes of morbidity and mortality among young people in developed nations [5]. The significant sequel of ARF is the development of RHD. Approximately 39 million people worldwide are estimated to be living with RHD. ARF and RHD more dangerous in female more than male because increase mortality and morbidity during pregnancy [2].

2. Diagnosis

2.1. Echocardiogram

This non-invasive test uses sound waves to evaluate the heart's chambers and valves. The echo sound waves create an image on a monitor as an ultrasound transducer is passed over the heart. Echocardiography is the key technique used to conform this is the best test to evaluation heart function [6].

2.2. 2012 WHF criteria for echocardiographic diagnosis of RHD

Echocardiographic criteria for individuals aged ≤20 years.

- ***Definite RHD (either A, B, C, or D)***

A. Pathological MR and at least two morphological features of RHD of the MV
B. MS mean gradient ≥4 mmHg*
C. Pathological AR and at least two morphological features of RHD of the AV‡
D. Borderline disease of both the AV and MV§

- ***Borderline RHD (either A, B, or C)***

A) At least two morphological features of RHD of the MV without pathological MR or MS
B) Pathological MR
E. C)Pathological AR

- ***Normal echocardiographic findings (all of A, B, C, and D)***

A) MR that does not meet all four Doppler echocardiographic criteria (physiological MR)
B) AR that does not meet all four Doppler echocardiographic criteria (physiological AR)
C) An isolated morphological feature of RHD of the MV (for example, valvular thickening) without any associated pathological stenosis or regurgitation
D) Morphological feature of RHD of the AV (for example, valvular thickening) without any associated pathological stenosis or regurgitationEchocardiographic criteria for individuals aged >20 years

- ***Definite RHD (either A, B, C, or D)***

A) Pathological MR and at least two morphological features of RHD of the MV
B) MS mean gradient ≥4 mmHg*
C) Pathological AR and at least two morphological features of RHD of the AV, only in individuals aged <35 years‡
D) Pathological AR and at least two morphological features of RHD of the MV
E) Abbreviations: AR, aortic regurgitation; AV, aortic valve; MR, mitral regurgitation; MS, mitral stenosis; MV, mitral valve; RHD, rheumatic heart disease; WHF, World Heart Federation.

3. Morphological features of RHD

3.1. Features in the MV

- AMVL thickening* ≥3 mm (age-specific)‡
- Chordal thickening
- Restricted leaflet motion§
- Excessive leaflet tip motion during systole‖

3.2. Features in the AV

- Irregular or focal thickening
- Cooptation defect
- Restricted leaflet motion
- Prolapse
- Abbreviations: AMVL, anterior mitral valve leaflet; AV, aortic valve; MV, mitral valve; RHD, rheumatic heart disease.
- Echocardiography machine settings
- Nyquist limits for color-Doppler echocardiography should be set on maximum to avoid overestimation of jet length
- Images for assessment of valvular and chordal thickness should be acquired with harmonics turned off and probes with variable frequency set on ≥2.0 MHz; low frequency settings and harmonics exaggerate valve and chordal thickness
- Gain settings should be adjusted to achieve optimal resolution; images acquired with an excessive gain setting will not be suitable for objective valve thickness measurements
- All other settings (including depth, sector size, and focus) should also be optimized to achieve maximal frame rate (ideally 30–60 frames per second) and resolution
- Electrocardiogram (ECG): A test that records the electrical activity of the heart, shows abnormal rhythms (arrhythmias), present or absence of hypertrophy, and can sometimes detect heart muscle damage [7].
- Transesophageal echocardiogram (TEE): This test involves passing a small ultrasound transducer down into the esophagus. The sound waves create an image of the valves and chambers of the heart on a computer monitor without the ribs or lungs getting in the way. TTE is the standard diagnostic test valve in the initial evaluation of patient with known or suspected VHD, also allows accurate assessment of valve anatomy and etiology, concurrent valve disease, and associated abnormalities, such as aortic dilatation, establishes chamber size [8].
- Chest X-ray: This test that uses invisible electromagnetic energy beams to produce images of internal tissues, bones, and organs onto film. An X-ray can show enlargement in any area of the heart, present or absence of pulmonary vascular, intrinsic lung disease, calcification of aorta and pericardium [9].
- Magnetic resonance imaging (MRI): This test uses a combination of large magnets, radiofrequencies, and a computer to produce detailed images of organs and structures within the body. The MRI used when quality of echocardiogram is inadequate, discrepant results, also to assess severity of valvular lesions, ventricular volume and systolic function.in practice, the routen use of MRI is limited because of its limited availability, compared with echocardiography [9].

4. Fluoroscopy

- Fluoroscopy is more specific than echocardiography for assessing valvular or annular calcification. It is also useful for assessing the kinetics of occludes of a mechanical prosthesis [10].
- Cardiac catheterization this test involves the insertion of a tiny, hollow tube (catheter) through a large artery in the leg or arm leading to the heart to provide images of the heart and blood vessels. This procedure is helpful in determining the type and extent of certain valve disorders [11].
- Coronary angiography is widely indicated for the detection of associated CAD when surgery is planned (Table 2). Knowledge of coronary anatomy contributes to risk stratification and determines if concomitant coronary revascularization is indicated [12].

5. Prevention of Rheumatic Valvular Disease

In a continent faced with famine, overcrowding, war, retroviral and other communicable diseases of epidemic proportions, lack of basic amenities such as provision of clean water and electricity, poor health services, lack of education, and political ineptitude, the prospects for a comprehensive program to eliminate rheumatic heart disease are grim [13]**.** The reasons for the declining incidence of rheumatic fever in the Western world are not entirely clear but in part probably relate to less overcrowding and better sanitation and general living conditions, all of which result in a reduction in infectious diseases in general and streptococcal infections in particular [14]. It is unlikely that a vaccine against rheumatogenic streptococcal strains will be available in the near future, and currently, prevention of the first attack of rheumatic fever by early treatment of streptococcal pharyngitis (primary prevention) or prevention of recurrent attacks of rheumatic fever (secondary prevention) is the only way to prevent rheumatic heart disease. Secondary prevention is a more cost-effective and attainable goal than primary prevention. A recent systematic review of the most effective antibiotic regimen for secondary prophylaxis given every 3 week intramuscular injections of benzathine penicillin. Africa and India faces many difficulties, and the challenge of preventing and treating the scourge of rheumatic heart disease is enormous. If we are to rise to this challenge, we need to establish the scope and magnitude of the problem with large, properly conducted epidemiological trials, and health authorities must be urgently convinced of the need to institute efficient and readily accessible programs for primary and secondary prevention of rheumatic heart disease [15].

References

[1] A. Sujhithra, S. Jayanthi, M. Chokkalingam, D.D. Vijay, R. Vidhya, S.A. Rajaratnam. (2022). Streptococcal Pharyngitis and Rheumatic Fever. J Pure Appl Microbiol. 16(1): 55-62.

[2] J. Rwebembera, A.Z. Beaton, S.R. de Loizaga, R.T. Rocha, N. Doreen, I. Ssinabulya, E. Okello, C.L. Fraga, B.F. Galdino, M.C.P. Nunes. (2021). The global impact of rheumatic heart disease. Current Cardiology Reports. 23: 1-10.

[3] S. Nulu, G. Bukhman, G.F. Kwan. (2017). Rheumatic heart disease: the unfinished global agenda. Cardiology clinics. 35(1): 165-180.

[4] M. Ismail. Knowledge and Practice of Primary Prevention of Rheumatic Heart Disease in Parents of Children With Acute Pharyngitis at Kenyatta National Hospital. UON, 2021.

[5] Y. Liang, D. Yu, Q. Lu, Y. Zheng, Y. Yang. (2023). The rise and fall of acute rheumatic fever and rheumatic heart disease: a mini review. Frontiers in Cardiovascular Medicine. 10: 1183606.

[6] S.K. Glen. (1997). Non-Invasive Cardiovascular Ultrasound. University of Glasgow (United Kingdom): pp.

[7] G. Finocchiaro, N. Sheikh, E. Biagini, M. Papadakis, G. Sinagra, A. Pelliccia, C. Rapezzi, S. Sharma, I. Olivotto. (2020). The electrocardiogram in the diagnosis and management of patients with hypertrophic cardiomyopathy. Heart Rhythm. 17(1): 142-151.

[8] H.E. McCrea, M.W. Fong. (2011). Transthoracic and Transesophageal Echocardiography (TTE/TEE). Manual of Outpatient Cardiology. 51.

[9] A.B. Wolbarst. (1999). Looking within: how X-ray, CT, MRI, ultrasound, and other medical images are created, and how they help physicians save lives. Univ of California Press: pp.

[10] M. Wong, C. Tei, P.M. Shah. (1983). Sensitivity and specificity of two dimensional echocardiography in the detection of valvular calcification. Chest. 84(4): 423-427.

[11] A.G. Kacharava, S.D. Clements Jr, A.M. Zafari. (2015). Pocket guide to diagnostic cardiac catheterization. Cardiotext Publishing: pp.

[12] P.S. Douglas, M.R. Patel, S.R. Bailey, D. Dai, L. Kaltenbach, R.G. Brindis, J. Messenger, E.D. Peterson. (2011). Hospital variability in the rate of finding obstructive coronary artery disease at elective, diagnostic coronary angiography. Journal of the American College of Cardiology. 58(8): 801-809.

[13] W.H. Organization *Horn of Africa: emergency-affected countries 2007: communicable disease epidemiological profile*; World Health Organization: 2007.

[14] A. Taranta, M. Markowitz. (2012). Rheumatic fever. Springer Science & Business Media: pp.

[15] J. Irlam, B.M. Mayosi, M. Engel, T.A. Gaziano. (2013). Primary prevention of acute rheumatic fever and rheumatic heart disease with penicillin in South African children with pharyngitis: a cost-effectiveness analysis. Circulation: Cardiovascular Quality and Outcomes. 6(3): 343-351.