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Severe Rheumatic Mitral Stenosis With Multivalvular Abnormalities in a British-Born Adult Without a Recognized History of Acute Rheumatic Fever

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Abstract

Rheumatic heart disease (RHD) has become uncommon in the United Kingdom, particularly among British-born adults without a recognized history of acute rheumatic fever (ARF). A 40-year-old British-born female with no previously diagnosed cardiac disease presented with a one-year history of progressive exertional dyspnoea. Chest radiography demonstrated cardiomegaly, and the N-terminal pro-B-type natriuretic peptide concentration was 1,800 pg/mL.

Transthoracic echocardiography showed very severe mitral stenosis with characteristic rheumatic morphology, a mitral valve area of 0.33 cm² by planimetry, and a mean transmitral gradient of 16.6 mmHg. Associated findings included mild mitral regurgitation, tricuspid valve abnormalities with moderate-to-severe tricuspid regurgitation, and discordant aortic valve findings consistent with a low-flow, low-gradient pattern of aortic stenosis, an estimated pulmonary artery systolic pressure of approximately 105-110 mmHg, left ventricular systolic impairment, and impaired right ventricular longitudinal systolic function. Further history identified intermittent involuntary left-hand movements, arthralgia, and an annular abdominal eruption with central pallor. These features raised the possibility of previously unrecognized rheumatic manifestations but were insufficient to establish the diagnosis of ARF. Following transoesophageal echocardiography, cardiac magnetic resonance imaging, and multidisciplinary review, the patient underwent mitral and aortic valve replacement with tricuspid valve repair. This case highlights that advanced RHD can present without a documented history of ARF and emphasizes the importance of valve morphology, integrated haemodynamic assessment, and timely multidisciplinary management.

Categories: Cardiology, Internal Medicine, Cardiac/Thoracic/Vascular Surgery

Keywords: cardiac surgery, echocardiography, impaired left ventricular function, mitral valve replacement, mitral valve stenosis, rheumatic fever, rheumatic heart, rheumatic heart disease (rhd), rheumatic valvular disease, rheumatic valvular heart disease

Introduction

Although the prevalence of rheumatic heart disease (RHD) has declined substantially in industrialized countries over the past century, it remains an important contributor to cardiovascular disease burden in resource-limited regions [1]. In the United Kingdom, RHD has become uncommon, particularly among the native-born population, although cases continue to occur in individuals with previous acute rheumatic fever (ARF) and in populations with epidemiological links to regions where RHD remains endemic [2,3]. These trends underscore the marked geographical and socioeconomic disparities that continue to characterize the global epidemiology of RHD [2].

RHD remains a major global public health concern and continues to be a significant cause of cardiovascular morbidity and mortality worldwide [4]. According to estimates from the Global Burden of Disease 2019 study, approximately 40.5 million individuals were living with RHD in 2019, with the disease contributing to an estimated 306,000 deaths annually [5]. The burden of RHD is characterized by marked geographic and socioeconomic disparities, disproportionately affecting populations in low- and middle-income countries. In 2015, RHD accounted for an estimated 10.67 million disability-adjusted life years (DALYs) globally, with the highest burden observed in regions such as Central Africa, Oceania, and South Asia, where poverty, inadequate healthcare infrastructure, and limited access to preventive and therapeutic services contribute to disease persistence [2]. In contrast, the incidence and prevalence of RHD have declined substantially in high-income countries, where improvements in living conditions, healthcare access, and public health interventions have contributed to a marked reduction in disease burden, highlighting the effectiveness of comprehensive prevention and disease control strategies [6].

How to cite this article

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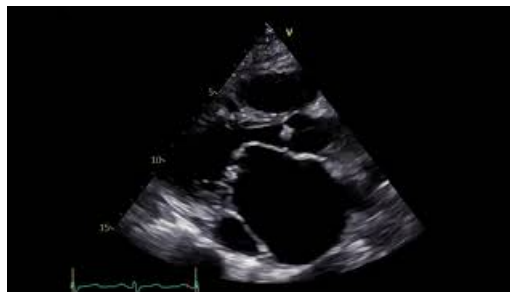
Case Presentation

A 40-year-old female who was born and raised in the United Kingdom, with no history of prolonged residence in regions where ARF is endemic and no previously diagnosed cardiac disease, presented with progressive shortness of breath on exertion and when walking uphill for approximately one year. She initially attributed her symptoms to cigarette smoking (5-10 cigarettes per day for 10 years) and did not seek medical attention. Over time, her symptoms worsened and were accompanied by chest tightness, intermittent palpitations, and dizziness, prompting review by her general practitioner.

A posteroanterior chest radiograph obtained in the community demonstrated cardiomegaly without radiographic features of chronic obstructive pulmonary disease. The N-terminal pro-B-type natriuretic peptide concentration was elevated at 1,800 pg/mL (normal <125 pg/mL), prompting urgent referral for transthoracic echocardiography.

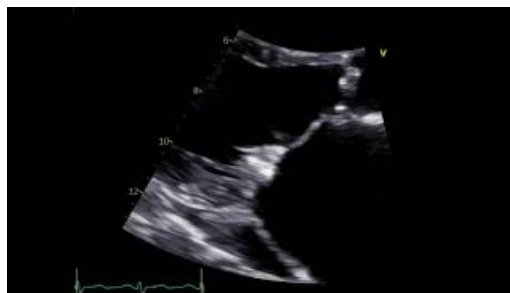
Transthoracic echocardiography

Transthoracic echocardiography demonstrated very severe mitral stenosis with characteristic rheumatic morphology. The anterior mitral leaflet was elongated, markedly thickened towards its tip, and had restricted opening, with diastolic doming; the posterior leaflet mobility was also restricted. The mitral valve area was 0.33 cm² by direct planimetry (normal = 4-6 cm²), with a mean transmitral gradient of 16.6 mmHg (normal <5 mmHg) and a peak gradient of 31.1 mmHg. Mild mitral regurgitation was present (Videos 1, 2). All accompanying videos are original recordings obtained from this patient's clinical records, with all identifying information removed to protect patient confidentiality.



VIDEO 1: Parasternal long-axis echocardiogram demonstrating the characteristic rheumatic appearance of the mitral valve with severe mitral stenosis. The aortic valve cusps are also thickened.

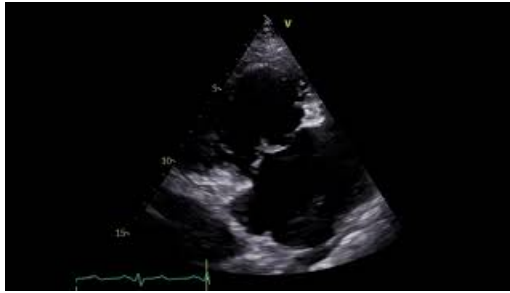
View video here: https://youtu.be/v72n-R3_KhQ?si=vcZLLxncofYZJAYm



VIDEO 2: Transthoracic echocardiogram showing mitral leaflet thickening predominantly towards the tips, restricted leaflet mobility, and the characteristic “hockey-stick” appearance of the anterior mitral leaflet, consistent with rheumatic mitral valve disease.

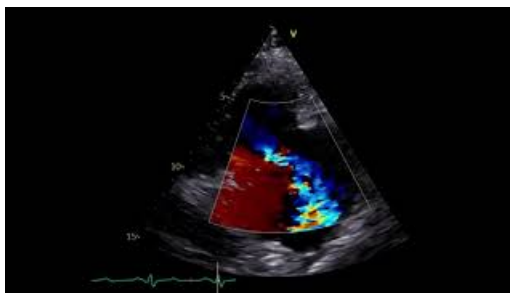
View video here: <https://youtu.be/RJCYipisnRk?si=pqDnTP05Fq-BVZHM>

The tricuspid valve demonstrated leaflet restriction and anterior leaflet thickening, with a possible component of tricuspid stenosis; the tricuspid valve area could not be measured. Moderate-to-severe tricuspid regurgitation was present, with a peak regurgitant velocity of 5.12 m/s (normal ≤2.8 m/s) and an estimated pulmonary artery systolic pressure of 105-110 mmHg (normal <35 mmHg), indicating a high probability of severe pulmonary hypertension. The main pulmonary artery was dilated at 2.8 cm (normal ≤2.5 cm) (Videos 3, 4).



VIDEO 3: Parasternal view of the tricuspid valve on transthoracic echocardiogram showing thickened tips of the leaflets with bowing.

View video here: https://youtu.be/-cZeeZd8WSM?si=49Mkit1yOt3lgG_



VIDEO 4: Transthoracic echocardiogram showing significant tricuspid regurgitation in the setting of severe rheumatic mitral valve disease and associated tricuspid abnormalities.

View video here: https://youtu.be/LsbvBsfHX5A?si=k-8YpWEB_qlnRKfx

The aortic valve was trileaflet, with calcification and restricted excursion of the right and non-coronary cusps. The peak transaortic velocity was 1.9 m/s (normal <2.5 m/s), with peak and mean gradients of 14.4 and 8.9 mmHg, respectively. The calculated aortic valve area was 0.8 cm² by the continuity equation (normal = 3–4 cm²), the dimensional index was 0.30, and the stroke-volume index was 17.4 mL/m² (normal ≥35 mL/m²), indicating a low-flow, low-gradient pattern of aortic stenosis in the setting of impaired left ventricular systolic function. Mild aortic regurgitation was also present (Video 5).



VIDEO 5: Parasternal short-axis view on transthoracic echocardiogram demonstrating a trileaflet aortic valve with thickening and restricted motion of the right and non-coronary cusps.

View video here: <https://youtu.be/IO3S88HKTkI?si=8E6c9Ujme3febTY9>

The left ventricle was normal in cavity size and wall thickness but demonstrated global systolic impairment, with a visually estimated ejection fraction of 30%–40% (normal ≥55%). The right ventricle was mildly dilated, with a basal diameter of 4.5 cm (normal ≤4.1 cm), and demonstrated impaired longitudinal systolic function (tricuspid annular plane systolic excursion (TAPSE) was 1.6 cm (normal ≥1.7 cm); lateral annular S' was 7 cm/s (normal ≥9.5 cm/s)). Radial right ventricular systolic function appeared preserved. There was marked biatrial enlargement. The left atrial volume index was 96.9 mL/m² (normal ≤34 mL/m²); the right atrial area was 25 cm² (normal ≤18 cm²) (Video 6). A small loculated pericardial effusion measuring up to 1.2

cm was present without haemodynamic compromise.



VIDEO 6: Apical four-chamber echocardiography demonstrating rheumatic mitral and tricuspid valve disease, severe mitral stenosis, and marked biatrial enlargement.

View video here: <https://youtu.be/vnlR18QgmhI?si=R1TYMdobt3lZKgFD>

The overall echocardiographic appearance was considered strongly suggestive of rheumatic valvular heart disease affecting mainly the mitral valve. Although the coexistence of aortic valve disease with severe rheumatic mitral disease raised the possibility of rheumatic aortic involvement, the aetiology of the aortic stenosis could not be established with certainty.

In view of these findings, the patient was reviewed immediately by the cardiology team and admitted to the acute cardiology unit for inpatient investigation and management.

Additional history and examination

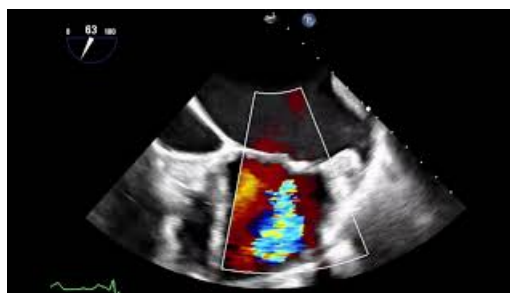
On detailed history following admission, the patient described intermittent episodes of rhythmic, involuntary movements of her left hand, lasting seconds to minutes, which had been occurring for several months and could not be voluntarily suppressed. She also reported a non-pruritic, pinkish rash on her abdomen with a pale centre, of uncertain duration, and a history of painful joints, predominantly affecting the knees.

She denied any known history of rheumatic fever during childhood, recent fever, personality changes, or emotional lability. Her obstetric history was unremarkable, with two uncomplicated pregnancies. She reported general fatigue and reduced energy levels.

On examination, the patient was alert and haemodynamically stable (blood pressure = 102/60mmHg, heart rate = 99beats/min). An annular pink eruption with central pallor was observed on the abdomen and was considered clinically compatible with erythema marginatum, although dermatological confirmation was not obtained. No involuntary movements were observed during admission, and a definitive neurological diagnosis was not established. No subcutaneous nodules were identified.

Cardiac auscultation demonstrated an accentuated first heart sound and a low-pitched, rumbling mid-diastolic murmur heard most clearly at the apex. Lung fields were clear. Electrocardiography demonstrated sinus rhythm with prominent P waves consistent with atrial enlargement. C-reactive protein was 5 mg/L (normal range less than 5 mg/L).

Transoesophageal echocardiography confirmed severe rheumatic mitral valve disease and demonstrated associated tricuspid and aortic valve abnormalities (Video 7).



VIDEO 7: Transoesophageal echocardiogram showing rheumatic

appearance of the mitral valve with severe mitral stenosis and regurgitation.

View video here: <https://youtu.be/BXFYqdmFHFE?si=fJU2OoLzlvq50dO2>

Management and clinical course

The working diagnosis was advanced chronic rheumatic multivalvular heart disease. The historical involuntary hand movements, arthralgia, and annular rash raised the possibility of previously unrecognized rheumatic manifestations; however, the available evidence was insufficient to establish active or recurrent ARF. These findings therefore cannot be regarded as diagnostic evidence of previous ARF. The patient was treated with optimum heart failure medications and intravenous diuretics for decongestion, with continuous cardiac monitoring.

She was referred to a tertiary cardiothoracic centre for further assessment. Transoesophageal echocardiography confirmed severe rheumatic mitral valve disease and associated multivalvular pathology. Cardiac magnetic resonance imaging subsequently demonstrated a left ventricular ejection fraction of approximately 50%, higher than the initial echocardiographic estimate of 30–40%. This discrepancy may reflect differences in imaging methodology and the marked haemodynamic loading conditions associated with severe multivalvular disease. Pre-operative coronary angiogram showed normal, unobstructed coronary arteries.

The case was reviewed by the multidisciplinary team (MDT). In view of the very severe mitral stenosis, associated aortic valve disease, significant tricuspid regurgitation, severe pulmonary hypertension, and ventricular dysfunction, surgical intervention was recommended. The patient subsequently underwent mitral valve replacement with a mechanical prosthesis, tricuspid valve replacement with a bioprosthesis, and insertion of an epicardial pacing lead. Surgical MDT discussion decided that there was no need to perform any intervention to the aortic valve. The patient remained under follow-up in the tertiary centre. Discharge medication included warfarin, carbocysteine, paracetamol, salbutamol inhaler, and bisoprolol. Detailed operative and postoperative information was not available at the time of manuscript preparation.

Discussion

This case describes an unusual presentation of advanced RHD in a British-born adult without a recognized history of ARF. Although RHD has declined substantially in high-income countries, it remains an important cause of cardiovascular morbidity and mortality worldwide, particularly in low- and middle-income countries [1–5]. In high-income countries, including the United Kingdom, the burden of RHD has declined substantially, although the disease has not been eliminated [2,3,6].

RHD is the chronic cardiac consequence of ARF and results from progressive inflammatory and fibrotic damage to the cardiac valves [7]. Importantly, the absence of a recognized episode of ARF does not exclude subsequent RHD, as previous episodes may have been unrecognized, minimally symptomatic, or never formally diagnosed. This is particularly relevant when patients first present in adulthood with established valvular disease.

The age and severity of presentation in this case are noteworthy. RHD may cause significant valvular disease during childhood and early adulthood, particularly in endemic populations [8]. In the Heart of Soweto study, newly diagnosed RHD was most frequently identified in adults aged 20–50 years, with approximately two-thirds of affected individuals being female [8]. Disease progression and age at presentation vary between populations, with patients in endemic regions sometimes presenting with advanced disease at a younger age, while disease in resource-rich settings may present later [9]. The presence of very severe multivalvular disease at 40 years of age in a British-born female is therefore unusual.

The predominant lesion was very severe mitral stenosis. Isolated mitral stenosis is the most common single-valve rheumatic lesion after the age of 30 years [10]. Rheumatic aortic valve disease generally occurs with mitral involvement and may develop over several decades. Rheumatic aortic stenosis in younger patients is uncommon but has been described in association with combined mitral and aortic valve disease [10,11]. In this patient, the aortic valve was trileaflet but thickened, calcified, and restricted, with mild aortic regurgitation. Although these findings occurred alongside unequivocal rheumatic mitral disease, the available imaging did not allow the aortic stenosis to be definitively attributed to a rheumatic mechanism.

The patient also had significant tricuspid abnormalities, including leaflet thickening and restricted mobility, with moderate-to-severe tricuspid regurgitation and a possible stenotic component. Rheumatic tricuspid valve disease is uncommon and usually occurs with concomitant mitral disease [12]. Organic rheumatic tricuspid regurgitation results from intrinsic leaflet abnormalities, whereas functional tricuspid regurgitation may occur secondary to right ventricular and annular dilatation associated with pulmonary hypertension from left-sided valve disease [13]. In this case, the abnormal leaflet morphology raised the possibility of intrinsic rheumatic involvement, although a contribution from secondary functional

regurgitation could not be excluded.

Echocardiography is central to the diagnosis and assessment of RHD, allowing evaluation of valve morphology, stenosis, regurgitation, subvalvular abnormalities, chamber remodelling, pulmonary pressures, and ventricular function [14]. The mitral valve findings in this patient were strongly supportive of chronic rheumatic involvement, including marked leaflet-tip thickening, restricted mobility, diastolic doming, and the characteristic “hockey-stick” appearance of the anterior mitral leaflet. These abnormalities were associated with a mitral valve area of 0.33 cm² and a mean transmitral gradient of 16.6 mmHg, confirming very severe mitral stenosis.

The 2023 World Heart Federation (WHF) guidelines provide the current echocardiographic framework for the diagnosis of RHD and represent an important update from the previous 2012 criteria [15]. The updated guideline incorporates revised screening and confirmatory criteria and introduces a stage-based classification of RHD to support diagnosis and assessment of disease progression [15]. In the present case, the combination of characteristic mitral morphology, severe stenosis, and associated structural and haemodynamic abnormalities provides strong evidence for established RHD.

The historical report of intermittent involuntary movements, arthralgia, and an annular abdominal eruption was clinically interesting but insufficient to establish previous ARF. Sydenham chorea and erythema marginatum are recognized manifestations of ARF; however, the involuntary movements were not observed during admission, and no definitive neurological diagnosis was established. Similarly, the rash was considered clinically compatible with erythema marginatum but was not formally confirmed. These features should therefore be regarded as historical findings potentially compatible with previous rheumatic disease rather than diagnostic evidence of ARF.

The haemodynamic consequences of the mitral disease were substantial. Estimated pulmonary artery systolic pressure of approximately 105–110 mmHg, marked biatrial enlargement, and impaired right ventricular longitudinal systolic function indicated advanced pressure and volume loading. These findings were consistent with the severity and chronicity of the valvular disease and contributed to the decision for definitive surgical treatment [7,14].

The difference between the initial transthoracic echocardiographic ejection fraction of 30–40% and the subsequent cardiac magnetic resonance measurement of approximately 50% illustrates the value of multimodality imaging in complex valvular disease. Differences in imaging technique and loading conditions may account for variation in ventricular function estimates. Cardiac magnetic resonance provided an additional quantitative assessment and contributed to the preoperative evaluation.

The combination of very severe mitral stenosis, severe pulmonary hypertension, significant tricuspid regurgitation, concomitant aortic valve disease, and ventricular dysfunction prompted multidisciplinary assessment at a tertiary cardiothoracic centre. The patient subsequently underwent mitral valve replacement, aortic valve replacement, and tricuspid valve repair. This case highlights the importance of early recognition of advanced RHD and specialist multidisciplinary assessment when severe valve disease is accompanied by pulmonary hypertension and right ventricular involvement [7].

This case has several limitations. There was no documented history of childhood ARF, and the historical neurological and dermatological features were not independently confirmed. Pulmonary artery pressure was estimated echocardiographically rather than measured invasively. The precise mechanism of the tricuspid regurgitation could not be established, and the aortic stenosis could not be definitively classified as rheumatic on the available imaging. Detailed operative and postoperative findings were also unavailable.

Overall, this case demonstrates that advanced RHD can present in adulthood despite the absence of a recognized history of ARF. In adults with unexplained severe mitral stenosis, particularly when characteristic rheumatic valve morphology is accompanied by multivalvular abnormalities, marked atrial enlargement, pulmonary hypertension, and ventricular dysfunction, RHD should remain an important diagnostic consideration. Contemporary echocardiography, informed by the 2023 WHF guidelines and complemented by multimodality imaging and multidisciplinary assessment, is central to establishing the diagnosis, defining disease severity, and guiding definitive management [14,15].

Conclusions

This case illustrates that advanced RHD may present in adulthood despite the absence of a documented history of ARF. The combination of characteristic rheumatic mitral valve morphology, very severe mitral stenosis, additional valve abnormalities, and severe pulmonary hypertension supported a diagnosis of advanced RHD, while the historical involuntary movements and annular rash were suggestive but not diagnostic of previous ARF.

In adults presenting with unexplained severe mitral stenosis, pulmonary hypertension, and multivalvular disease, RHD should remain within the differential diagnosis even when there is no known history of

childhood rheumatic fever. Careful echocardiographic assessment of valve morphology, complemented by detailed clinical history, multimodality imaging, and multidisciplinary evaluation, is essential for timely diagnosis and appropriate referral for definitive intervention.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Adel Kenawi, Nouralhuda Hamad, Hatem Ali Abdelnasser, Marwa Ruziek, Ahmed Jaber

Acquisition, analysis, or interpretation of data: Adel Kenawi, Nouralhuda Hamad, Hatem Ali Abdelnasser, Marwa Ruziek, Ahmed Jaber

Drafting of the manuscript: Adel Kenawi, Nouralhuda Hamad, Hatem Ali Abdelnasser, Marwa Ruziek, Ahmed Jaber

Critical review of the manuscript for important intellectual content: Adel Kenawi

Supervision: Adel Kenawi

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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We confirm that the patient's consent was obtained before publishing this case. All data and study materials are available upon reasonable request. All data are stored as de-identified data without showing any patient's identity information. We confirm that two of the authors are senior clinicians and currently working at consultant level.

References

1. World Health Organization: Rheumatic Fever and Rheumatic Heart Disease: Report of a WHO Expert Consultation, Geneva, 29 October - 1 November, 2001. World Health Organization, Geneva, Switzerland; 2004.
2. Watkins DA, Johnson CO, Colquhoun SM, et al.: Global, regional, and national burden of rheumatic heart disease, 1990-2015. *N Engl J Med*. 2017, 377:713-22. [10.1056/NEJMoa1603693](https://doi.org/10.1056/NEJMoa1603693)
3. Seckeler MD, Hoke TR: The worldwide epidemiology of acute rheumatic fever and rheumatic heart disease. *Clin Epidemiol*. 2011, 3:67-84. [10.2147/CLEP.S12977](https://doi.org/10.2147/CLEP.S12977)
4. Ou Z, Yu D, Liang Y, et al.: Global burden of rheumatic heart disease: trends from 1990 to 2019. *Arthritis Res Ther*. 2022, 24:138. [10.1186/s13075-022-02829-3](https://doi.org/10.1186/s13075-022-02829-3)
5. Roth GA, Mensah GA, Johnson CO, et al.: Global burden of cardiovascular diseases and risk factors, 1990-2019: update from the GBD 2019 study. *J Am Coll Cardiol*. 2020, 76:2982-3021. [10.1016/j.jacc.2020.11.010](https://doi.org/10.1016/j.jacc.2020.11.010)
6. Hibino M, Halkos ME, Murphy DA, et al.: Age period cohort analysis of rheumatic heart disease in high-income countries. *Clin Res Cardiol*. 2023, 112:1568-76. [10.1007/s00392-023-02168-6](https://doi.org/10.1007/s00392-023-02168-6)
7. Kumar RK, Antunes MJ, Beaton A, et al.: Contemporary diagnosis and management of rheumatic heart disease: implications for closing the gap: a scientific statement from the American Heart Association. *Circulation*. 2020, 142:e337-57. [10.1161/CIR.0000000000000921](https://doi.org/10.1161/CIR.0000000000000921)
8. Sliwa K, Carrington M, Mayosi BM, Zigiriadis E, Mvungi R, Stewart S: Incidence and characteristics of newly diagnosed rheumatic heart disease in urban African adults: insights from the Heart of Soweto study. *Eur Heart J*. 2010, 31:719-27. [10.1093/eurheartj/ehp550](https://doi.org/10.1093/eurheartj/ehp550)
9. Zühlke LJ, Beaton A, Engel ME, et al.: Group A Streptococcus, acute rheumatic fever and rheumatic heart disease: epidemiology and clinical considerations. *Curr Treat Options Cardiovasc Med*. 2017, 19:15. [10.1007/s11936-017-0513-y](https://doi.org/10.1007/s11936-017-0513-y)
10. Feinstein AR, Wood HF, Spagnuolo M, Taranta A, Jonas S, Kleinberg E, Tursky E: Rheumatic fever in children and adolescents. A long-term epidemiologic study of subsequent prophylaxis, streptococcal infections, and clinical sequelae. VII. Cardiac changes and sequelae. *Ann Intern Med*. 1964, 60:87-123.
11. Vijayaraghavan G, Cherian G, Krishnaswami S, SU IP, John S: Rheumatic aortic stenosis in young patients presenting with combined aortic and mitral stenosis. *Br Heart J*. 1977, 39:294-8. [10.1136/hrt.39.3.294](https://doi.org/10.1136/hrt.39.3.294)

12. Sultan FA, Moustafa SE, Tajik J, Warsame T, Emani U, Alharthi M, Mookadam F: Rheumatic tricuspid valve disease: an evidence-based systematic overview. *J Heart Valve Dis.* 2010, 19:374-82.
13. Vahanian A, Beyersdorf F, Praz F, et al.: 2021 ESC/EACTS guidelines for the management of valvular heart disease: developed by the Task Force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J.* 2022, 43:561-632. [10.1093/eurheartj/ehab395](https://doi.org/10.1093/eurheartj/ehab395)
14. Pandian NG, Kim JK, Arias-Godinez JA, et al.: Recommendations for the use of echocardiography in the evaluation of rheumatic heart disease: a report from the American Society of Echocardiography. *J Am Soc Echocardiogr.* 2023, 36:3-28. [10.1016/j.echo.2022.10.009](https://doi.org/10.1016/j.echo.2022.10.009)
15. Rwebembera J, Marangou J, Mwita JC, et al.: 2023 World Heart Federation guidelines for the echocardiographic diagnosis of rheumatic heart disease. *Nat Rev Cardiol.* 2024, 21:250-63. [10.1038/s41569-023-00940-9](https://doi.org/10.1038/s41569-023-00940-9)