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Case Report

Impact of Benzathine Penicillin Prophylaxis and Its Risk of Sudden Cardiac Arrest in Patients with Rheumatic Heart Disease: Analysis of A Case Report

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Abstract

Rheumatic Heart Disease (RHD) remains a leading cause of cardiovascular morbidity and mortality in low-income settings, highest burden being in sub-Saharan Africa. Benzathine Penicillin G (BPG) is central to secondary prophylaxis, effectively preventing recurrent acute rheumatic fever and progressive valvular damage. Severe adverse outcomes such as sudden cardiac arrest (SCA) following administration have been reported, which is of concerns. This study is to evaluate the potential association between BPG prophylaxis and sudden cardiac arrest in patients with RHD, and to highlight clinical implications for monitoring, risk stratification, and management. Patient with established RHD, developed sudden cardiac arrest shortly after routine intramuscular BPG administration, despite having no preceding allergic symptoms or conventional cardiovascular risk factors. ECG revealed T-wave abnormalities, while echocardiography showed normal biventricular function with only trace mitral regurgitation. Troponin levels were within normal limits, and no structural abnormalities or ischemic changes were identified. The absence of severe valvular disease or anaphylaxis suggests a transient arrhythmic event, potentially triggered by BPG injection. While BPG remains indispensable in preventing acute rheumatic fever recurrence and reducing long-term sudden cardiac arrest risk, its potential to trigger sudden electrical instability, even in structurally normal hearts, needs clinical vigilance.

Keywords: *Rheumatic heart disease, benzathine penicillin, sudden cardiac arrest, secondary prophylaxis, arrhythmia.*

Introduction

Rheumatic Heart Disease (RHD) remains a major global public health concern, affecting an estimated 40 million people and contributing to over 300,000 deaths annually1. The burden is higher in low- and middle-income countries (LMICs), with sub-Saharan Africa accounting for nearly half of all global cases. In endemic regions, prevalence among school-aged children ranges between 1–3%2.

In Kenya, hospital-based studies estimate that 25–30% of patients admitted with heart failure have underlying RHD3. The rural counties, where access to echocardiographic diagnosis and long-term prophylaxis programs are limited are of great concern.4

Acute Rheumatic Fever (ARF), triggers an autoimmune inflammatory condition by Group A Streptococcus infection that primarily damages the heart valves5. Preventing recurrent ARF is therefore essential to prevent disease progression. The World Health Organization (WHO) recommends long-term secondary prophylaxis with intramuscular Benzathine Penicillin G (BPG) as the gold standard in patients with prior ARF or established RHD6. BPG prophylaxis has been shown to dramatically reduce streptococcal reinfection rates.

SCA in patients with RHD is often due to malignant ventricular arrhythmias, severe heart failure, or mechanical obstruction from advanced valvular lesions7. A link exists between consistent BPG prophylaxis and a reduced risk of SCA, as preventing recurrent ARF reducing valvular damage and arrhythmogenic sensitivity. There are only few clinical studies have directly assessed this association8 Emerging evidence and expert advisories indicate that, in patients with severe valvular heart disease or advanced cardiac dysfunction, cardiac compromise rather than classic anaphylaxis may underlie sudden adverse events temporally associated with benzathine penicillin administration. Mechanisms of SCA could be anaphylaxis, vasovagal syncope, embolic phenomena, or a possible direct myocardial excitability triggered 9.

Secondary prophylaxis with regular intramuscular benzathine penicillin G (BPG) is considered the cornerstone of RHD management to prevent recurrent rheumatic fever and to slow disease progression by maintain adequate levels10.

Fear of adverse outcomes has contributed to reduced adherence to BPG prophylaxis among patients and reluctance among healthcare providers, undermining the effectiveness of RHD control programs. By identifying the relationship between prophylaxis, disease severity, and cardiac outcomes, the study will help clarify safety concerns, support evidence-based decision-making, and contribute to improved patient confidence and adherence.

MATERIAL&METHODS

28-year-old female patient, is a known case of rheumatic heart disease (RHD), diagnosed at the age of 15 following an episode of acute rheumatic fever. She has been maintained on regular secondary prophylaxis with monthly intramuscular benzathine penicillin G injections and has remained adherent to follow-up and treatment. She has no prior history of arrhythmias, ischemic heart disease, or documented heart failure. After shortly after receiving her most recent scheduled dose of intramuscular benzathine penicillin G at a local clinic, she developed an abrupt onset of severe central tight chest pain radiating to the left arm, rapidly followed by loss of consciousness. The patient became unresponsive and was noted to have no palpable pulse. Cardiopulmonary resuscitation (CPR) was initiated promptly on site, and return of spontaneous circulation was achieved. She was stabilized and subsequently transferred to the Karen branch for further evaluation and management. She also had no known cardiovascular risk factors, including hypertension, diabetes mellitus, smoking, or a family history of premature cardiovascular disease.

General examination did not reveal any fever, weight loss, or night sweats, cough, dyspnea. Examination of CNS, Reparatory ,Gastrointestinal systems were normal.Teetotler by habit.

Past Medical History revealed RHD diagnosed at the age of 15years and on regular secondary prophylaxis with Benzathine penicillin G 1.2 million units intramuscularly every four weeks. She has no known drug allergies. There was no family history of cardiac ailments. Patient demonstrates good adherence to medical follow-up and prescribed prophylaxis.

The patient was in a fair general condition and was conscious and oriented. She appeared mildly short of breath at rest. There was no pallor, jaundice, cyanosis, or peripheral edema noted. The extremities were warm , and capillary refill time was less than 2 seconds, indicating adequate peripheral perfusion. Vital signs revealed a blood pressure of 101/76 mm of Hg.

Peripheral pulses were palpable, with the radial pulse noted to be regular at a rate of 66 beats per minute and of good volume. The jugular venous pressure was not elevated. On auscultation, the first and second heart sounds were heard clearly, and no murmurs were appreciated at the time of examination. On auscultation, breath sounds were normal with no added sounds, consistent with normal vesicular

breathing. The Abdominal and Central Nervous system examination were normal after successful resuscitation.

Routine hematological and biochemical parameters were within normal limits. There was no evidence of electrolyte imbalance or metabolic derangement that could account for the syncopal event. Cardiac biomarkers were not suggestive of acute myocardial ischemia. A 12-lead electrocardiogram (ECG) performed after stabilization demonstrated a sinus rhythm with no acute ischemic changes or documented arrhythmias at the time of recording. Continuous cardiac monitoring was initiated due to the history of cardiac arrest.

Transthoracic echocardiography confirmed underlying rheumatic heart disease, with structural valvular abnormalities consistent with the known diagnosis. There was no evidence of acute mechanical complications. Left ventricular systolic function was preserved. No intra-cardiac thrombus was identified.

INVESTIGATIONS.

Table 1: Laboratory Investigations (15/02/2025)

Test Category	Parameter	Value	Reference Range	Interpretation
Full Hemogram	WBC	7.13 $\times 10^9$/L	4.5–11 $\times 10^9$/L	Normal
	Hemoglobin	13.2 g/dL	11.6–15 g/dL	Normal
	Platelets	250 $\times 10^9$/L	150–450 $\times 10^9$/L	Normal
Urea, Electrolytes & Creatinine (U/E/Cs)	Urea	4.8 mmol/L	2.6–7.0 mmol/L	Normal
	Creatinine	73 µmol/L	50–120 µmol/L	Normal
	Potassium	3.5 mmol/L	3.3–5.3 mmol/L	Normal
	Sodium	139 mmol/L	135–150 mmol/L	Normal
	Chloride	98 mmol/L	96–106 mmol/L	Normal
Thyroid Function Tests (TFTs)	TSH	0.9 mIU/L	0.4–4.0 mIU/L	Normal

Test Category	Parameter	Value	Reference Range	Interpretation
	T3	2.5 pmol/L	2.3–4.2 pmol/L	Normal
	T4	1.1 pmol/L	0.8–1.8 pmol/L	Normal
Cardiac Biomarker	Troponin	9 ng/L	<40 ng/L	Normal
Random Blood Sugar	RBS	5.0 mmol/L	3–7 mmol/L	Normal

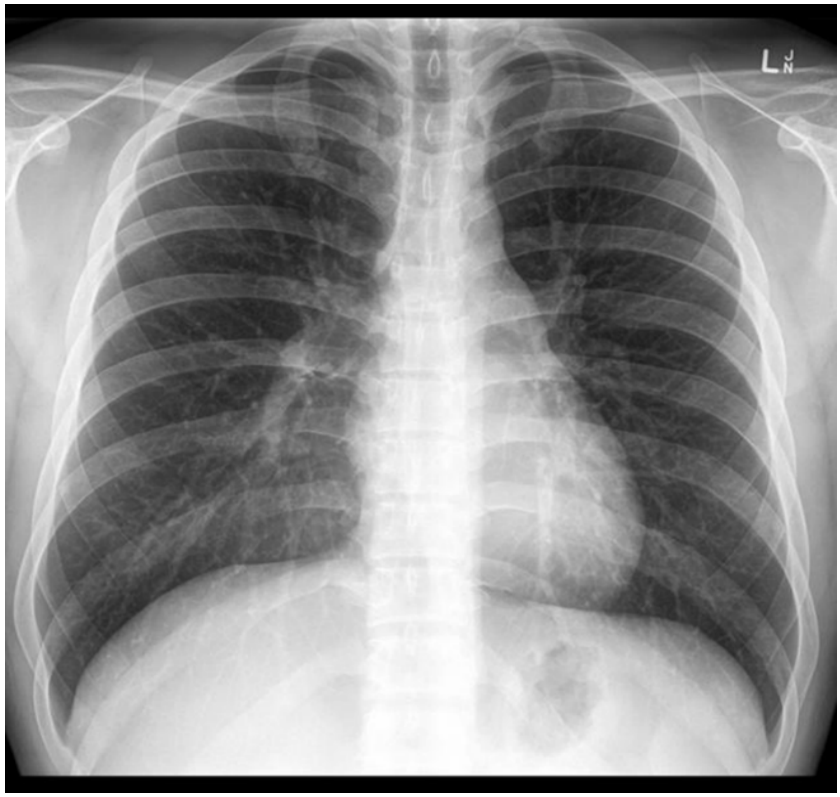
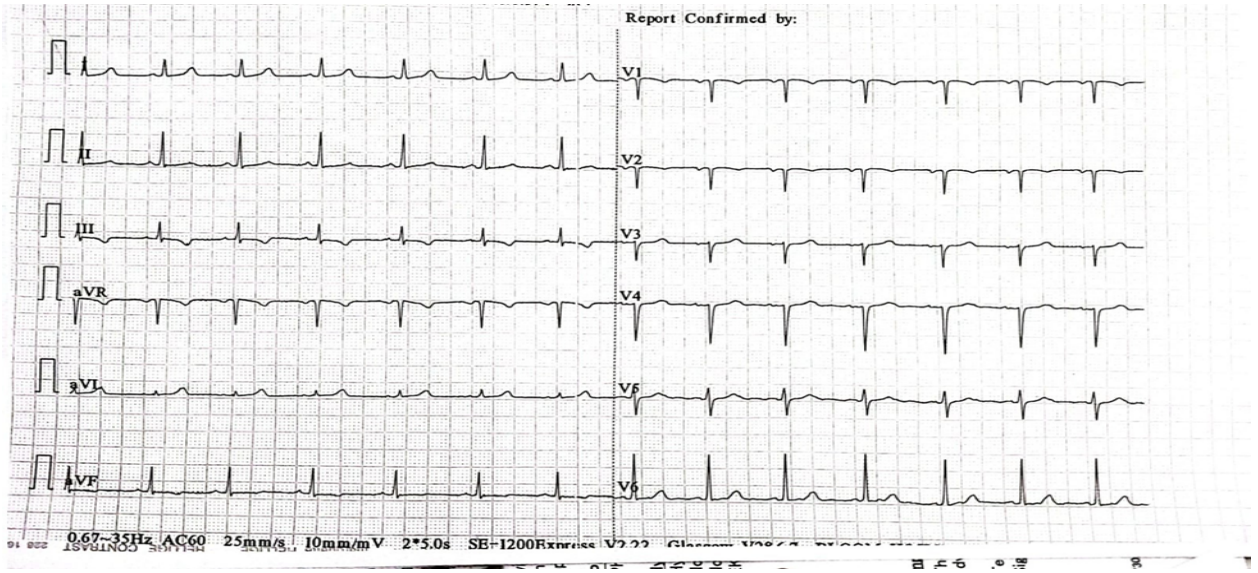


Table 2:Chest X-ray (PA View)

The chest X-ray demonstrates mild cardiomegaly with prominence of the left heart border, consistent with left atrial and/or left ventricular enlargement typical of rheumatic heart disease. Pulmonary vascular markings are within normal limits, and the bony thorax is intact without abnormalities. The diaphragm and costophrenic angles appear normal.

Table 3: Electrocardiography (ECG)Showing Sinus rhythm

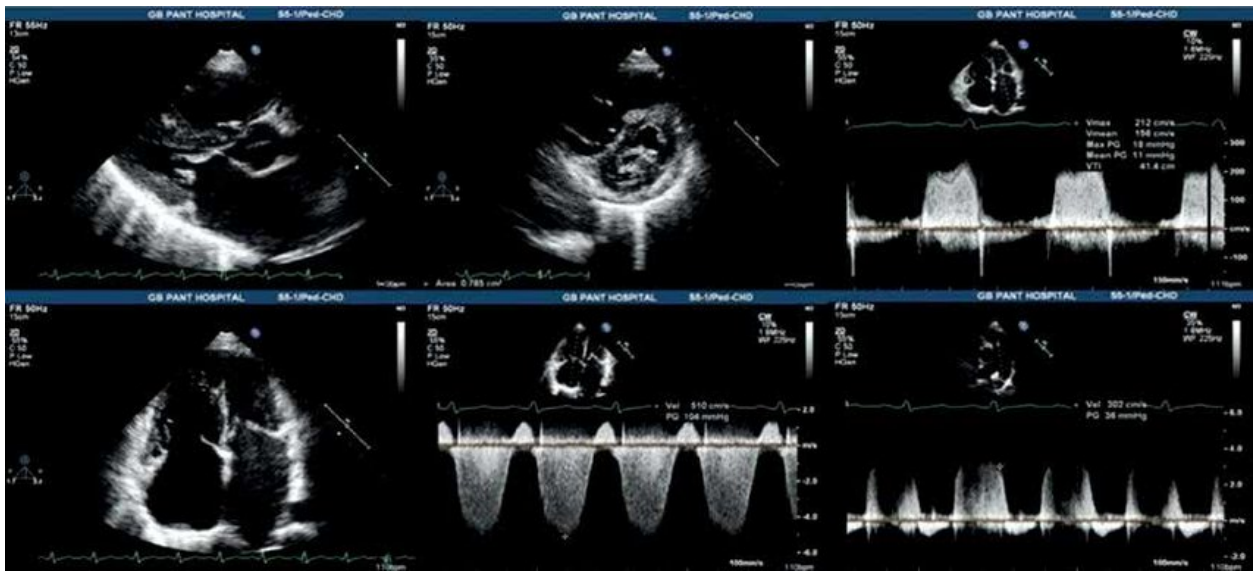


The 12-lead ECG demonstrates a normal sinus rhythm with a heart rate of approximately 60–70 beats per minute. The P waves, QRS complexes, and T waves are regular and appropriately timed without evidence of arrhythmia. There are no significant ST-segment or T-wave abnormalities suggestive of acute ischemia or infarction. The QRS duration and axis are within normal limits.

No pathological Q waves, conduction blocks, or ventricular hypertrophy criteria are observed. Overall, the ECG is unremarkable and shows no acute electrical abnormalities to explain the sudden cardiac arrest event.

Given the clinical scenario of sudden cardiac arrest in a patient with rheumatic heart disease and recent intramuscular benzathine penicillin G administration, the absence of acute ischemic changes or arrhythmias on this ECG suggests that the arrest was unlikely due to acute myocardial infarction or ongoing arrhythmia at the time of recording. The ECG may reflect a return to baseline rhythm following successful resuscitation. Holter monitoring did not reveal any abnormality.

Table 4:Echocardiography



Echocardiographic findings were consistent with Chronic Rheumatic Valvular Heart Disease, with preserved biventricular systolic function and no acute structural abnormalities. There was no echocardiographic evidence of intracardiac thrombus or mechanical cause to explain the sudden cardiac arrest at the time of evaluation. Valvular morphology demonstrates features consistent with chronic rheumatic valvular disease, including leaflet thickening and restricted mobility. No significant valvular stenosis or regurgitation was identified on this study.

Medical Management

1. Atenolol 25 mg orally once daily(initiated to reduce sympathetic stimulation, control heart rate, and potentially prevent arrhythmias, given the patient's risk of sudden cardiac arrest in the context of rheumatic heart disease)

2. Erythromycin 500 mg orally twice daily (prescribed as an alternative secondary prophylactic antibiotic regimen in place of intramuscular Benzathine Penicillin G (BPG), to mitigate the suspected adverse reaction while maintaining protection against recurrent streptococcal infection.

Reinstitution of intramuscular BPG may be reconsidered if erythromycin is poorly tolerated or if streptococcal prophylaxis proves inadequate, potentially with premedication or alternative administration protocols to reduce adverse reactions.

The patient was advised to avoid strenuous physical activity or high-intensity exercise to minimize the risk of arrhythmia or sudden cardiac events, particularly while on a modified prophylactic regimen. Emotional support and counseling were offered to help the patient and family cope with the psychological impact of sudden cardiac arrest and ongoing disease management. Continuous reinforcement of adherence to prophylactic therapy, lifestyle modifications were ascertained.

DISCUSSION

Rheumatic heart disease (RHD) remains a significant cause of morbidity and mortality in young adults, primarily through chronic valvular damage, heart failure, and arrhythmias. Secondary prophylaxis with intramuscular benzathine penicillin G (BPG) is the cornerstone of RHD management, effectively preventing recurrent episodes of acute rheumatic fever and progressive valvular injury11. Despite its well-documented benefits, rare adverse events, including anaphylaxis and cardiovascular complications, have been reported, which may precipitate sudden cardiac arrest (SCA) in susceptible individuals12.

Our patient, with cardiac and laboratory evaluations, including ECG, echocardiography, and biomarkers, were largely unremarkable, suggest that the arrest was not caused by acute myocardial infarction or electrolyte disturbances. Anaphylactic reactions to BPG are rare, estimated at 0.001–0.004%13, and can trigger sudden hypotension, arrhythmias, or cardiac arrest, particularly in patients with pre-existing structural heart disease.

RHD itself is an independent risk factor for arrhythmias and SCA. Left atrial enlargement, valvular dysfunction, and ventricular remodeling create a substrate for atrial fibrillation and ventricular arrhythmias, which may remain silent until a precipitating event occurs11,14. In our patient, structural heart disease likely increased susceptibility to an arrhythmogenic trigger, potentially compounded by the acute hemodynamic or immunologic effects of intramuscular BPG. Although cause cannot be definitively established, the association raises clinical awareness of rare but serious complications of

routine prophylaxis.

Management of such cases requires a multidisciplinary approach, balancing the risk of recurrent rheumatic fever against potential adverse drug events. Alternatives to intramuscular BPG, such as oral erythromycin, can provide temporary prophylaxis, though adherence is critical due to lower efficacy15. Continuous cardiac monitoring and patient education regarding early recognition of adverse drug reactions are essential. Long-term strategies may include rhythm surveillance, medical optimization, and consideration of device therapy if recurrent arrhythmias occur.

BPG remains safe and effective for the vast majority of patients, clinicians should be aware of rare adverse reactions that may precipitate SCA, and plan prophylaxis and follow-up accordingly.

Benzathine penicillin G (BPG), while highly effective for secondary prophylaxis, can rarely trigger severe hypersensitivity reactions or hemodynamic changes that may precipitate cardiac arrest, highlighting the importance of monitoring during administration13,15.

Comprehensive evaluation following SCA in RHD patients should include ECG, echocardiography, cardiac biomarkers, and laboratory assessments to exclude ischemic, electrolyte, or metabolic triggers. Patient and family education is critical, focusing on recognition of drug allergy signs, avoidance of strenuous activity during recovery, and timely medical intervention in the event of recurrence

CONCLUSION:

This case highlights a rare but serious potential complication of routine BPG prophylaxis in RHD patients, demonstrating the need for vigilant monitoring, individualized prophylactic planning, and patient-centered education. Awareness of this risk enables clinicians to optimize secondary prevention while ensuring patient safety, particularly in those with structural heart disease predisposed to arrhythmias and sudden cardiac events.

The study highlights the need for focused research to clarify the impact of BPG prophylaxis on the risk of sudden cardiac arrest in RHD populations, especially those with severe valvular pathology, to inform safer guidelines and optimize prophylactic strategies.

BPG prophylaxis should be administered with short post-injection monitoring, readiness for emergency response, basic risk assessment, and patient education. Alternative prophylaxis may be considered in suspected adverse cases, while integrating safety protocols and supporting further research remain essential.

Recommendations:

Pre-administration Risk Assessment:

Evaluate RHD patients for baseline arrhythmias, conduction abnormalities, or severe valvular disease before BPG administration.

Consider alternative prophylactic strategies (e.g., oral erythromycin) in patients with prior adverse reactions or high-risk profiles.

Monitoring During Administration:

Administer BPG in settings equipped for emergency resuscitation. Monitor patients for early signs of hypersensitivity, hypotension, or arrhythmia, especially during or immediately after injection.

Patient and Family Education:

Inform patients and caregivers about recognition of drug allergies, warning signs of arrhythmia or syncope, and the importance of urgent medical attention if these occur.

Provide guidance on avoiding strenuous activity in the immediate post-injection period until safety is established.

Multidisciplinary Approach:

Collaborate among cardiologists, primary care providers, and infectious disease specialists to balance the benefits of secondary prophylaxis against potential adverse events.

Reassess prophylaxis regimen periodically and adjust based on clinical response, adherence, and tolerance.

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