




Challenges Faced and Lessons Learned: The Journey of a 22-Year-Old Male with a Mechanical Heart Valve Complicated by Ischemic Stroke in a Developing Country: A Sub-Saharan Africa Prospect

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Abstract: This report reviews an Ethiopian patient who underwent cardiac surgery and had a mechanical heart valve implanted on the mitral valve with tricuspid valve repair for rheumatic heart disease via a local non-profit organization donation later complicated by cardio-embolic stroke, and aims to describe the challenges faced by patients from rural Ethiopia who require cardiac surgery for rheumatic heart disease and narrate the importance of careful follow-up. The lessons to be drawn from this case are that careful follow-up and adherence to prescribed Vitamin K antagonists after surgery for mechanical heart valves are critical and, when such patients are lost to follow-up as was witnessed in this case, it can induce lifelong morbidity. Morbidity that could have been avoided with strict and meticulous follow-up and with standardized patient tracing or contact systems. When patients are lost to follow-up it needs to be top priority to trace them after cardiac surgery and this report highlights the pivotal role of the health education in such populations. Unless we utilize this opportunity to unlock the door and embrace a systemic approach to reforming our risk assessment, referral chain system, and integration of various healthcare professionals in patient follow-up, as well as enhancing health education among our patients in rural Ethiopia and other low-income countries, the consequences could prove to be significant. Preventing such fatal complications is far superior to managing them afterwards, as it not only saves on expenses but also saves lives and enhances quality-of-life.

Keywords: anticoagulation, mechanical valve, cardioembolic stroke, sub-Sahara

Introduction

Rheumatic heart disease, a type of valvular heart disease, is a significant, preventable cause of morbidity and mortality in all WHO regions, affecting at least 33 million people and killing over 300,000 people each year, particularly among vulnerable and marginalized groups such as children, adolescents, pregnant women, and the poor and indigenous populations. Rheumatic heart disease is very common in East Africa, affecting roughly one out of every seven people. It is a leading cause of cardiovascular disease in Ethiopia, particularly among young people.¹⁻⁴

The majority of the sub-Saharan population with rheumatic heart disease are diagnosed late at advanced stage. The majority of those who could be stratified presented in stages C and D of disease progression according to the 2014/2017 AHA/ACC guidelines; however, they also presented with concomitant clinical and echocardiographic features that placed them at high risk of peri-operative morbidity.^{5,6}

Surgery for rheumatic heart disease is one of the most pressing unmet needs in sub-Saharan Africa. Despite the high prevalence of rheumatic heart disease in the region, only a small number of surgeries are performed; 22 cardiac centers serve a population of nearly 1 billion, with an estimated demand of 300 operations per million annually.^{7,8}

Cardiac surgery for rheumatic heart disease is at its infancy stage from the accessibility point of view in Sub-Saharan Africa. In Ethiopia there are only five cardiac surgeons for 120 million and counting people. More than 15,000 patients are on the waiting list for surgery, mainly because of a lack of consumables and limited numbers of centers and workforce. In Ethiopia, there is no public center that performs cardiac surgery without interruption. The workforce is very low.⁹ There is an excellent immediate patient outcome (patient outcome following open heart valve surgery within 30 days of the index surgery) following open heart surgery done by the local cardiac surgical team for rheumatic valvular disease in a resource limited setting.¹⁰ Yet there is no literature showing the long-term outcome following open heart surgery, which is an open area for exploration.

In sub-Saharan Africa, left-sided valve surgery for rheumatic heart disease is associated with acceptable perioperative outcomes, but a high incidence of major adverse valve-related events at follow-up, as well as a lack of effective postoperative follow-up, remain major limiting factors. Patients who were lost to follow-up had severe disease, were in congestive heart failure or worse functional class at enrollment, or were less educated.^{7,11}

Anticoagulation therapy has an extremely important role in the management of patients who underwent valve replacement. Ultimately, the use of long-term or life-long anticoagulation after a mechanical valve replacement is recommended unless contraindicated. The reported cases in the literature include only a small number of event-free patients without anticoagulation up to 37 years. These eventless situations have been attributed to advantageous genetic variations and fortune of others.^{12,13} Anticoagulation mismanagement is reported to cause major valve-related events, such as thromboembolism, anticoagulation-related hemorrhage, and valve thrombosis, which account for $\geq 75\%$ of all valve-related events. Anticoagulation management issues following mechanical cardiac valve replacement revolve around target levels for chronic oral anticoagulation. While these levels are important, they are only one aspect of the follow-up process that should be individualized for each patient with a mechanical cardiac valve and coupled, risk factor modification, long-term follow-up, and patient education.¹²⁻¹⁴

For patients with rheumatic heart disease, those who have completed primary school is associated with a significant decrease in mortality. In resource-poor nations such as ours, patient education serves as a barometer of socioeconomic status and patients with rheumatic heart disease in rural Ethiopia have a lower quality-of-life.^{15,16}

There are no reports from low-to-middle income countries about such patients that signifies the potential gap between the diagnostic challenge they face from the beginning then the referral chain system and pre- and post-cardiac surgery communication between the referring and accepting institution and additionally the risk assessment model for such patients. Our case is a waving signal that taught us patients from rural Ethiopia having a cardiac surgery need to have a rigorous health education before the surgery and the need to develop a risk assessment model with further research.

Case Presentation

The patient, a 22-year male from the rural part of Ethiopia in sub-Saharan Africa, arrived at hospital 3 years earlier, exhibiting significant symptoms and signs of valvular heart disease. The patient was referred for a potential surgical intervention after a comprehensive evaluation revealed that the patient had severe rheumatic valvular disease, which required a mechanical heart valve implantation. A non-profit group arranged and provided funding for the necessary heart surgery because of the patient's financial limitations.

Treatment and Surgical Intervention

The surgical procedure was performed by a skilled team of cardiac surgeons and support staff at a reputable center in a developing country as per the center's protocol and pre-operative risk assessment. The mechanical heart valve replacement was successful and was implanted at the mitral valve with tricuspid valve repair, ensuring the restoration of the patient's cardiac function. [The mechanical valve is typically the preferred choice over tissue valves for young individuals in developing countries, in accordance with guidelines and protocols. However, there are exceptions for young females who plan to become pregnant or for those unable to take chronic oral anticoagulants. In these regions, Redo surgery is frequently deemed nearly unfeasible when valve failure occurs, mostly due to financial and access limitations.] Strict adherence to postoperative care and anticoagulation therapy was emphasized to mitigate potential

complications and was advised and linked to the initial referring hospital to continue his follow-up with chronic anticoagulation with warfarin and regular International Normalizing Ratio (INR) follow-up.

Discontinuation and Disappearance

Unfortunately, 6 months after successful cardiac surgery, the patient discontinued follow-up appointments and vanished. The reasons for this sudden disappearance are unclear, but usually patients from the rural Ethiopia has a thought of being “cured” whenever there is symptomatic improvement from their previous functional class and efforts to contact and trace the patient’s whereabouts have been unsuccessful.

Later, the patient revealed that he was unable to come for follow-up due to financial reasons. As a result, the patient continued to purchase warfarin (7.5 mg PO per day) from a local pharmacy without undergoing INR follow-up or dose adjustments for 18 months. Anticoagulation therapy with warfarin was discontinued for 35 days. Tragically, the patient’s non-adherence to the prescribed medications and regular check-ups led to an overlooked complication of a cardioembolic ischemic stroke.

Complication with Ischemic Stroke

Ischemic stroke occurred following the patient’s failure to engage in regular follow-up. The patient was brought to hospital, 4 days after the occurrence of the ischemic stroke, exhibiting a facial deviation to the left side, speech difficulties, and an abrupt start of right-sided body weakness that was maximal at the time. He was kept at home for 4 days, assuming that he would improve, but there was no improvement. The patient was subsequently admitted to the emergency department. Upon Examination, his vital signs were found to be within the normal range. Cardiovascular examination revealed flat JVP and audible metallic mitral valve opening and closing clicks at the mitral area with no signs of cardiac congestion. On neurological examination, the patient had right-sided hemiparesis and Broca’s Aphasia with a National Institutes of Health Stroke Scale (NIHSS) score of 8. Blood work-up revealed a Prothrombin Time of 14 s, INR of 1.18, activated Partial Thromboplastin Time of 24.6 s and complete blood count, organ function tests, and serum electrolytes were within the normal range. Brain MRI revealed a left middle cerebral artery acute infarction (as shown in Figure 1) and the Transthoracic Echocardiographic study revealed a normal functioning mechanical prosthetic valve at mitral area with good leaflets movement with trans prosthetic mitral valve mean pressure gradient (mPG) of 3.7 mmHg with no regurgitation, thrombosis or vegetation (see Figure 2).

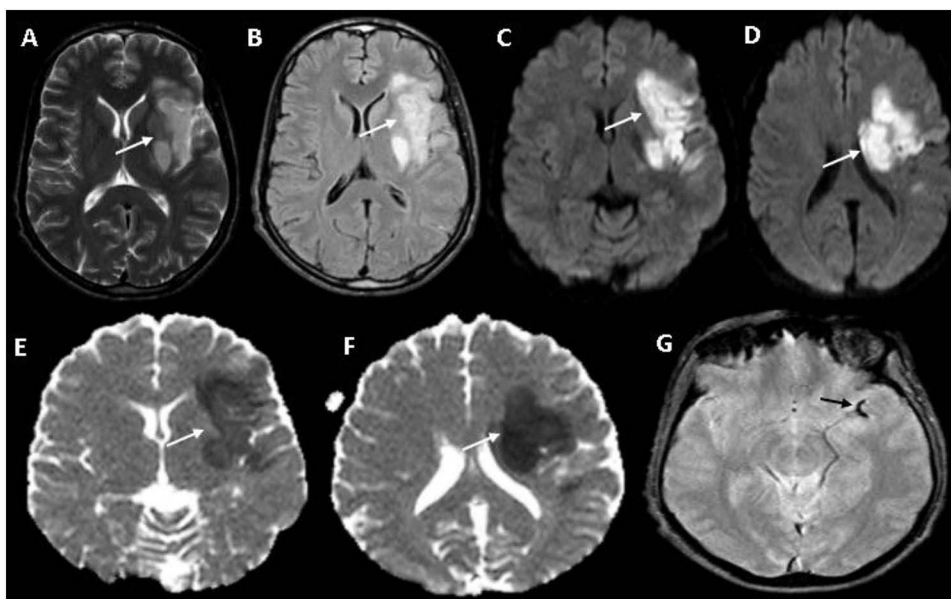


Figure 1 Brain MRI images: Axial T2WI (A), FLAIR (B), DWI (C and D), and Apparent Diffusion Coefficient (E and F) map of a patient’s brain reveal acute infarction in the left middle cerebral artery territory. The scans show significant hyperintensity in the left insular cortex, body of the caudate nucleus, posterior part of the lentiform nucleus, and lateral part of the inferior frontal lobe, with evident restricted diffusion (white arrow). The gradient echo image (G) displays a blooming artifact in the M2 segment of the left middle cerebral artery (black arrow), likely indicating a thrombosed vessel.

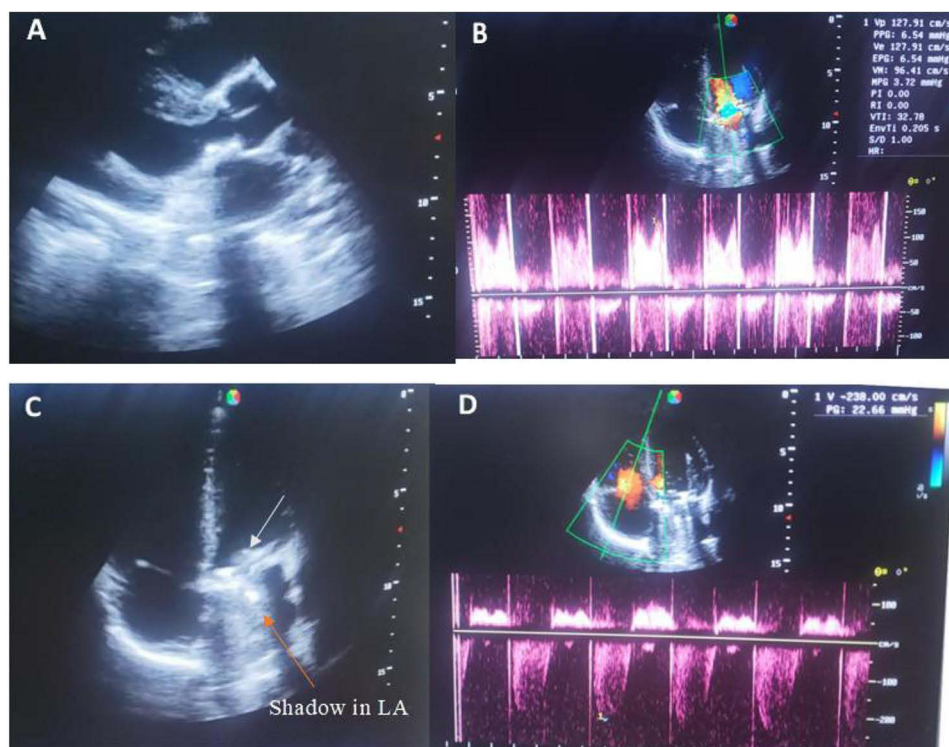


Figure 2 Transthoracic echocardiography showing a well seated mitral metallic valve (A) and normal trans mitral prosthetic valve mean pressure gradient of 3.7 mmHg (B), Apical 4-chamber view showing a metallic prosthetic valve at the mitral valve area (C) (white arrow) and mechanical valve shadow in the left atrium (LA) (orange arrow) with normal velocity and pressure gradient across the tricuspid valve (D).

Management and Outcome

Given the patient's mechanical heart valve and the recent discontinuation of warfarin therapy and cardioembolic stroke, a multidisciplinary team swiftly approached the patient. Supportive management, including rehabilitation therapy was initiated. The patient received comprehensive education regarding the importance of consistent anticoagulation therapy and access to affordable healthcare services.

During the hospital stay, the patient showed gradual improvement in neurological deficits. He was discharged with a prescription for warfarin and linked to the cardiology clinic for regular follow-up and INR monitoring. Efforts have been made to establish a reliable healthcare support system for patients, including financial aid programs, community health worker visits, and education programs for promoting medication adherence.

Discussion

Challenges Faced and Lessons Learned

It is very difficult to get in touch with and track down patients, especially those from rural Ethiopia, who need strict follow-up and optimal medical care because of the weak referral system chain. This includes whether the patient is sent from a higher health care facility to a lower one, or vice versa, as well as an inadequate documentation system. Donations from non-profit organizations that aim to improve people's lives can truly have a life-changing impact on improving quality-of-life, but in some cases, like this, end up as lifelong morbidity. This case may be just the tip of the iceberg and it emphasizes the importance for patients with mechanical heart valves to receive ongoing medical follow-up and adhere to their prescribed treatment plans.

It serves as a reminder of the difficulties faced by patients in developing nations with regard to healthcare accessibility as well as the financial constraints associated with such surgeries performed in third-world countries. It also emphasizes the importance of non-profit organizations in helping those in need of life-saving surgeries.

The lessons we need to learn in order not to narrow the possibility of similar complications is that a thorough pre-operative risk assessment of the patient's financial status, health education status, access to remote follow-up via phone,

and the distance from the nearest health care facility where the INR test is available are worthy to additionally consider a brief discussion between the referring institution and the surgical team to defer or to give access to the surgery according to the risk assessment of the patient and we need to apply specific risk mitigation systems like a patient specific health education before the surgery and patient-centered follow-up after such cardiac surgeries.

In general, we regret the patient ended up in such morbidity, but it is important to remember that he could have developed life-threatening conditions, such as fatal prosthetic valve thrombosis (Valve Stuck), which may have necessitated Redo surgery and could have resulted in mortality if left untreated. Yet it needs to push as a key factor to change the way we are currently practicing by having broadened research, adopting systems thinking, development of risk assessment models, and improving the health education status of our patients from rural Ethiopia, as well as decentralizing the cardiac centers. These are the next goals for healthcare workers, Ministry of Health Ethiopia, policy makers, and other stake holders.

Conclusion and Recommendations

The journey of our patient with a mechanical heart valve complicated by ischemic stroke, amplified by discontinuation and subsequent disappearance during follow-up, highlights the critical importance of continued care and patient engagement. This serves as a reminder of the obstacles faced by patients in developing countries, where the general public health education status is low, and particularly underscores the significance of non-profit organizations in ensuring access to essential medical interventions.

It is imperative to periodically enhance a patient's health education status during the perioperative period and follow-up to prevent catastrophic complications and maximize the value of donations. Stakeholders in the fight against rheumatic heart disease should also focus on developing a national registry and referral system specifically for these patients as their next task.

One of the applicable options that we recommend is to incorporate Health Extension Workers to actively engage in tracing and follow-up of such patients in rural Ethiopia. The possible advantages are continuous health education provision and informing the follow-up team on the status of the patient, and the Health Extension Program in our country showed promise for similar large, sustainable system redesigns, though this evidence needs to be contextualized and adapted in different settings to inform policy and practice.

Ethical Issue

Written informed consent was obtained from the patient for the publication of this case, and the consent form contained details and photos unique to this case. The publication of a single case report by this institution does not require ethical approval.

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Disclosure

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