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Physiotherapy-Led Cardiac Rehabilitation Following Mitral Valve Replacement: A Case Report from a Resource-Limited Setting

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ABSTRACT

To evaluate the effectiveness of a structured cardiac rehabilitation programme in a 61-year-old woman who underwent mechanical mitral valve replacement due to rheumatic heart disease, a comprehensive 40-day intervention spanning lung expansion techniques, airway clearance, progressive mobilization, resistance and aerobic training, patient education, nutritional advice, and psychosocial support was initiated from postoperative day one; consequently, the patient achieved clinically meaningful, complication-free improvements across all primary outcomes by day forty, demonstrated by a reduction in pain intensity from 6/10 to 2/10, an increase in six-minute walk distance from 160 m to 240 m, and a decrease in borg perceived exertion ratings from "somewhat hard" to "very light," alongside marked enhancements in emotional wellbeing and health-related quality of life as evidenced by a reduction in hospital anxiety and depression scale scores for anxiety from 11 to 6 and depression from 8 to 3, as well as increases in the sf-36 physical component score from 32 to 42 and the mental component score from 45 to 52; ultimately, these multidimensional outcomes underscore that early, structured, and progressive cardiac rehabilitation contributes substantially to physical recovery, psychological improvement, and quality-of-life enhancement, thereby highlighting the profound clinical value of individualized physiotherapy in optimizing postoperative results, particularly within resource-limited settings where rheumatic heart disease remains heavily prevalent.

INTRODUCTION

This case report presents a 61-year-old patient with rheumatic heart disease who had a valvular replacement surgery. Rheumatic. What makes this case report stand out is that an open-heart surgery together with a structured cardiac rehabilitation program was carried out in a resource limited setting where top-notch cardiac rehabilitation programs are difficult to assess. This study became imperative due to the fact that limited healthcare facilities in low- and middle-income settings like Kano, Nigeria have become prevalent (Abubakar *et al.*, 2022). It also highlights the importance and benefits of physiotherapy in the cardiac rehabilitation team with the aim of improving functional independence, overall quality of life and the need for a real and positive policy change in Nigeria to better improve healthcare outcomes in the country.

LITERATURE REVIEW

Rheumatic heart disease (RHD) is a global health challenge, affecting an estimated 40 million people worldwide and causing approximately 300,000 deaths each year (Lupieri *et al.*, 2025). The condition is more prevalent in low- and middle-income countries due to the high incidence of acute rheumatic fever (Ogah *et al.*, 2020; Tang *et al.*, 2025). RHD develops when an abnormal immune response to Streptococcus pyogenes infection damages the heart valves, causing progressive fibrosis and deformity of the valve leaflets over time (Sika-Paotonu *et al.*, 2017; Salik *et al.*, 2025). The mitral valve is the most commonly affected valve in RHD, with the aortic valve involved in more than one-third of cases, usually alongside mitral disease (Javed *et al.*, 2025). A detailed evaluation consisting of laboratory tests, echocardiography, and a chest x-ray is required to confirm the diagnosis (Salik *et al.*, 2025), and valvular repair or replacement remains the mainstay of management once valve damage becomes severe (Perone *et al.*, 2025; Elnagar *et al.*, 2025).

Cardiac rehabilitation (CR) involves the use of structured exercises, educational interventions, and psychosocial support delivered across various stages to optimize cardiac function, improve exercise tolerance, and enhance overall quality of life (Zhang *et al.*, 2025b). Early initiation of tailored cardiac rehabilitation has also been shown to improve pulmonary function, stabilize hemodynamics, and expedite functional recovery (Grochulska *et al.*, 2025), while structured CR programmes more broadly have been shown to reduce hospital readmissions and promote long-term adherence to heart-healthy behaviours (Myneni *et al.*, 2024). Global initiatives have been developed to improve CR like the International Council of Cardiovascular Prevention and Rehabilitation (ICCPR) which launched a Global CR Registry to support quality improvement (Grace *et al.*, 2023). In the United States, the formation of the Million Hearts Cardiac Rehabilitation Collaborative has been initiated to CR participation and education (Wall *et al.*, 2020). In the United Kingdom, the Hearts manual program has been initiated to improve evidence-

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based approaches to CR and to improve better outcomes (Deighan *et al.*, 2017). Although cardiac rehabilitation (CR) has well documented benefits, lack of adequate education, constrained resources and poor healthcare facilities limit adequate per and post-operative cardiac rehabilitation in low- and middle-income countries (Bashir *et al.*, 2024). Cardiac rehabilitation must evolve with the diverse heterogenous cardiovascular conditions with the solution targeted at team work, easy access, reimbursement reform and better policies (Mueller & Kim, 2025). Furthermore, there are limited studies documenting the cardiac rehabilitation treatment regimen in resource-limited environments.

MATERIALS AND METHODS

We present a case of a 61-year-old woman who had pain in the chest and epigastric region that radiated to the back which was exacerbated by activity and relieved by rest. After about eight years, the condition worsened where she began experiencing shortness of breath on exertion and while walking long distances. Although there was no history of loss of consciousness, she complained of headaches and episodes of blurry vision. A history of low blood pressure was recorded on subjective assessment with a systolic pressure below 60mmHg. She had no history of asthma, diabetes mellitus, sickle cell disease or epilepsy. She had a subtotal thyroidectomy procedure done 18 years prior to presentation.

On preoperative subjective assessment, the patient presented with shortness of breath, chest palpitations and bilateral pedal edema. Objectively, she had a blood pressure 100/80 mmHg, a pulse rate of 80 bpm with a normal jugular venous pressure. On cardiac auscultation, the first and second heart sounds were heard and normal with no murmurs. She was conscious, alert, and oriented. Coronary angiography was done and it revealed normal coronary arteries. Echocardiography revealed rheumatic mitral valve stenosis with a "candle flame" appearance, a mitral valve area of 1.8 cm^2 with annular dense calcification. More echocardiographic findings revealed normal size of the left ventricle with good systolic function and no regional wall motion abnormality. Left ventricular relaxation was impaired, and the left atrium appeared dilated.

The patient underwent a successful mechanical mitral valve replacement (MVR) under general anesthesia. Postoperatively, a mediastinal drain and a left posterolateral pleural tube were inserted. She was then transferred to the coronary care unit of the hospital, extubated, and placed on supplemental oxygen via nasal prongs. Physiotherapy intervention commenced the same day.

RESULTS AND DISCUSSION

We followed the protocol of the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation on cardiac rehabilitation (Brown *et al.*, 2024). Postoperatively on the first day, the patient was assessed while lying in a semi fowlers position on the treatment couch. On central nervous system assessment, she was conscious, alert, and oriented, she had a blood pressure of 100/60 mmHg, a heart rate of 78 bpm, a respiratory rate of 16 cycles per minute, and an oxygen saturation of 98%. She had reduced chest expansion at the sternal area, and the abdomen moved normally with respiration. Her chief complaint was pain at the suture site, rated a 6/10 on the Numeric Pain Rating Scale (NPRS). Her gross muscle strength was 4/5 in both upper and lower limbs using the oxford grading scale. Physiotherapy management primarily consisted of patient education, lung expansion therapy, bronchial hygiene techniques, positioning, postural correction, and mobilization as tolerated. Sessions were conducted twice daily.

On the second day after surgery, the patient said her pain was 4/10 while resting, but she experienced much more pain, up to 8/10, whenever she moved her arms or coughed. We spent some time explaining how she could protect her sternum during movement, including how to get in and out of bed safely and how to use the sternal binder correctly. She was encouraged to sit upright with good support and was shown how to gently hold a pillow against the surgical wound whenever she needed to cough or sneeze. Breathing exercises were introduced to help improve lung expansion. These included diaphragmatic, segmental, and thoracic expansion exercises, which were performed while she was sitting upright. Gentle shoulder movements, including flexion and abduction, were also incorporated as tolerated. She was encouraged to take a slow, deep breath while gently moving her arms away from her body and then breathe out slowly as she returned her arms to the starting position. Once she was comfortable with these exercises, we commenced assisted walking. Initially, she was supported by two physiotherapists and walked only a short distance, with the aim of gradually increasing her mobility as her tolerance improved.

By postoperative day three, active-assisted range of motion exercises were introduced, including ankle-toe movements, assisted straight-leg raises up to 15 degrees, assisted hip abduction, active finger flexion and extension, elbow flexion and extension, and shoulder flexion which were all done in 5 repetitions and 2 sets each. The patient tolerated supported sitting and was able to ambulate independently for a longer distance without assistance.

By day seven, she was discharged home and moved into outpatient rehabilitation at the cardiopulmonary unit of the physiotherapy department, continuing through to day fifteen. When we examined her, her vitals were stable, pain at the suture site had come down to 2/10, and her muscle power had climbed back up to 5/5 across all four limbs. With that progress, we upgraded her plan to include chest expansion exercises, sit-to-stand training, step exercises all done at 10 repetitions and 3 sets each. She also underwent cycle ergometer sessions of 10 minutes of moderate cycling, and treadmill walking of 15 minutes at 1.0km/h speed.

From day fifteen through to day forty, she stayed clinically

stable and kept working through structured rehabilitation, now built around treadmill training, nutritional counselling, psychosocial support, and independent walking at home over pre-set distances. Both her functional capacity and her emotional wellbeing came on noticeably over this stretch. Her six-minute walk distance climbed from 160 metres on day six to 240 metres by day forty. Pain dropped from 6/10 to 2/10, and her anxiety and depression scores improved markedly alongside it. HADS-anxiety fell from 11 to 6, and HADS-depression from 8 to 3 (Table 1). On the Numeric Pain Rating Scale, that meant going from 6/10 (moderate pain) down to 2/10 (minimal pain). Her SF-36 scores told a similar story: the Physical Component Summary rose from 32 to 42, and the Mental Component Summary from 45 to 52. And her perceived exertion on the Borg 6–20 scale eased from "somewhat hard" down to "very light" as the rehabilitation period went on.

Table 1: Summary of Outcome Measures from Postoperative Day 2 to Day 40

Outcome Measure	Day 2	Day 6	Day 15	Day 40	Interpretation / Remark
Numeric Pain Rating Scale (NPRS)	6/10 (moderate pain)	4/10 (reduced pain)	2/10 (mild pain)	2/10 (minimal pain)	Steady reduction in surgical site pain due to analgesia and progressive mobilization.
6-Minute Walk Test (6MWT)	—	160 m	210 m	240 m	Gradual improvement in exercise tolerance and cardiovascular endurance.
Hospital Anxiety and Depression Scale (HADS)	A: 11, D: 8	A: 10, D: 7	A: 8, D: 5	A: 6, D: 3	Progressive reduction in anxiety and depressive symptoms, showing psychosocial recovery.
Rate of Perceived Exertion (RPE, 6–20 BORG scale)	13 ("Somewhat hard")	11 ("Fairly light")	9 ("Very light")	9 ("Very light")	Improved exercise capacity with reduced perceived effort during physical activity.
SF-36 Quality of Life	PCS: 32 MCS: 45	PCS: 32 MCS: 45	PCS: 38 MCS: 48	PCS: 42 MCS: 52	Progressive improvement in both physical and mental health components.

Cardiac rehabilitation has become a core part of comprehensive care for patients going through mitral valve intervention, and the evidence backing its place in standard postoperative management keeps building (Lee, 2024). The main aim of cardiac rehabilitation is to reduce functional limitation and improve health related quality of life (Haseen *et al.*, 2026). This case adds to that picture, showing just how central structured physiotherapy is within a comprehensive cardiac rehabilitation programme after mitral valve replacement. Our patient, a 61-year-old woman with rheumatic mitral stenosis, made real gains in exercise tolerance, pulmonary function, and psychosocial wellbeing over her 40-day rehabilitation duration. What we saw in her recovery lines up with the growing evidence that early, progressive physiotherapy genuinely optimizes recovery after cardiac surgery.

There's a clear physiological reason why structured rehabilitation matters so much after mitral valve disease and the surgery that follows it. Patients with significant valve disease often develop left ventricular volume overload, pulmonary hypertension, and right ventricular dysfunction which do not necessarily go away just because the valve itself has been fixed (Velidakis *et al.*, 2023). On top of that, the deconditioning that comes with advanced valvular heart disease tends to get worse, not better, once you factor in the systemic inflammatory response and the musculoskeletal trauma of a sternotomy which all adds up to pain, reduced exercise capacity, and a lower quality of life (Bartels & Prince, 2021). This is where cardiac rehabilitation earns its place through targeted exercise training which works on several fronts at once, improve endothelial function, boosts how well skeletal muscle extracts oxygen, and even helps reverse ventricular remodeling (Lee, 2024).

Pulmonary atelectasis, reduced lung compliance, and muscle deconditioning are all common after cardiac surgery (Setlers *et al.*, 2024), and the lung expansion techniques we used here which are diaphragmatic breathing, thoracic expansion, incentive spirometry likely played a real part in keeping the patient's chest clear of complications. That fits with a recent scoping review of exercise rehabilitation after valve intervention, which found that structured programmes reliably improve functional capacity, even if the protocols across studies still aren't standardized (Zhang *et al.*, 2025a). Starting breathing and mobilization work from day one rather than waiting is in line with what's been reported elsewhere (Agrawal & Berry, 2023) as it provides better oxygenation and shorter hospital stays after open-heart surgery. Pairing breathing exercises with postural correction and supported ambulation from day two helped her chest wall

move more freely and supported venous return, both of which feed into better cardiopulmonary performance overall.

Her six-minute walk distance is probably the clearest single marker of how far she came, climbing from 160 m to 240 m over the postoperative period which is a pattern that lines up with what others have found after valve replacement surgery, where structured exercise-based rehabilitation reliably improves exercise capacity and functional independence (Aleksandrowicz *et al.*, 2023). We'd put that down to a few things working together: better convective oxygen transport as stroke volume improved, better peripheral oxygen use as capillary and mitochondrial density increased in her skeletal muscle, and tighter ventilation-perfusion matching.

Her growing activity tolerance, alongside a falling Rate of Perceived Exertion, points to more than just improved cardiovascular efficiency, it also reflects her building confidence in moving her body again, which matters just as much clinically as the numbers do. Pain told a similar story, dropping from 6/10 to 2/10 by day forty, in keeping with earlier work showing that physiotherapy-led education on sternal precautions, combined with structured postoperative exercise, genuinely helps minimize discomfort and supports recovery (Brocki *et al.*, 2010). The combination of correct coughing technique, consistent sternal binder use, and graded mobilization eased sternal stress and, in our experience, supported better wound healing.

Her psychological wellbeing improved just as markedly, with HADS-anxiety dropping from 11 to 6 and HADS-depression from 8 to 3 by day forty. That tracks with what's already well established in the literature that cardiac rehabilitation combining structured exercise, patient education, and emotional support meaningfully reduces anxiety and depression in people recovering from cardiac conditions (Lavie *et al.*, 2016). What this psychological component was doing, in practice, went beyond treating the emotional trauma of major surgery, it also addressed the practical and motivational barriers that get in the way of adopting heart-healthy habits: resistance to change, time pressure, gaps in knowledge. Ongoing education, reassurance, and psychosocial counselling throughout her program seemed to build both her emotional resilience and her willingness to stick with treatment.

Her improved SF-36 scores, across both the physical and mental components, echo similar findings from the wider rehabilitation literature, which shows that cardiac rehabilitation drives meaningful gains in both physical capacity and mental wellbeing for people with cardiac conditions, reinforcing its value as a core part of postoperative recovery (Subih *et al.*, 2024). Taken together, these improvements make one point clearly: rehabilitation after cardiac surgery isn't just about restoring the body, it restores a person's sense of function and wellbeing more broadly.

We think this case matters particularly because of where it happened. Structured cardiac rehabilitation is still rare in Nigeria and particularly in Kano state, held back by low awareness, weak infrastructure, and a shortage of trained staff. This pattern repeats across much of Africa, where the near-total absence of clinical practice guidelines and structured CR programs signals just how low a priority rehabilitation still is, despite an estimated unmet need of close to a million patients with ischemic heart disease across the continent (Maruf & Mohammed, 2023). As such awareness campaigns should be in cooperated as form of preventive measures of cardiovascular diseases (Khan, 2026). What this patient's outcome tells us is that individualized, evidence-based physiotherapy can still deliver results comparable to those seen in high-income settings, even where the surrounding system offers little support.

CONCLUSION

This patient's recovery after mitral valve replacement makes a strong case, on its own, for what structured cardiac rehabilitation can do. It fits with what a growing body of evidence already tells us: that rehabilitation only works when it's tailored and progressive, and that this kind of approach is what actually drives functional recovery, psychological wellbeing, and lasting outcomes after valve surgery. But a good outcome in one case doesn't mean the path there is easy because access to this kind of care is still far from where it needs to be, especially in resource-limited settings like ours. That gap is exactly why we think Nigerian healthcare systems need to move toward structured CR protocols more broadly, not just in isolated centers where the right staff and equipment happen to come together. Getting there will take a few things working in tandem which are standardized evidence-based rehabilitation protocols built specifically for valvular heart disease, delivery models that don't assume a fully resourced hospital with digital health tools among them and a real policy push to treat cardiac rehabilitation as a core part of postoperative care.

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Ethical Approval

The management of the patient and the subsequent writing of this case report were part of a humanitarian medical outreach program. Formal ethical approval for the specific publication of this single case report was

reviewed and waived by the Research Ethics Committee of Aminu Kano Teaching Hospital (AKTH)

Informed Consent

Verbal informed consent for the publication of this case report was obtained from the patient following the provision of detailed information. The patient was explicitly informed of the purpose of the publication, the nature of the information to be shared, and the measures taken to protect their privacy and ensure anonymity.

Conflicts of Interest

The authors declare no conflict of interest

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