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In hospital phase of postoperative cardiac rehabilitation in elderly patient with aortic valve replacement: A case report

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ABSTRACT

Introduction: Aortic stenosis (AS) is brought on by a restriction in the aortic valve's opening, which results in enlarged and dysfunctional left ventricles and increased pressure in the lungs and right side of the heart. Aortic valve replacement is a surgical operation in which a failing aortic valve is being replaced by a prosthetic heart valve. Cardiac rehabilitation after surgery involves physical activity promotion, exercise training, cardio vascular risk management, and health education. A 59 year old female presented with complaints of breathlessness on exertion and during activities, chest pain, palpitations, sweating and dizziness since 1 month. She was diagnosed with severe aortic stenosis the patient was evaluated and was suggested for Aortic Valve Replacement surgery and successfully underwent the same. She was started with 12 weeks of cardiac rehabilitation from postoperative day 1. *Conclusion:* In this case study, the physiotherapy protocol used has a significant effect on improving functional independence, reducing cardio vascular risk factors related to prolonged bed rest, and gaining an optimal level of physical fitness through cardiac rehabilitation.

Keywords: Aortic stenosis, rheumatic heart disease, aortic valve replacement, cardiac rehabilitation.

1. INTRODUCTION

Aortic Stenosis (AS) is caused by a restriction in the opening of the aortic valve, which causes systolic dysfunction of left ventricle, dilation, and elevated pressure in the lungs and right side of the heart if left untreated (Fernandez and Blackwood, 2018). It is a chronic condition that starts with minor fibro calcific leaflet alterations, known as aortic sclerosis, and develops to more severe calcification, obstructing left ventricle ejection (Carità et al., 2016). Clinical features of aortic stenosis include dyspnea or syncope on exercise, angina pectoris light headedness, a systolic ejection murmur and sudden death (Fernandez and Blackwood, 2018). Symptoms have an insidious

onset and vary greatly among persons with the same degrees of valve stenosis (Fernandez and Blackwood, 2018). As the condition progresses, decreased coronary flow reserve produces myocardial ischemia; moreover, hypertrophic left ventricle and excessive after load cause systolic and diastolic left ventricle dysfunction (Huang et al., 2018). AS has a long uneventful phase, and if symptoms appear, there is usually a poor prognosis. There are presently no medical interventions to avoid the disease's regression, whose natural history necessitates surgical replacement of valve even in elderly, high risk individuals (Carità et al., 2016). Aortic valve replacement is a surgical operation in which a failing aortic valve is substituted with a synthetic heart valve. Aortic valve replacement is required when the valve is leaky, as in aortic insufficiency or aortic regurgitation, or when the valve is narrowed and does not open fully, as in aortic stenosis. Adults with aortic valve replacement surgeries have reported enhanced quality of life, greater life span, and better outcomes (Fernandez and Blackwood, 2018).

Patients having heart valve surgery frequently have impairments in physical activity and physical capacity for several years prior to surgery. This patient group is not in an ideal level of physical fitness upon hospital discharge when paired with a period of bed rest following surgery, needing physical and cardiac rehabilitation (Sibilitz et al., 2013). Cardiac rehabilitation is a multi faceted treatment that involves exercise training, physical activity promotion, health education, cardio vascular risk management, and psychological support people who have been identified as having heart disease (Taylor et al., 2021). Early mobilization and exercise in the ICU is safe, reduces the time needed to achieve mobility milestones, and decreases the duration of ICU and hospital. The main aim of physiotherapy is to help patient gain functional independence, reduce cardio vascular risk factor related to prolonged bed rest and to gain optimal level of physical fitness through cardiac rehabilitation.

2. PATIENT INFORMATION

A 59 year old female presented to AVBRH, Sawangi, and Meghe with complaints of breathlessness on exertion and during activities like climbing stairs, she also complained of chest pain which was retrosternal and radiating to back along with palpitations, sweating and dizziness since 1 month. She is a known case of diabetes mellitus and hypertension since 4 years. She had previously undergone the investigations such as 2D echo and coronary angiography in Chandrapur 1-2 months back which was suggestive of degenerative severe calcific aortic stenosis, mild regional wall motion abnormality (RWMA), grade 1 diastolic dysfunction, mild pulmonary artery hypertension and non critical coronary artery disease, medical management for coronaries and aortic valve replacement respectively. The Patient was evaluated and suggested for Aortic Valve Replacement and advised to review after 15-20 days for surgery. Then after 15 days the patient was re-admitted for the aortic valve replacement surgery after 6 days, 'Aortic Valve Replacement TTK CH 21' surgery was performed through midline a sternotomy. The Patient was stable after surgery and was shifted to ICU. Patient was then referred to cardio respiratory physiotherapy department for further treatment and was started with cardiac rehabilitation in ICU (ABG interpretations and medications of the patient is mentioned in table 2 and table 3 respectively) (Timeline of incidents is mentioned in table 1).

3. CLINICAL FINDINGS

Patient was examined in supine position, he was cooperative, conscious and well oriented to time, place and person. In spectory findings were, she was on 10 liters of oxygen per minute through basal prongs, mid sternal drain and peripheral lines were placed in situ. Anteriorly median sternotomy incision was present over chest. After cardio vascular examination respiratory rate was 34 breaths per minute (regular rhythm), blood pressure was 132/92 mmHg. Auscultatory findings were S1-S2 heard in addition with click sound. Respiratory findings were respiratory rate as 34 breaths per minute (regular rhythm) along with absent chest wall movement over left side, air entry was absent in lower zones, bilaterally. She was not maintaining saturation in sitting positions and was having breathlessness MMRC grade 3 and 4 on post operative day 1 to 3 she was reintubated on day 2 on cap mode medications and cardiac rehabilitation phase 1 was given twice a day. On post operative day 5 she was extubated vitals were stable shifted from ICU where further medical and cardiac rehabilitation was done (x-ray findings of both pre operative and post operative are shown in figure 1A, 1B, 1C).

Timeline

Table 1 Showing timeline

Date of admission	15/12/2021
Date of Aortic valve replacement surgery	21/12/2021
Date of beginning of physiotherapy Rehabilitation	22/12/2021

Diagnostic Assessment: (Pre-operative)

Coronary Angiography: It suggests, LMCA having Distal mild plaque, LAD: Type 2, proximal LAD is having mild adventitial calcium, mild plaques present, no flow limiting lesion, LCX: Co-dominant, with proximal mild plaque, RCA: Co-dominant, multiple mild plaques present. It suggests, Non–critical CAD.

2D Echo: It suggests Degenerative severe calcific aortic stenosis, Mild regional wall motion abnormalities (RWMA), Grade1 diastolic dysfunction and Mild pulmonary artery hypertension.

ABG Interpretations

Table 2 ABG findings and their interpretations are explained.

	Pre operative	Post operative day 1	Post operative day 2
pH	7.47	7.42	7.43
pCO2	34	46	45
pO2	153	224	251

Medications

Medications which were given to the patient which includes antibiotics, antacids, and analgesics are listed in table 3 along with their dosage.

Table 3 Medications

Medications	Dosage
Targocid	400 mg
Ceftriaxone	200 mg
Amikacin	500 mg
Pantoprazole	40 mg
Paracetamol	100 mg
Ondensterone	4 mg

X-Ray Findings

X-ray findings are shown in Figure 1.

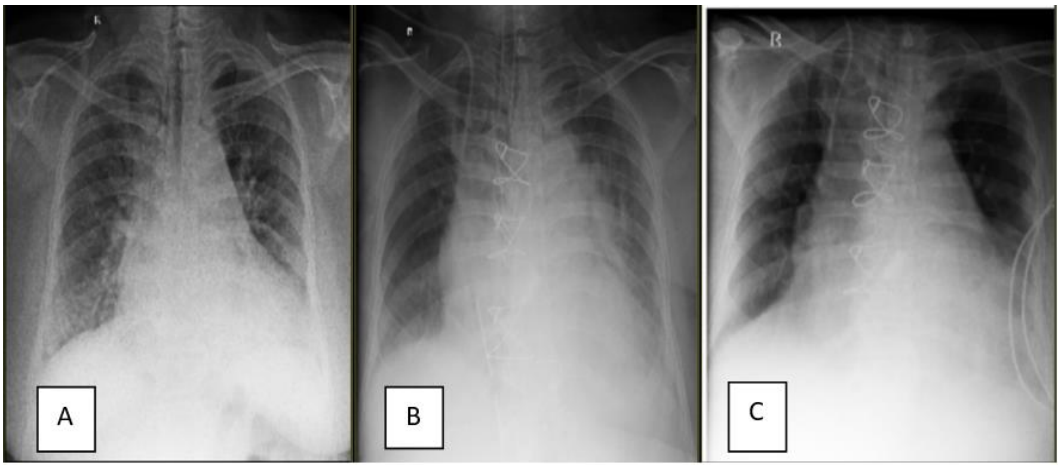

Figure 1 1A – Pre operative, 1B – Post operative day 1, 1C – Post operative day 5.

Physiotherapeutic Intervention

Following aortic valve replacement surgery patient was started with in patient cardiac rehabilitation from post operative day 1, phase wise cardiac rehabilitation was planned for the patient whose aim was to promote physical activity, health education, management of risk factors associated with cardio vascular system and psychological support according to the patient's need based on her health status. Early mobilization will help her to decrease the adverse effects of bed rest, which will help her to get back to the activities of daily living (ADL), within the limits of the disease. Detailed physiotherapeutic rehabilitation is explained in table 3.

Pre operative cardiac rehabilitation intervention

Patient was started with pre cardiac rehabilitation before surgery to engage the patient taking charge of their self managed care prior to surgery with the aim of improving post surgical outcomes. It resulted in improved physical functioning and exercise capacity. It also resulted in reduction in frailty, improved exercise capacity, physical activity behavior, in hospital outcomes, improved clinical outcomes 3 months and 1 year post operatively, and overall quality of life. Detailed pre operative cardiac rehabilitation is explained in table 4 and Post operative Cardiac Rehabilitation intervention is explained in detail in table 5. Post operative treatment given is shown in figure 2 (2A-Patient performing bubble PEP exercise, 2B-Patient performing Incentive Spirometry, 2C-Patient was started with ambulation) and pre and post intervention measures are mentioned in table 6.

Table 4 Showing pre operative rehabilitation.

Pre operative cardiac rehabilitation	Intervention planned	Rationale
1	Breathing exercises	To improve breathing pattern
2	Incentive Spirometry	To prevent from atelectasis post surgery
3	Range of motion exercise	To maintain posture and balance

Table 5 Showing post operative rehabilitation.

Phases of Cardiac Rehabilitation	Intervention planned	Rationale
PHASE I	Reassurance, and patient education, risk factor assessment, mobilization was done. Mobilization included graded exercises, walking and stair climbing. During this phase patient was also started with airway clearance techniques to prevent accumulation of secretion due to prolong bed rest : Patient was started with Bubble PEP i.e. Bubble Positive Expiratory pressure (PEEP) in which patient was taught to make bubbles in the water with the help water tubing. After this patient was taught to huff or cuff to clear out the secretions Protocol was divided into levels – Level 1 consisted of Complete Bed Rest Day 1 in ICU Dyspnea relieving positions were taught. Breathing exercises were started(diaphragmatic breathing) Active ROM exercises to bilateral upper limb and lower limb like ankle toe movements and wrist finger movements. Level 2 consisted of Partial bed rest Days 1, 2.	Protocol guided phase I CR results in a substantially quicker recovery of heart rate and blood pressure to baseline after the 6 Minute Walk Test, without a significant increase in RPE, reflecting a training advantage among these individuals. The prevalence of ICU acquired weakness appears to be reduced when patients are moved early in the ICU. Early mobility in the ICU appears to reduce the frequency of ICU acquired weakness (ICU-AW), enhance functional capacity of the patient, increase the number of patients who can ambulate, reduce the number of ventilator days` In a Bubble PEP, A positive pressure is generated within the tube and delivered to the airways in your

	It includes sitting 1, 2 hours per day. Relaxation, breathing exercises (diaphragmatic breathing) were continued. Patient was started with Incentive Spirometry. Active ROM exercises progress to hip knee with five repetitions three times a day. Patient was taken in bed side sitting. Level 2 (a) sitting time was progressed to 3, 4 hours per day. Patient was taught alternate heel slides and static quadriceps and glutei. Level 3 Patient was made Up and About: Days 3 – 5. Exercises progression to 10 repetitions. It included: Walking in a room (three times a day) Standing and doing Upper limb flexion (5 repetitions three times a day) Level 3(a) Progression was done to walk standing and stride standing with lower limb flexion (5 repetitions three times a day) Walking outside the room and 6 Minute Walk Test (6MWT) was performed. Intensity of exercise : Training of the patient was done up to a HR of 120 beats per minute which was looked up by symptoms of chest pain and dyspnea (Borg's rating of perceived exertion < 13)	lungs. The Positive pressure aids in maintaining open the airways that allowing more air to enter and exit then the air can get behind the secretions and help it to move easier upwards through the wide airways.
PHASE II	At the beginning, patient was educated about the risk factors, its modification and adherence to medications, about nutritional guidance, counseling and about stress management. Cardiac rehabilitation during this phase was carried out in 3 phases: Warm up period, aerobic exercise period and cool down period. Each training session lasted for 45 minutes which included a 5-10 minute of warm-up period, 20 minute of aerobic training (with speed adjusted according to the patient's target heart rate) and a 5-10 minute of cool down period. Exercises such as walking, jogging, cycle ergo meter, stair climbing and aerobic dancing were performed. Frequency of exercise was 5 days/week with intensity 65%-85% of the maximal heart rate or 60%-70% of the heart rate reserve.	This phase is based partly on risk assessment; it improves functional capacity through a tailored exercise program and also teaches the patient about lifestyle changes, red flags of heart disease, and medication information. It will result in more enhancements in left ventricular ejection fraction at the end of the program. METs achieved will also be significantly improved.
PHASE III	It included home exercise program: Patient education was the basis of HEP; she was	This phase places a greater emphasis on independence and self monitoring,

	thoroughly explained about the program, its important role in reducing cardio vascular risk factors by sticking to and following the protocol at home. Patient was taught identification of risk factors and quickly contacting for help if needed. Aerobic exercise program was taught: A regular walking or stationary cycling was advised. To warm up and cool down is very important. Patient was advised not to exercise at an intensity that will cause shortness of breath.	as well as building flexibility, strength, and aerobic conditioning. It helps in long term maintenance of lifestyle changes, monitoring the risk factor changes and secondary prevention of disease. Combination of cardiac rehabilitation and relaxation also results in improved quality of life (QOL) of patient.

Figure 2 A-Patient performing bubble PEP exercise, B-Patient performing Incentive Spirometry, C-Patient was started with ambulation.

Outcome measures which were used are 6MWT; HADS and functional classification spirometric measurement are listed in table 6 along with their scores.

Table 6 Outcomes Measures

	Pre Rehabilitation	At the time of Discharge	Follow up
Functional Classification grade Incentive Spirometry measurement	>600cc	<600cc	<900cc
6MWT	100m	250m	380m
HADS	12	9	5

3. DISCUSSION

Aortic Stenosis (AS) is caused by a restriction in the opening of the aortic valve, which causes left ventricular systolic dysfunction, dilation and elevated pressure in the lungs and right side of the heart if left untreated (Fernandez and Blackwood, 2018). AS has a long uneventful phase and if symptoms appear there is bad prognosis. There are presently no medical interventions to avoid the disease's regression, which necessitates surgical valve replacement also in elderly and high risk individuals (Carità et al., 2016). Patients having heart valve surgery frequently have impairments in physical activity and physical capacity for several years prior to surgery. This patient group is not in an ideal level of physical fitness upon hospital discharge when paired with a period of bed rest following surgery, needing physical and cardiac rehabilitation (Sibilitz et al., 2013).

Cardiac rehabilitation has been shown to raise the standard of living of cardio vascular patients while lowering morbidity and mortality (Mampuya et al., 2012). Mc Mohan et al., (2017) in his study stated that patients participating in CR after valve surgery observed an increase in quality of life, along with an increase in VO2MAX and exercise capacity. Study done by Anderson et al., (2016) confirms that exercise based Cardiac Rehabilitation will decrease cardio vascular mortality and provided significant data indicating shorter hospital stays and higher quality of life.

Thus, In this case study, cardiac rehabilitation program after heart valve surgery will promote exercise training, physical activity, health education, management of cardio vascular risk factors and will reduce the time needed to achieve mobility milestones, and decreases the duration of ICU, hospital stay, improve score of outcome measures such as spirometry measurement, 6MWT, HADS and will improve quality of life.

4. CONCLUSION

According to this case study, after 12 weeks of cardiac rehabilitation patient has shown significant improvement in functional independence, reduction of cardio vascular risk factor related to prolonged bed rest and gained optimal level of physical along with improvement in quality of life of the patient.

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Informed consent

Written and oral consent was obtained from the participant included in the study. Additional informed consent was obtained from the individual for whom identifying information is included.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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