

Exercise Based Cardiac Rehabilitation in a Resuscitated; Post Mitral Valve Replacement Middle Aged Woman - A Case Report

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ABSTRACT

Introduction- Rheumatic heart disease (RHD) affects more than 30 million people globally and accounts for about 30,000 fatalities. RHD can worsen with time, leading to significant mitral stenosis and/or mitral regurgitation, which affect more than 30% of patients.

Case Presentation- A 39 years old female, known case of Rheumatic valvular heart disease since 2005; came with a complaint of palpitation and dyspnea on exertion. Investigations revealed severe mitral stenosis with severe tricuspid regurgitation for which she underwent Mitral valve replacement and Tricuspid valve repair and was referred for physiotherapy. On POD-5, she developed VF with asystole and was revived post resuscitation. Once she was hemodynamically stable, physiotherapy sessions were re-started thrice a day, post which recovery was seen in majority of the outcome measures.

Management and Outcomes- Patient underwent regular exercise based Phase I cardiac rehabilitation program. Outcome measures assessed were NYHA, chest expansion values, single breath count, 30 seconds sit to stand test, distance ambulated and RPE.

Discussion- Cardiac rehabilitation post cardiac surgery has proven to be beneficial in terms of length of hospital stay, functional capacity as well as prevention of postoperative pulmonary as well as vascular complications.

Conclusion- Exercise based cardiac rehabilitation helped our patient to overcome respiratory complications in the immediate post operative period. It helped in improving the lung expansion, cardiovascular endurance as well as the functional capacity. It also helped in reducing the fatigue and rate of perceived exertion levels.

Key words- cardiac rehab, valvular heart disease, functional capacity

INTRODUCTION

Rheumatic heart disease (RHD) affects more than 30 million people globally and accounts for about 300,000 fatalities and 10 million impairments annually. RHD is a major worldwide health burden, particularly in low-income and emerging nations, where high morbidity and mortality are common.⁽¹⁾ RHD can worsen with time, leading to

significant mitral stenosis and/or mitral regurgitation, which simultaneously affects aortic valves in more than 30% of patients⁽²⁾ According to the World Health Organization, in rheumatic heart disease, the heart valves are harmed by one or more episodes of rheumatic fever, an autoimmune inflammatory infection of the throat caused by Group A streptococci.⁽³⁾ The mitral valve

is the most frequently damaged cardiac valve. Percutaneous mitral balloon commissurotomy (PMBC), which is a safe and effective procedure, is recommended by the current American College of Cardiology/American Heart Association guidelines for the treatment of RHD-related conditions. However, its use is constrained by the severity of MR and the absence of left Atrial thrombus and calcification.⁽⁴⁾ Usually the line of treatment involves Percutaneous mitral balloon commissurotomy and mitral valve (MV) surgery with valve repair or replacement.⁽³⁾ For many years, the full sternotomy method has been the gold standard for replacing or repairing cardiac valves, and most cardiac surgery centers still employ it because it provides the best possible exposure of the heart and major blood arteries. Despite these advancements in surgical technique and patient care over the years, pulmonary problems are still the greatest contributor towards morbidity and mortality following heart surgery.⁽⁵⁾

Post pulmonary complications are the conditions affecting the respiratory system that may negatively affect a patient's post-operative clinical course and that develop usually after 48 to 72 hours.⁽⁶⁾ Most of the times patients stay in cardiac recovery unit gets lengthened due to development of respiratory complications. This also increases the financial burden on the patient and the family. These issues have a significant impact and pose increased financial burden on health care systems by causing longer hospital stays and more readmissions to the ICU. Atelectasis, pleural effusions, pneumonia, pneumothorax, diaphragm paralysis due to phrenic nerve injury, and pulmonary infection are the most common post operative pulmonary complications.⁽⁵⁾ Phase I cardiac rehabilitation which starts immediately in the hospital phase plays a very important role in improving the patients cardiovascular endurance, preventing the development of respiratory complications, promoting mobility and also

preventing vascular complications. Every single aspect of phase I cardiac rehabilitation has its own importance and holistically helps in improving the patient's physical as well as psychological well being. Some of the commonly practiced components include: patient education which help the patients understand the Dos and Don'ts, especially in the early post operative period, lung expansion therapy techniques to ensure good lung expansion and prevention of Atelectasis and related problems. Bronchial hygiene therapy techniques ensure prevention of retention as well as clearance of secretions. Early bedside mobility is promoted with progressive increase in ambulation in order to decrease the effects of immobility and the vascular complications.

CASE DESCRIPTION

A 39 years old female, housewife by occupation came with complaints of palpitation and dyspnea on exertion. She was diagnosed with Rheumatic valvular heart disease in 2005. She underwent Balloon mitral valvotomy (BMV) for the same in 2006. After that she experienced dyspnea on exertion intermittently; however it did not affect her activities of daily living. But around 15-20 days prior to the current admission in March 2023; her dyspnea on exertion increased. It also limited her daily activities to some extent; NYHA class 3. She was then advised to undergo lab investigations including 2D ECHO; which revealed rheumatic affection of mitral and aortic valve, severe mitral restenosis with mild mitral regurgitation, no Aortic stenosis, trivial Aortic regurgitation, normal tricuspid and pulmonary valve, severe tricuspid regurgitation, mild PAH, organized clot at left atrium free wall, no vegetations, pericardial effusion noted, LVEF was 60%. The patient was then advised to undergo Mitral valve replacement and Tricuspid valve repair. She was admitted to the hospital for the same and was operated via median sternotomy under general anaesthesia. Post surgery there was

retrosternal and pericardial drains. After that patient was shifted to cardiac recovery and was eventually extubated the next day i.e. on POD-1. She was referred for physiotherapy on the same day. Postoperatively, patient was examined in the long sitting position, her chief complaint was pain at the suture site which was 6/10 on numeric rating scale (NRS). On POD-2, patient reported pain of 4/10 at rest, 8/10 on activities like upper limb movements and during coughing. She also complained of extreme weakness. On POD-3, the drains were removed. She also developed multiple episodes of ventricular tachycardia on the same day. Then the patient was kept on intermittent NIV support (2 hours on and off period). On POD-4 she developed bilateral pedal oedema and episodes of bigeminy continued. She underwent investigations for the same. 2 D- ECHO revealed mitral valve prosthesis in situ, no mitral regurgitation/aortic regurgitation, mild tricuspid regurgitation, no pleural/pericardial effusion, no clots/vegetations and ECG demonstrated Junctional rhythm with occasional Ventricular premature complexes (VPCS). In the early morning of POD- 5 she had an event of ventricular fibrillation followed by asystole, required 1 DC shock of 150J , resuscitation done as per Advanced Cardiovascular Life Support (ACLS) by American Heart Association (AHA) guidelines, it then reverted to normal sinus rhythm and the patient regained consciousness. She was then taken on NIV support for few hours and gradually NIV support was weaned and the patient was put on 10 litres/minute of oxygen supply via face mask. On POD-6, she was drowsy, not obeying commands and was put on 4-6 litres/ minute of oxygen via nasal prongs. On POD-7 she was conscious and her oxygen flow rate was reduced to 2 litres/minute via nasal prongs. On POD-8, she was well oriented and obeyed commands. On POD-9, examination was done and she reported intensity of pain at suture site on numeric rating scale (NRS) to be 1/10 at rest and 4/10 on activity, fatigue at rest

(3/10). On palpation bilateral pedal oedema of grade 2 was present. Chest expansion was found to be reduced at all the three levels i.e. at intercostals 2, 4, 6 levels. Findings of same are demonstrated in Table 1. On auscultation, air entry was reduced bilaterally in the lower zones and fine crepitations were present in the left basal zone. Gross muscle power was 3/5 in the upper limb and barely 3/5 in the lower limb. Single breath count value was 6. To check the endurance 30 seconds sit to stand was performed with 2 litres/minute of oxygen via nasal prongs. She hardly managed to complete 3 repetitions and also needed moderate support. She was in no state of doing the test for 1 minute, hence it was conducted for 30 seconds. After that she described Rate of perceived exertion to be 11 that is fairly light on 6-20 point scale. On POD-10 she complained of severe dyspnea at rest for which chest X-ray was done which was suggestive of right pleural effusion. Right ICD insertion was done in view of dyspnea and desaturation. On POD-11 around 800 ml pleural fluid was drained. After that her dyspnea decreased to some extent. On POD-12, right ICD was removed and again Ultrasonography of thorax was done which was suggestive of mild left side pleural effusion. Patient's treatment was continued with IV fluids, antibiotics, analgesics, antacids, anticoagulants, antiarrhythmic drug and Physiotherapy. Patient was hemodynamically stable but still required minimal O₂ support. On POD -14, patient described pain at suture site of about 1/10(at rest) and 2/10 (on activity). Chest expansion improved than earlier; as demonstrated in Table 1. On auscultation, air entry was reduced at left basal zone. Gross muscle power had improved to 4/5 in the upper limb and 3+/5 in the lower limb. Single breath count value had increased to 10. 30 seconds sit to stand was repeated to evaluate improvement in functional capacity if any. She could perform the test now with minimal support and manage to complete 7 repetitions. She graded her RPE for the same at 9 this time on the scale of 6-20.

With same treatment continued further, she was discharged on POD 15.

Physiotherapy management

On the postoperative day (POD) 1, patient was extubated and her vitals and hemodynamic were checked and found to be stable.

Physiotherapy treatment comprised of the following broad components: Patient education, Lung expansion therapy, Bronchial hygiene therapy, Positioning, Postural correction and Mobilization as tolerated. The sessions were taken thrice daily from POD 2 to POD- 15.

Physical therapy intervention was initiated on POD-2 thrice a day to ensure good air entry, reducing the chance of developing post pulmonary and vascular complications. Exercises were performed as per schedule in order to make the patient comfortable and independent as early as possible. The patient was instructed to perform 1 hourly during awake time before lunch or 1 to 1.5 hour after lunch, deep breathing exercises 3 sets, 5 repetitions in each set.

Patient education comprised of appropriate sternal precautions especially during coughing, and transfers in and out of the bed. Patient was advised to sit in supported upright position as much as possible. Proper technique of donning and doffing sternal binder and also the importance of using it were emphasized. The patient was advised to protect the suture site while coughing/sneezing in order to decrease the pressure on the incision.

Lung expansion therapy included Diaphragmatic breathing, segmental breathing and thoracic expansion exercises taken in upright position, Thoracic expansion exercises were accompanied with bilateral shoulder flexion to a tolerable range and also bilateral shoulder abduction in short lever. The patient was asked to inhale slowly and deeply while moving her hands away from body and exhale slowly and in a controlled manner, while taking her hands back close to the body. Incentive spirometry (flow based) was started to

improve lung volumes and capacities. Initially she was finding it very difficult to perform incentive spirometry. With consistent sessions she could perform 600cc/sec on POD-8 but with some accessory muscle usage. But at the time of discharge she was able to perform it easily with no accessory muscle usage. The patient was instructed to perform some form of lung expansion technique including incentive spirometry every 1 hourly. She was instructed to perform breathing exercises in terms of 2 sets with 5 repetitions in each set.

Bronchial hygiene techniques were given to reduce the retention of secretion. Vibration technique was given to the posterior basal zone bilaterally. After that to promote airway clearance splinted huffing and coughing techniques were initiated.

Postural correction exercises like shoulder elevation and scapular retraction were started initially without holds and then progressed to 5 seconds holds as per the tolerance.

On POD-3, in addition to above mentioned exercises, mobility exercises including active assisted range of motion exercises of both upper and lower limbs was initiated. It included ankle toe movements, assisted single leg raise of 10-15 degree and assisted hip abduction, active finger movements, elbow flexion/extension, shoulder flexion were started, and same treatment was continued and progressed as per tolerance for the next 2 days.

On POD-6, patient was taken to bed side sitting. She was on 3 liters / minute of Oxygen supply via nasal prongs. Her vitals were stable in sitting. In order to improve the strength of the lower limb musculature, dynamic quadriceps comprising of 3 sets with 10 repetitions each was started. It incorporated hold for 5 seconds with each repetition. Similar sessions were taken thrice that day with the focus being improvement in the lower limb musculature.

On POD-7, she was on 2 litres/ minute of Oxygen supply via nasal prongs, standing was attempted with maximum support. She

could come up to standing with maximum support, but was finding it very difficult to maintain standing posture. She had buckling in both knees with right being more than left. So her knees were stabilized and standing was attempted again. She could maintain standing with moderate support and bracing of knees by the physiotherapist for few seconds. In the second session, along with everything in the above mentioned protocol, spot marching was attempted. She could do it with minimal-moderate support. In the evening session of that day she could manage to do spot marching with minimal support. On the same day, she was also instructed to activate her quadriceps in set of 2 with 5 repetitions each, every one hourly. Then spot marching and heel raises were started. But she was finding it difficult to do that due to grade 2 pedal edema. Also right knee buckling was present. On the same day in the second session, ambulation (4-5 steps) was started with moderate support. On POD-8, along with all the exercises, spot marching was initiated; she could perform it well with moderate support in the morning session. In the afternoon session she could complete 10-12 steps of ambulation with minimal- moderate support. And in the

evening session she could walk around 20-25 steps very well with moderate support. On POD-9, ambulation was measured which was found to be 1680 meters at a stretch, which she could complete with moderate support along with all the exercises. Same line of physiotherapeutic treatment continued for the next 2 days with progression in the distance ambulated and reduction in support. On POD-12 all the exercises were continued; along with that Proprioceptive Neuromuscular Facilitation (PNF) technique to improve lung expansion post ICD removal was started. Intercostals stretch and sustained manual pressure were given in sets of 3 with 5 repetitions in each set. Ambulation further progressed with minimal to no support. On POD-14 she was able to ambulate independently, distance of 3360 meters at a stretch, under supervision. All the vitals were stable pre and post treatment as shown in Table-2. On POD-1 to POD-6 systolic blood pressure was found to be 130 mm of Hg with diastolic blood pressure to be 70-80 mm of Hg and on POD-8 to POD-15 systolic blood pressure was in the range of 100- 110 mm of Hg with diastolic blood pressure to be 60-80 mm of Hg.

Table-1 Outcome measures used

Outcome measures	POD-9	POD-14
New York Heart Association (NYHA)	Grade 3	Grade 2
Chest Expansion values	0.5” 0.5” 0.4”	0.8” 0.8” 0.7”
Single Breath Count (SBC)	8	10
Sit to stand test (30 seconds)	3 repetition	7 repetition
Distance ambulated at a stretch	1680 m	3360 m
Rate of perceived exertion(6-20 Point BORG scale)	Fairly light	Very light

Table -2 Vital parameters pre and post treatment sessions

Parameters	Day 1		Day 6		Day 8		Day 12		Day 15	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST	PRE	POST
Pulse Rate (beats per minute)	90	130	68	95	78	100	89	100	73	90
Respiratory Rate (breaths per minute)	20	16	20	20	20	16	20	14	16	16
SPO2	100% on 10 litres o2		100% on 10 litres o2 via nasal prongs		100 % on 6 litres O2 via nasal prongs		96 % on 2 litres O2 via nasal prongs		91 % on Room air	

DISCUSSION

Pulmonary complications are the second most prevalent factor that can lead to major

morbidity after cardiovascular event, causing up to one in four fatalities within a week of operation.⁽⁷⁾ Post pulmonary

complications (PPCs) is defined as “pulmonary anomalies that cause observable illness or dysfunction and have a negative impact on the patient's clinical outcome.”⁽⁶⁾ The prevalence of PPCs varies greatly, ranging from 2% to 40%. 5–10% of patients undergoing non-thoracic surgery and 22% of high-risk patients experience post-operative pulmonary complications. The incidence can be between one and two percent, even for minor procedures.⁽⁷⁾

Cardiac rehabilitation is a multidisciplinary approach that includes the physician, nurse, physical and occupational therapists, exercise physiologist, nutritionist, and social service caseworker. Cardiac rehabilitation starts in the hospital and extends into the maintenance phase.⁽⁸⁾ Phase 1 is the in hospital phase of cardiac rehabilitation which is administered 2–4 times a day of hospital stay. Recommended intensity is rate of perceived exertion (RPE) less than equal to 13 on scale of 6–20 or HR rest + 30 beats as the arbitrary upper limit. In hospital phase is usually 3–4 days in uncomplicated patients.⁽⁹⁾

Early mobilisation after cardiac surgery has been proven to be of benefit in terms of length of hospital stay, functional capacity as well as prevention of postoperative complications.⁽¹⁰⁾ Early cardiac rehabilitation has been proven to be effective in significantly improving physical function and has been associated with a higher survival rate following valvular surgeries.⁽¹¹⁾ Supervised physical activity in the early postoperative period after cardiac surgery has accounted for approximately 50% of overall physical activity. Physical therapy also results in improvement in postoperative physiological functional capacity (PPFC) and reduces the length of stay in hospital.⁽¹²⁾

CONCLUSION

Regular supervised sessions of physiotherapy helped our patient to overcome respiratory complications in the immediate post operative period. It helped in improving her lung expansion, her

cardiovascular endurance as well as functional capacity. It also helped in reducing the fatigue and rate of perceived exertion levels.

Declaration by Authors

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