



INTERNATIONAL JOURNAL OF PHARMACEUTICAL RESEARCH AND BIO-SCIENCE

INFLUENCE OF GRADED AEROBIC EXERCISE ON EXERCISE TOLERANCE IN POST SURGICAL MITRAL VALVE DISEASE INDIVIDUAL – A PROSPECTIVE RANDOMIZED OPEN LABEL STUDY

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Accepted Date: 24/06/2016; Published Date: 27/06/2016

Abstract: **Back ground** Exercise training as a part of cardiac rehabilitation aims to restore patient with heart disease to health. However six minute walk test is clinically used to assess the functional status of patients with cardio pulmonary disease, It has also been used to assess result of cardiac rehabilitation. **Objective:** To investigate the effectiveness of graded aerobic exercise protocol on six minute walk test, NYHA functional classification in post-surgical mitral valve disease individuals. **Methods:** Randomized open label studies, post-surgical mitral valve disease individual patients from the age group of 20-60 years, were recruited from SVIMS hospital Tirupathi. Exclusion criteria were severe mitral regurgitation, double valve replacement, 100 patients were randomized either into group I or group II. The group I underwent a 12 week structured graded individually exercise program either in the form of hospital –based exercise or home based exercise. The group II received only non-graded (not individualized) exercise training. Six minute walk test, NYHA was measured before, at the time of discharge and after 12 weeks of exercise training for two groups. **Results:** Repeated measures ANOVA was used to compare mean values of continuous variables between baseline and at the time of discharge and Three months after surgery for each parameter. Comparison of means between groups was done by the unpaired student's t test. Comparison of proportions such as NYHA Class between groups was done by the Chi- square test. Mean age of the subjects was 40.18±10.29 years. There was a significant increase in six minute walk distance in the group I(360.08±27.23 to 522.10±46.29) compared to with the group II (358.54± 12.78 to 443.82 ± 33.41) p <0.001 and NYHA functional class were significant improvement in both groups. **Conclusion:** Structured graded aerobic exercise training significantly improves six minute walk distance, NYHA in post-surgical mitral valve disease individuals.

Keywords: Rheumatic heart disease, graded exercise, NYHA class and exercise tolerance.



PAPER-QR CODE

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Access Online On:

www.ijprbs.com

How to Cite This Article:

C. Shanthi, IJPRBS, 2016; Volume 5(3): 165-173

INTRODUCTION

Rheumatic heart disease has been a major public health problem in India^{1,2}. All the valves of the heart gets affected in rheumatic heart disease. Mitral valve is the most common valve which gets affected in RHD³. Rheumatic heart disease usually has multi valvular involvement with 38% affecting mitral valve causing stenosis and 35 % affecting aortic valve, 6% affecting tricuspid valve⁴. It is estimated that 15.6-19.6 million people suffer from RHD worldwide with approximately 282,000 new cases⁵. On the contrary, in the developing countries the prevalence is still high, of more than 10 cases per 1000 in India and 4-10 cases per 1000 in China, Russia, Africa, Australia⁶. Ethiopia has highest estimated prevalence of RHD in the world⁷. India contributes to nearly 25% to 50% of the global burden of RHD⁸. In 2003, 45% of cardiac admission in tertiary care teaching hospital in Orissa were due to RHD⁹. Agarwal et al. in his population survey which was done in 2000 in North India reported a high prevalence of RHD i.e, 6.4/1000¹⁰. The prevalence of RHD was 0.5/1000 in children belonging to age group of 5-15 years¹¹. Mitral stenosis has been associated with decrease in the exercise intolerance which results in impaired activities daily of living. Physio therapy plays a major role to improve physical activities of daily living and functional activities. A few studies were done on graded protocol for post operative MVR. Hence there was a need of study to find out the influence of graded aerobic exercise on exercise tolerance in post surgical mitral valve disease individual.

MATERIALS AND METHODS:

STUDY DESIGN

The study procedure was designed in accordance with Helsinki declaration this was open label study. patients who gave a written inform consent were allocated into group I and group II by means of lottery method .

STUDY SUBJECTS

Mitral valve disease patients those who were clinically diagnosed and admitted in cardiothoracic ward at a tertiary care centre, Sri Venkateswara Institute of Medical Sciences University, Tirupathi, Andhra Pradesh.

INCLUSION CRITERIA

Mitral stenosis with LVEF >45% before surgery, mitral stenosis with moderate to trivial mitral regurgitation, mitral stenosis with atrial fibrillation. mitral stenosis with or without trivial to moderate MR with mild aortic valve disease. Calcific mitral valve, mitral restenosis, post PTMC or post CMV or post OMV. mitral stenosis with tricuspid regurgitation, Age range : 20 – 60 age group and Both sex.

EXCLUSION CRITERIA

Isolated severe Mitral regurgitation, Mitral stenosis with severe mitral regurgitation, Ischemic Mitral regurgitation, Mitral valve replacement with coronary artery bypass grafting, Double valve replacement, Congenital mitral valve disease, Patients more than 60 years less than 20 years. Chronic Obstructive Pulmonary Diseases, Atrial septal defect with Mitral stenosis,

Study period

Exercise protocol was administered for 12 weeks post surgically. The sampling and data record was done from 2010 to 2014.

METHODOLOGY:

Graded aerobic exercise protocol for group I:

During their hospital stay, subjects in the group I received a physical therapist supervised phase I stabilization protocol (Table I). After discharge they received a structured aerobic exercise training (Phase II) lasting for 12 weeks (TableII)

During phase I, the patients were exercised in hospital under supervision and monitoring. The exercise prescription was individualized for each patient’s tolerance. If patients was able to perform a particular step without any discomfort a faster progression through the steps was made. On the contrary, if a patients was unable to perform a particular step, the progression was not made until the patient was comfortable at that level.

After discharge from the hospital, Group I patients were expected to attend supervised exercise sessions two times per week for three months in physiotherapy outpatient department. Exercises included 10 to 15 minutes of warm up. The total exercise time was approximately 40 minutes. This was followed by a cool down period of 10 -15 minutes.

Phase I (0-8 days) - stabilization phase.

Table No.1 Wenger’s protocol¹²:

Step I	1-2 days	Stabilization phase	Incentive spirometry in the form deep Breathing exercises, active assistive to active range of motion. Postural awareness and care with monitoring.
Step II	3-5 days		In sitting-Repeat exercises from step1 and increase repetitions to5-10 Mobilization of Upper limb, monitored Ambulation of 100 feet as tolerated.
Step III	6- 8 days		In standing-step 1+2 Active upper limb, Trunk exercises, ankle exercise 5-10 repetitions twice daily Out of intensive care unit, pre discharge plan, monitored ambulation 200 feet twice daily or as tolerated.

- Phase II (Training phase)

Graded aerobic exercise programme.

TABLE – II Exercise protocol

	Warm up	Target zone	Cool- down
	Walk slowly	Walk briskly	Walk slowly
Week 1	5 minutes	5 minutes	5 minutes
Week 2	5 minutes	7 minutes	5 minutes
Week 3	5 minutes	9 minutes	5 minutes
Week 4	5 minutes	11 minutes	5 minutes
Week 5	5 minutes	13 minutes	5 minutes
Week 6	5 minutes	15 minutes	5 minutes
Week 7	5 minutes	18 minutes	5 minutes
Week 8	5 minutes	20 minutes	5 minutes
Week 9	5 minutes	23 minutes	5 minutes
Week 10	5 minutes	26 minutes	5 minutes
Week 11	5 minutes	28 minutes	5 minutes
Week 12	5 minutes	30 minutes	5 minutes

Group II-Non graded Exercises

They were advised to carry on the home program of aerobic exercises (non graded) The exercises were not monitored, nor individualized according to exercise tolerance. Exercises prescribed for group II included breathing exercises, upper limb and lower limb exercises, and walking within the limit of tolerance. Patients were asked to record day in and day out activities and limitations faced by them in a log book.

RESULTS:

Table 3: Demographic characteristics of subjects in the group II and group I

Group	N	Age	Gender	
			Male	Female
Group-II	50	40.18±10.29	24 (48.00%)	26(52.00%)
Group-I	50	39.86 ±9.22	20(40.00%)	30(60.00%)

Interpretation of results Table reveals that gender wise percentage distribution of subject in each group in group 1 males are of 40% and females are of 60% out of 50 samples.

Whereas in group II males are of 48% and females are of 52% out of 50 samples

Table 4: Mean of 6 MWT in the Group II and Group I

PARAMETER		GROUP I MEAN ±SD	GROUP II MEAN ±SD	P VALUE I & II	GROUP
6MWT	BASE LINE	360.08±27.23	358.54±12.78	0.718	
	AT DISCHARGE	327.28±19.38	320.14±13.39	0.035	
	POST	522.10±46.29	443.82±33.41	0.000	

Interpretation of results- Baseline both groups were matched for their 6 MWD but following 12 wks of treatment the patient in group I i.e those who put on graded exercise had increased more than 79 meter from baseline where as the patient on non graded exercise .

So finally there was significance difference between two groups resulting in better 6 MWT.

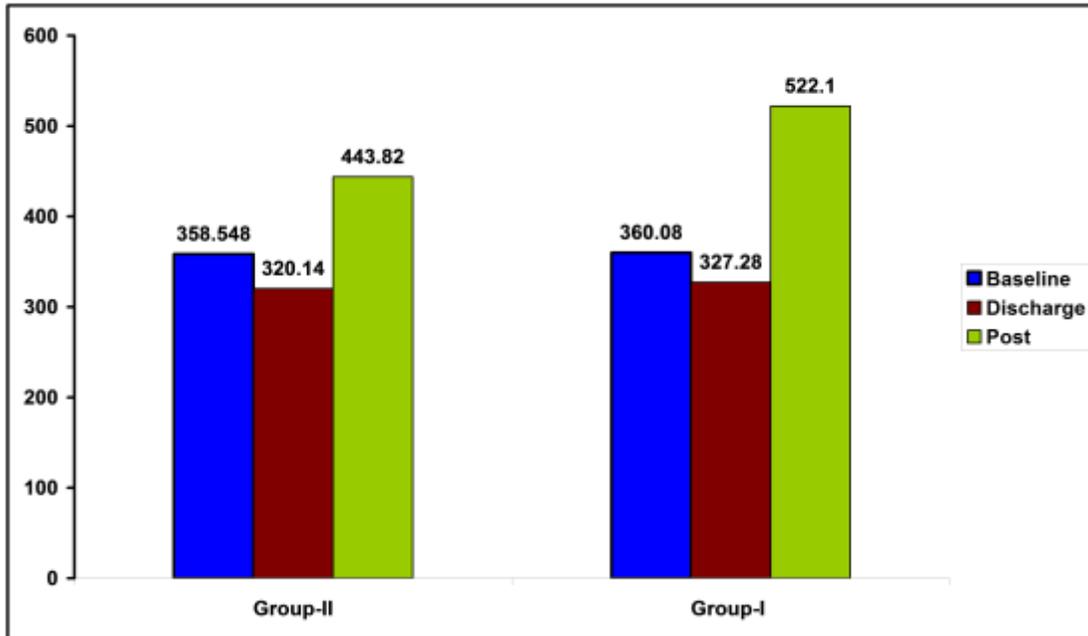
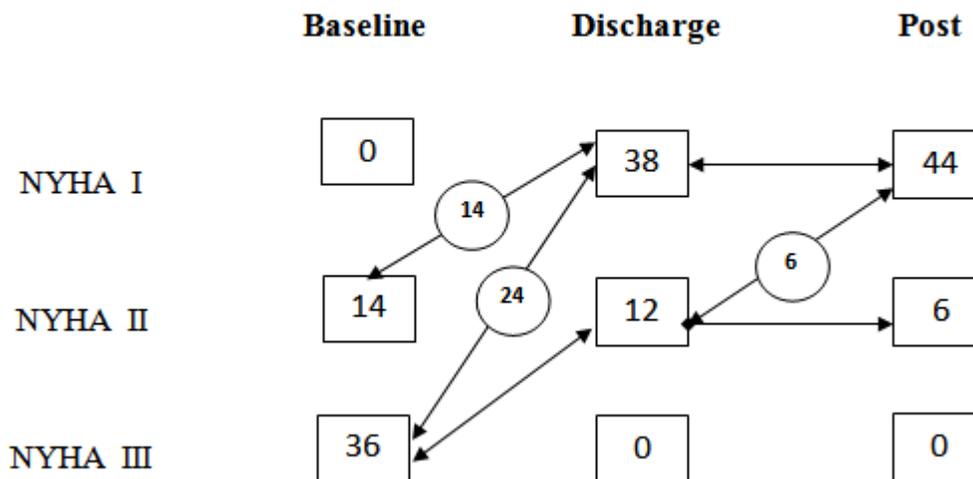
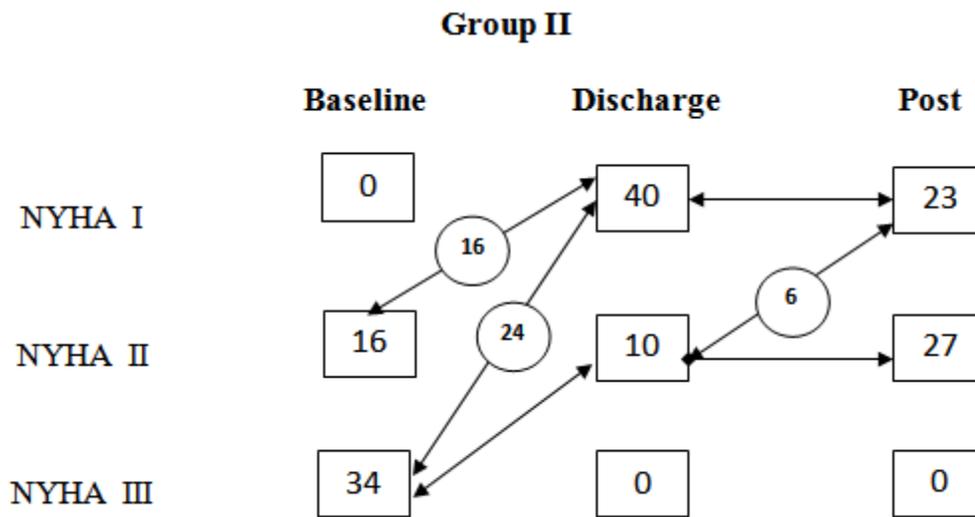


Fig:1 Comparison of mean values of 6 MWT between in Group II and Group-I

Chi-square analysis is done between two group I & II

NYHA in the Group I





DISCUSSION:

The demographic data collected in the present study shows 56% were female and 44% were males.

BASELINE, DISCHARGE AND POST INTERVENTION VALUES OF 6MWT BETWEEN GROUP II AND GROUP- I

In this study, graded aerobic exercises showed significant improvement in the group I than group II. Lucas de, Assis Pereira C et al. studied (6mwt) in the post operative cardiac surgery patient and found significant distance difference¹³.

Habel verge et al. in their study revealed that cardiac rehabilitation improved physical working capacity by 25 % after undergoing an eight week programme where as control subject do not improve.¹⁴ Possible mechanism behind this contribute to improved functional capacity in patients with heart failure who participated in cardiac rehabilitation, central hemodynamic mechanisms include increases in peak cardiac output, heart rate, and stroke volume. Peripheral mechanisms include improved endothelial vasodilator function, increased cellular oxidative enzyme activity, a greater oxygen extraction from the blood, and an improved neuro humoral axis. These peripheral adaptations result in an increased oxygen delivery or utilization in the metabolically more active skeletal muscle, thus delaying reliance on anaerobic metabolism. Exercise training has beneficial effects on skeletal muscle directly by improving function Training increases the number and size of mitochondria and the number of aerobic system.

BASELINE, DISCHARGE AND POST INTERVENTION VALUES OF NYHA BETWEEN GROUP II AND GROUP- I

In Group I before operation thirty six patients (72%) were in grade III, fourteen (28%) were in grade II and no patients were in grade I of the NYHA. At discharge thirty eight patients(76%) were in grade I, twelve (24%) in grade II and no patients were in grade II of the NYHA. after three month forty four patients(88%) were in grade I six patients(12%)were in grade II and no patients were in grade II of the NYHA. In Group II before operation thirty four patients(68%) were in grade III, sixteen (32%) were in grade II and no patients were in grade I of the NYHA. At discharge forty patients(80%) were in grade I, ten(20%)were in grade II and no patients were in grade II of the NYHA. after three month twenty three patients(46%) were in grade I, twenty seven patients(54%)were in grade II and no patients were in grade III of the NYHA. Similar finding where reported by Lim *et al*¹⁵. H Ramington *et al*¹⁶. Dilip *et al*. Maurice Enriquez-Sarano *et al*¹⁷

Conclusion

We conclude that rejecting null hypothesis and accepting alternate hypothesis in post-surgical mitral valve disease individuals. Therefore, we strongly concluded that the graded aerobic exercise has been effective as compared to non-graded exercise in the following parameters.

Longer 6min walk distance, Improved NYHA functional status.

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