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EFFECTS OF SUPERVISED EXERCISES ON FUNCTIONAL EXERCISE CAPACITY IN POST SURGICAL SINGLE VALVE REPLACEMENT INDIVIDUALS WITH POST-OPERATIVE ANAEMIA- A PILOT STUDY

Physiotherapy & Rehabilitation

Dr. N. Kavitha* Faculty, College Of Physiotherapy, SVIMS University, Tirupati. *Corresponding Author

Dr. M. Suresh Kumar Faculty, College Of Physiotherapy, SVIMS University, Tirupati.

ABSTRACT

Rheumatic fever is a primary cause of valvular heart diseases, leading to stenosis and regurgitation of the heart valves. When these valves become diseased, valve replacement surgeries are commonly performed using either mechanical or bioprosthetic valves. Postoperative anemia, defined as a hemoglobin level below 10 g/dL within 48 hours after surgery, can affect patients who undergo valve replacement. These patients may experience symptoms such as fatigue, weakness, dizziness, shortness of breath, and reduced exercise capacity when mobilized. Cardiac rehabilitation plays a crucial role in helping patients cope with both physiological and psychological limitations. In a recent pilot study conducted at SVIMS, 20 subjects who underwent single valve replacement surgery (aged 30-60 years) were enrolled. The study involved informed consent and categorized subjects into two groups: Group I: Subjects with hemoglobin levels between 8 and <9 g/dL for females and 9-<10 g/dL for males. Group II: Subjects with hemoglobin levels >9-12 g/dL for females and >10-13 g/dL for males. These groups were further divided into supervised and unsupervised subgroups. Functional exercise capacity was assessed using the six-minute walk test at discharge, 1 month, and 3 months follow-up. Cardiac rehabilitation was administered to the supervised groups during the postoperative phase and after discharge, spanning a duration of 3 months. Notably, the supervised groups showed an increase in functional exercise capacity among post-surgical single valve replacement individuals with postoperative anemia.

KEYWORDS

valve replacement ,supervised exercises, post-operative anaemia , haemoglobin, six minutes walk test, cardiac rehabilitation

INTRODUCTION

Valvular heart disease is one of the common causes of cardiac morbidity and mortality.(1) The most common cause of valvular heart diseases is rheumatic fever which causes either valvular stenosis or regurgitation(5). In India, the prevalence of rheumatic fever / rheumatic heart disease among the school children is 2-10 per 1000,with a mean of 6 per 1000.(2) The adult average ranges between 123 and 200 per 1,00,000 population, when compared to the industrialised nations where the prevalence is <0.05 per 1000.(3,4)

Rheumatic fever is caused by a streptococcal infection of pharynx.(30). Single or repeated attacks of rheumatic fever leads to a systemic immune, rheumatic heart disease(30). The valve leaflets become deformed, rigid, the commissures fuse, and there is resultant fusion and shortening of chordae tendinae(30). The valves become incompetent ,stenosed and lead to regurgitation and requires repair or replacement. Valve replacement surgeries are usually performed to replace the diseased valves by a mechanical or bio prosthetic valve (6). The bio prosthetic valves are from porcine pericardium or cadaveric homografts and artificial valves are bileaflet,, tilting disc etc(31)

Anaemia is a common finding in patients undergoing valve replacement surgery and is a risk factor for morbidity and mortality.(7) The world health organization anaemia standard is Haemoglobin less than 11.5g/dl for 11 years, less than 12g/dl for above 12 years in females and 13g/dl in post menopausal females and men of all ages.(8)

Post-operative anaemia has been reported in up to 90% of individuals undergoing major surgeries. Post operativeanaemia is defined as a haemoglobinlevel < 10g/dl within the 48-hour postoperative period.(28) According to the WHO, postoperative anaemia could be classified as mild (haemoglobin 110–119 $g.l^{-1}$ in women and 110–129 $g.l^{-1}$in men, respectively (110–119/129 $g.l^{-1}$)), moderate (haemoglobin 80–109 $g.l^{-1}$) or severe (haemoglobin< 80 $g.l^{-1}$) (32)The reasons are peri-operative blood loss at the localised site, frequent blood sampling and inadequate nutritional uptake.(15,14,18). The contributing factors for post operativeanaemia are excessive fluid administration which may lead to haemodilution , other nutritional deficiencies and pharmacological interactions. (33). Anaemia leads to symptoms such as fatigue, weakness, dizziness, shortness of breath and decreased exercise capacity, due to the reduced oxygen carrying capacity of the red blood cells.

Cardiac rehabilitation plays a vital role in enhancing the psychosocial and vocational status of patients undergoing valve replacement surgeries and helps them to cope up with the physiological and psychological limitations through exercise, education and counselling.(9). There are ample number of literatures that substantiate the effectiveness of low intensity aerobic exercises from Phase I to Phase IV of cardiac rehabilitation. Monitoring the exercise capacity of the patients is important to observe the long term effects of cardiac rehabilitation.

Methodology :

The study was conducted in SVIMS Cardiovascular and Thoracic surgery department. The study protocol was accepted by the SVIMS – Institutional Ethical committee. IEC.No.1180. 20 Individuals who met the inclusion criteria were educated in the pre operative phase about cardiac rehabilitation and the study was explained to them and an informed consent to participate in the study was obtained. Inclusion criteria-Haemoglobin level < 9 gm/dl in females and< 10 gm/dl in males (Group I) and > 9 -12 gm/dl in females and > 10 -13 gm/dl in males (Group II).Age 30 to 60. Left ventricular ejection fraction > 45 %.Mitral valve replacement.Mitral valve replacement with tricuspid valve repair. Tricuspid Annuloplasty. Exclusion criteria-Resurgery, Concomitant AVR, CABG,Mitral valve repair, Recent MI, Recent cardiac failure, Post CVA, Musculoskeletal disorders, Renal patients, COPD, Cardiomyopathies, Individuals who are not willing to give consent. Outcome measures: To measure the functional exercise capacity through six minute walk test in meters. On the zero post-operative day Participants were categorised as Group I and Group II The subjects in Group I and II were randomly (lottery method) divided into supervised group and unsupervised group . An assessment consisting of anthropometric measurements, Functional exercise capacity through six minute walk test, was performed at discharge, 1 month and 3 months follow up. Cardiac rehabilitation in the post-operative phase and after discharge for a duration of 3 months was administered for the supervised groups and advised for the un-supervised groups.

RESULTS :

T test was used to analyse the data. All continuous data are described using mean (SD). A p value of <0.05 was considered statistically significant. An increase in functional exercise capacity in the follow-up at1st month and 3rd month in all the groups.

Table 1. Descriptive Statistics

Groups		Mean	Std. Deviation
Anaemic Supervised	Discharge	214.12	16.59
	1 Month	343.17	36.78
	3 Month	503.17	85.41
Anaemic Unsupervised	Discharge	205.30	14.27
	1 Month	335.59	36.08
	3 Month	504.13	40.68

Non-Anaemic Supervised	Discharge	226.39	21.32
	1 Month	376.07	26.23
	3 Month	592.94	56.36
Non-Anaemic Unsupervised	Discharge	218.37	13.40
	1 Month	357.75	17.56
	3 Month	530.97	12.18

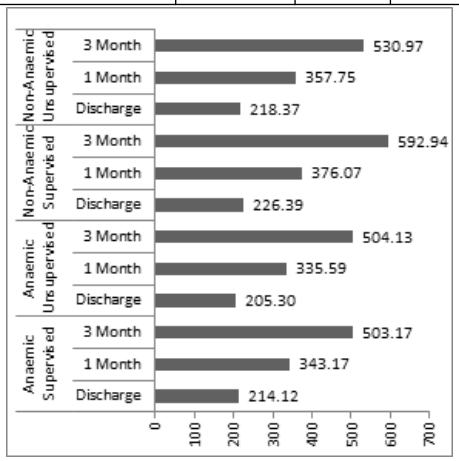

Fig. 1 Graph representing descriptive means of Six Minutes Walk Test of the 4 Groups

The above graph (Fig. 1) displays the descriptive means of the two groups. An increase in the performance is seen across all the 4 sub-groups. With a better increase in the Anaemic supervised and Non-Anaemic supervised groups.

Table 2.Multiple Comparisons

Groups		Mean Difference	P Value
Anaemic Supervised	Anaemic Unsupervised	5.15 ±20.07 (-55.23,65.52)	1.00
Anaemic Supervised	Non-Anaemic Supervised	-44.98± 20.07 (-105.35,15.40)	0.24
Anaemic Supervised	Non-Anaemic Unsupervised	-15.54±20.07 (-75.92,44.84)	1.00
Anaemic Unsupervised	Non-Anaemic Supervised	-50.13±20.07 (-110.5,10.25)	0.14
Anaemic Unsupervised	Non-Anaemic Unsupervised	-20.69±20.07 (-81.06,39.69)	1.00
Non-Anaemic Supervised	Non-Anaemic Unsupervised	29.44±20.07 (-30.94,89.81)	0.97

Values are mean difference ± std.err .95% confidence intervals in parenthesis. The mean difference is significant at the .05 level

The effect of treatment on the functional exercise capacity through six minutes walk test for all four groups was examined by repeated measures ANOVA and it revealed, that there was no statistically significant increase in the functional exercise capacity within or between any subgroups(Table 2). However an increase in the mean distance covered by the Anaemic supervised and Non-Anaemic supervised groups was noticed (Table 1).

DISCUSSION :

Supervised exercises improved both functional exercise capacity and quality of life in single valve replacement patients with postoperative anemia. The study included individuals with and without postoperative anemia.

Liqing Zeng, Peng Pi et al. (38) conducted a study that highlighted the benefits of exercise on post-operative valvular heart disease patients, showing significant improvements in their exercise capacity. Their findings emphasize the importance of incorporating exercise regimens in the recovery process of these patients to enhance their physical capabilities. .Li, M.M., Miles, S., Callum, J. et al. (36), in their review article, identified post-operative anemia as a significant risk factor that adversely affects functional outcomes in patients who have undergone cardiac surgery. Their review underscores the need for careful management of anemia to optimize post-operative recovery and functional health.

In our study, we observed that supervised exercises increased the functional exercise capacity in individuals who underwent single valve replacement and were also experiencing post-operative anemia. These findings are in line with those of Marco Ranucci et al. (27), who documented similar improvements in walking distances among cardiac patients with post-operative anemia, with distances increasing from 258 ± 107 meters at baseline to 415 ± 73 meters at the time of discharge.

This alignment of results across different studies highlights the critical role of exercise and anemia management in enhancing the recovery and functional outcomes of cardiac surgery patients.This is one of the fewer studies which has dealt with post-operative anaemia on single valve replacement individuals in India. The limitations of our study is the smaller sample size in each sub-groups, which might have contributed to the increase in functional exercise capacity across all groups and limits the generalizability of the results. Future research might be conducted on larger sample sizes and inclusion of other parameters like haemoglobin levels, quality of life etc.

CONCLUSIONS

This study examined the effects of supervised and unsupervised cardiac rehabilitation on individuals with post-operative anaemia after single valve replacements. Cardiac rehabilitation requires increased oxygen consumption by the muscles. The results show that supervised exercise improves the functional exercise capacity and quality of life of the participants more than unsupervised exercise. Therefore, supervised and tailored cardiac rehabilitation is beneficial for individuals with post operative anaemia after single valve replacement surgery.

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