

Comparison of Sit to Stand Test and Two Minute Walk Test for the Evaluation of Functional Status in Post Cardiac Valve Replacement Surgeries

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ABSTRACT

Background: Valve problems are congenital or acquired and require surgical correction or replacement of the valve. Post surgery functional capacity reduces causing reduction in muscle strength and functional capacity. There being dearth in literature and evidences the study aimed at assessing the functional status of this population.

Materials and methodology: Twenty Two participants were included who underwent a valve replacement surgery. Each participant performed sit to stand and two minute walk test. Individuals were haemodynamically stable were included. Individuals with locomotor disability were excluded from study.

Results: The unpaired t test was used to compare the vital parameters between both tests. The p values of Heart rate pre was (0.37) and post (0.128). The p values of RR pre and post was (1.00) and post (0.02). The p values of systolic blood pressure were (0.961) and (1.00) respectively. The p values of saturation pre and post was (0.329) and (0.34). The p values of Rating of Perceived exertion pre and post showed (0.45) and (0.186). All parameters showed an insignificant result in their respective p values stating both tests are comparable with each other. Except for respiratory rate which in post test value showed (p=0.02) was significant.

Conclusion: Heart rate, arterial blood pressure and the Rating of Perceived Exertion (RPE) showed insignificant readings of their respective p values stating they being comparable with each other. Hence sit to stand and two minute walk test is comparable and can be used for evaluation of functional status.

Key words: Two minute walk test, Sit to Stand Test

INTRODUCTION

Valvular heart disease is a leading cause of morbidity and mortality and it ranks among the major cardiovascular afflictions. Valve problems may be congenital or acquired. Symptoms of valve diseases include shortness of breath and/or difficulty in breathing, weakness or dizziness, discomfort in chest, palpitations, oedema, wheezing after limited physical

exertion, chest pain, fatigue, fever and weight gain. ^[1] Severely damaged heart valves that cause significant valvular disease, not amenable to repair due to extensive calcification, infection, or congenital malformation, are replaced by a prosthetic valve. ^[2] Valve replacement is performed through a median sternotomy. Patients show dysfunctions such as reduction in lung volume and capacity,

which can contribute to changes in the ventilation/perfusion relationship^[3]

The primary focus of phase I cardiac rehabilitation is the management of symptoms, prevention of future coronary events, and improvement of patients' quality of life. Strong evidence states that cardiac rehabilitation programs reduce mortality, decrease symptoms, and improve exercise tolerance.^[4] The 2 minute walk test is the most time efficient test for evaluating functional status in cardiac patients. The distance walked in 2 minutes also correlates well with the longer 6 and 12 minute walk distances. The 2MWT is quick and easy to administer. It also correlates well with the physical functioning of cardiac patients.^[5-6] The sit to stand manoeuvre is a common activity of daily living. The ability to stand up from a chair is an important component to maintaining independence.^[7]

Two minute walk test is performed in a corridor and requires more space. The sit to stand test is a test which can be performed in minimal space and can be monitored more efficiently. A common disadvantage is that sometimes not much space is present in a hospital to carry out the walk test. In the sit to stand test limited space is used to assess the functional status of the patient.

Therefore, the study aimed to evaluate the functional status by the sit to stand test and two minute walk test in valve replacement patients, and determine whether they are comparable with each other or not.

MATERIALS AND METHODOLOGY

Approval was obtained from the ethics committee. The inclusion criteria for the study were participants that have undergone a single valve replacement surgery and those who were haemodynamically stable in the post operative phase. Subjects with existing neuromuscular disease, or limitation to walking were excluded from the study. An informed written consent was obtained from all subjects. A total of twenty two

participants, (13 males and 9 females) were recruited for the study. The vitals were measured at the beginning and end of the test to note the changes after the tests.

Sit to Stand Test: The STS test was performed on a chair where the subjects were asked to complete the sitting and standing positions correctly without using the arms for support while rising and sitting. Seated subjects were asked to come forward on the chair until their feet were flat on the floor and were also asked to fold their arms across their chest. They were asked to stand and sit down landing firmly and comfortably on the chair. The subjects were instructed by the command "Go!", they would stand and sit down again, repeating the procedure as many times as possible in 30 seconds period at a self-selected speed which they feel is safe and comfortable until they wished to stop.^[7] At the beginning and end of the test the vital parameters i.e. heart rate, respiratory rate, blood pressure, rating of perceived exertion (RPE) and SPO2 were noted.

2 Minute Walk Test: Subjects were instructed to walk in a corridor of 15 m long at their own pace, while attempting to cover as much distance as possible in the allotted 2 minute time. If the subject felt uneasy or experienced any discomfort during the test they were asked to stop and start walking again. The subjects stopped walking at the end of 2 minutes and their vitals were noted. At the beginning and end of the test the vital parameters i.e. heart rate, respiratory rate, blood pressure, rating of perceived exertion (RPE) and SPO2 were noted.^[12]

Both the tests were performed prior to discharge on the same day with a gap of an hour.

RESULTS

The statistical analysis was done using the SPSS software (version 26). The unpaired t test was used for the comparison between the two tests. The mean age was

49.68 +/- 4.7. The demographic details are presented in table 1:

Table 1: Demographic Characteristics

Characteristics	Mean ± SD
Age	49.68 +/- 4.7
Gender	13 Males, 9 Females

The mean readings of vital parameters of the 2 minute walk test is shown in table 2

Table 2: Pre And Post Parameters Of 2 Minute walk test

PARAMETERS	2 MWT	
	PRE	POST
HR (beats/min)	89 ± 5.75	96 ± 5.83
RR (breath/min)	23 ± 1.15	28 ± 1.63
SBP (mm Hg)	122 ± 8.91	132 ± 8.99
DBP (mm Hg)	80 ± 5.40	82 ± 5.39
SPO2	94 ± 0.99	91 ± 1.11
RPE	6.04 ± 0.21	11.09 ± 0.29

Table 3 shows the mean readings of vital parameters taken during the Sit to stand test

Table 3: Pre And Post Parameters Of STS

PARAMETERS	STS	
	PRE	POST
HR (beats/min)	89 ± 5.6	92 ± 6.5
RR (breath/min)	23 ± 1.19	25 ± 1.95
SBP (mm Hg)	122.18 ± 7.9	126.04 ± 8.2
DBP (mm Hg)	78.9 ± 4.80	78.1 ± 5.1
SPO2	95 ± 1.06	94.40 ± 0.9
RPE	6.09 ± 0.29	9.32 ± 9.43

Unpaired t test was applied between the two tests and their *p* values were obtained. The tests were said to be comparable if the *p* value ≤ 0.05: significant.

Table 4: *p* values of Pre Test and Post test between the 2 MWT and STS

PARAMETERS	PRE	POST
HR	0.317	0.128
RR	1.00	0.02*
SBP	0.961	0.100
DBP	0.639	0.646
SPO2	0.329	0.34
RPE	0.45	0.186

p value ≤ 0.05: significant

Table 4 shows *p* values of pre test reading between the sit to stand and 2 minute walk test. All the values are insignificant stating that they were comparable with each other. Table 5 also shows *p* values of post test readings between the sit to stand and 2 minute walk

test. All the values are insignificant stating that they were comparable with each other except for the RR *p* value which was shown to be 0.02 stating it to be significant.

DISCUSSION

Functional capacity is known as the ability to perform activities of daily living which requires a sustained aerobic metabolism. The integrated efforts and health of the pulmonary and cardiovascular, and musculoskeletal system show an individual's functional status. [9] Cardiac surgery causes clinical as well as functional complications mostly post-operative complications which can lead to increase in the morbidity and mortality and also increase the time to return back to their productive life. [10]

Certain dysfunctions can be seen such as reduction in lung volume capacity which contributes to development of atelectasis and changes in ventilation/perfusion relationship. This goes to an extent to reduce the endurance of the patient and is also influenced by some factors like physical postoperative inactivity, prolonged bed rest that can also lead to muscle de-conditioning and also loss of muscle strength. [3]

The STS being a measure of mobility related function and physical performance is used in cardiac rehabilitation programs for measuring the functional status. It is simple to perform and takes few minutes to administer. [8] The STS shows high reproducibility and also shows high correlations with the other tests being performed such as 6 MWT and stair climbing. [7]

The 2MWT shows an alternative to the 6MWT as the distance covered during the 2 MWT correlates highly with the 6 MWT. It closely reflects everyday activity and common form of locomotion. [14] Therefore, it was considered that both these tests could determine the functional status as in patients undergone valve replacement. In order to compare the two tests, we explored the results obtained from both tests by the

main functional parameters of the subjects (heart rate, respiratory rate blood pressure, rate of perceived exertion, saturation level).

When the unpaired t test was applied, the p values of pre and post test for the HR were not significant stating that both the tests are comparable with each other. Individually seen, the HR mean value was higher of the 2 MWT as compared to STS test. This shows that the STS test had a lesser response to the heart rate when compared to the 2MWT.

Higher the intensity of exercise, higher rate of respiration is seen. Lower intensity of exercise shows lower rates of respiration. The pre test p value for the RR showed a statistically insignificant result but the result of the post test value showed a statistically significant result. This states that the post test p value was not comparable. But on comparing both the mean values as seen in table 2 and 3 there was lesser rise in the RR of the STS as compared to 2MWT. The p values of the pre test and post test values of the SBP were not significant showing it to be comparable with each other.

The response of systolic blood pressure was reduced while performing the STST as compared to the 2 MWT. The diastolic blood pressure (DBP) shows a different response than SBP response to exercise. The p values of the DBP pre test and post test here are insignificant showing them to be comparable with each other. There was not much difference of rise seen in the levels of the mean values of diastolic blood pressure when the two tests were performed.

An important indication while performing any exercise testing is the signs of hypoxemia. A continuous measurement of the spo₂ is very essential. The p values of saturation levels were also insignificant stating them to be comparable as well. While performing the 2 MWT there was more drop in the saturation levels as compared to STS test. Overall, it shows that the STS does provoke a lesser oxygen desaturation and the absence of desaturation

in STS test shows that its test can evaluate the exercise capacity more accurately. [24]

The RPE value indicates the individuals rating of the exertion encountered during the test. It is helpful in establishing appropriate exercise prescription intensity levels, progression within an exercise program and as an outcome measure. [22] In the present study, we found out that rating of perceived exertion (RPE) the p values when compared statistically showed it to be insignificant. Hence resulting it to be comparable with each other. The (RPE) in the patients in this study was shown to be lower when the sit to stand test was performed as there is a lower ventilatory demand and higher ventilatory reserve during the test.

CONCLUSION

From the findings it can be concluded that the heart rate, the arterial blood pressure and the Rating of Perceived Exertion (RPE) showed insignificant readings of their respective p values stating that they are comparable with each other. Hence the STS and 2 MWT are comparable tests and can be used to evaluate the functional performance.

Clinical Implication

The STS test can be used for the evaluation of patients in phase 1 of Cardiac Rehabilitation. It is a simple test and uses minimum amount of space. It is a good functional outcome tool.

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