



COMPARISON OF VO₂ MAX VALUES ESTIMATED FROM SIX-MINUTE WALK TEST AND QUEEN'S COLLEGE STEP TEST IN PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY PATIENTS

Physiotherapy & Rehabilitation

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ABSTRACT

Introduction: Exercise testing after MI can be performed before or soon after hospital discharge for prognostic assessment, activity prescription and evaluation of further medical therapy or interventions. Sub maximal tests may be used before hospital discharge at 4 to 6 days after acute MI. submaximal exercise tests are generally considered safer and more convenient options, especially for sedentary populations or individuals with chronic health conditions since they can eliminate the need to obtain medical approval. **Material And Methodology:** 6MWT and QCST was performed using specific standard guidelines by ACSM in post PTCA patients. Pre and post vitals and Vo₂ max was calculated by the given formulas from ACSM and McArdle. **Statistical Analysis:** Statistical analysis done using SPSS software version 29. Mann Whitney test was applied for the comparison of VO₂ max values **Conclusion:** QCST better estimates VO₂ max values then 6MWT in PTCA patients.

KEYWORDS

Six-minute walk test (6MWT, SMWT), Queen's college step test (QCST), Percutaneous Transluminal Coronary Angioplasty (PTCA), Sub maximal exercise testing.

INTRODUCTION

The highest rate of oxygen consumed by the body during exercise (VO₂max) is frequently used to assess cardiorespiratory fitness^(1,2) It is defined as the maximum amount of oxygen utilized by the body during strenuous exercise.⁽¹⁾ Maximal oxygen uptake is the product of the maximal cardiac output(L bloodmin) and arterial venous oxygen difference(ml O₂ per L blood)⁽³⁾

However, the gold standard assessment of VO₂max requires the expertise, highly trained personnel and costly labs. This method involves direct measurement of pulmonary gas and requires the participants to engage in a maximal exercise test until exhaustion. To improve accessibility, several VO₂max prediction models have been developed. Some even eliminate the need for exercise testing, but yield inconsistent results⁽⁴⁾ On the other hand, indirect estimations of VO₂max commonly involve maximal or submaximal exercise tests without direct pulmonary gas measurement. Although, evidence suggests that the risk of adverse events in maximal exercise tests are minimal under appropriate supervision⁽⁵⁾; submaximal exercise tests are generally considered safer and more convenient options, especially for sedentary populations or individuals with chronic health conditions since they can eliminate the need to obtain medical approval, as suggested with common exercise preparticipation health screening algorithms⁽⁶⁾

Peak oxygen uptake (peak V_{O2}) and age-gender adjusted peak oxygen uptake (peak %V_{O2}) measured during cardiopulmonary exercise testing have been widely used to assess functional capacity and predict survival in patients with advanced, symptomatic heart failure⁽³⁾ The value of early angioplasty in the treatment of acute myocardial infarction depends not only on its ability to establish reperfusion of the infarct-related artery but also on its ability to ensure continued patency of this vessel⁽⁴⁾

Exercise testing after MI can be performed before or soon after hospital discharge for prognostic assessment, activity prescription and evaluation of further medical therapy or interventions. Sub maximal tests may be used before hospital discharge at 4 to 6 days after acute MI⁽⁵⁾ The 6-Minute Walk Test (6MWT) is the most validated field test⁽⁶⁾ in cardiorespiratory diseases and is widely used to assess functional exercise capacity and prognosis since it is reproducible and well tolerated in patients with chronic heart failure⁽⁷⁾ and with CAD⁽⁸⁾ Among various indirect protocols the Queen's College step test(QCST) is the simplest one, but its applicability has not yet been explored in an Indian population.⁽⁹⁾ The Queen's College step test is recommended as a valid method for evaluation of cardiorespiratory fitness in a young sedentary population of West Bengal, India.⁽¹⁰⁾

QCST is externally paced and 6MWD is self paced. So need of this study is to compare the VO₂ max values from both test and to find out which is the more effective test for the same

Material & Methodology:

After ethical approval and written informed consent of 40 Post PTCA patients from municipal hospital Ahmedabad having EF > 50%, fitness

given by cardiologist and Willingness to participate were included in study. Patients having Other respiratory, musculoskeletal, neurological disorders, balance problem, Diabetic patients, Ejection fraction < 50% were excluded. HR, SpO₂ monitor, Borg's scale of RPE, stop watch, 16.25 inch step for step test, metronome, 30 meter runway for 6MWT was used in this study.

The Six minute walk test was performed using ATS guidelines and distance covered was noted and used in prediction equation for calculation. Prediction equation for 6MWT: VO₂ max(ml/kg/min) = 0.03 * distance (in meters) + 3.98⁽³⁾ Queens College step test was done using wooden stepping bench of 16 inch along with metronome and stop watch. Heart rate obtain was used in prediction of equation and VO₂ max was calculated. Prediction equation for QCST VO₂ max(ml/kg/min)= 55.232(0.096*pulse rate in beats/min)⁽¹¹⁾

Statistical analysis & Result:

Statistical analysis done using SPSS software version 29. Mann Whitney test was applied for the comparison of VO₂ max values. Mean age & duration PTCA was 56 years and 25 days respectively. Mean LVEF was 55.81 %

Table:1 Vo₂max values from two submaximal exercise test

Vo ₂ max	Mean±SD (ml/kg/min)	U value	P value
6MWT	17.68 ± 1.0	0.000	≤0.001
QCST	41.18 ± 0.77		

Table:2 Post vitals from two submaximal exercise tests.

Test	HR (mean ± SD)	RR (mean± SD)	RPE (mean± SD)
6MWT	112.14± 7.68	30.28±5.42	11.67±0.65
QCST	152.67± 8.66	40.14±6.40	18.52±0.51

DISCUSSION:

Submaximal field exercise tests provide a feasible, safe, easy-to-administer, and inexpensive technique for the prediction of VO₂max.3 Among field walking tests, the 6-minute walk test (6MWT) is used because of its ease of administration⁽¹²⁾

The aim of this study was to compare the Vo₂ max values obtained from two submaximal exercise testings. Six-minute walk test (VO₂max-6MWT) from ACSM guidelines and Queens college step test Vo₂max from McArdle WD (11) A total of 40 males participated in the study. All the participants were male due to availability of participants. All subjects were completed both the tests successfully.

There was significant difference found in VO₂ max values. The Vo₂ max values obtained from 6MWT and QCST were 17.68 ± 1.0 ml/kg/min & 41.18 ± 0.77 ml/kg/min respectively. That shows there is a significant higher Vo₂ max obtained from QCST. Even according to table 2. There was significant difference in post vitals from both the tests. Post vitals were at higher side in QCST despite the shorter duration of QCST.

So present study justifies that, QCST is more challenging than 6MWT,

although both the tests are submaximal. This is supported by the findings that the rise in HR, RR and RPE is also significant in post QCST than post 6MWT. We can assume that walking (during the 6MWT) and getting up on a step (during the QCST) involve different biomechanics and metabolic requirements. That can explain the difference for heart rate and fatigue for the lower limb reached

There was no external forcing while doing 6MWT where as QCST was metronome paced and subjects were forced to pace with the metronome beat. As subject can pace with the speed in 6MWT so Vo2max values falls lower side, where as QCST is metronome paced and subjects has to pace with speed hence QCST takes subject to their submaximal level without self pacing. That's why QCST shows higher values in Vo2max than 6MWT.

So good effort was noted in QCST than in 6MWT. Chatterjee et al (2004) did a study on thirty male college students to calculate indirect PVO₂ max values and found that there was no statistical difference ($p \geq 0.10$) in VO₂ max values and PVO₂ max values calculated indirectly. (10)

CONCLUSION:

QCST better estimates VO2 max values then 6MWT in PTCA patients.

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