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Effect of Cardiac Rehabilitaion in Percutaneous Transluminal Coronary Angioplasty (PTCA)

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Abstract

Introduction: Percutaneous transluminal coronary angioplasty (PTCA) also called percutaneous coronary intervention (PCI) is a minimally invasive procedure to open blocked or stenosed coronary arteries allowing unobstructed blood flow to the myocardium. Cardiac rehabilitation is important role for more successful PTCA. To increase cardiac efficiency, increase exercise tolerance or endurance and to get the effective and better results.

Case presentation: 45 years male admitted in emergency department with chest pain during gym workout. Blood reports, ECG, ECHO, and angiography done in investigation. In angiography RCA 99% stenosis and in D1 ostial 60% stenosis. PTCA procedure done with DES to RCA. Twelve days after surgery patient came for cardiac rehabilitation in physiotherapy department.

Management and Outcome: warm-up, aerobic period, and cool-down, abdominal exercise, strengthening exercise included in cardiac rehabilitation. Pulse rate, blood pressure, respiratory rate, Spo_2, Rate of perceived exertion scale and 6-min walk test, distance, vo_2 max calculated as an outcome.

Discussion: Cardiac Rehabilitation is most important for faster recovery as well as better efficiency for cardiac endurance. Maximum oxygen uptake increased after cardiac rehabilitation protocol.

Conclusion: Cardiac Rehabilitation is helpful for more successful PTCA.

Key words: Cardiac Rehabilaition,PTCA,VO2 max, Aerobic exercise.

Introduction

Percutaneous transluminal coronary angioplasty (PTCA) also called percutaneous coronary intervention (PCI) is a minimally invasive procedure to open blocked or stenosed coronary arteries allowing unobstructed blood flow to the myocardium[1]. Cardiac rehabilitation is important role for more successful PTCA. To increase cardiac efficiency, increase exercise tolerance or endurance and to get the effective and better results.

The blockages occur because of lipid-rice plaque within the arteries, diminishing blood flow to the

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myocardium. The accumulation of lipid-rich plaque in the arteries is known as atherosclerosis. When atherosclerosis affects the coronary arteries, the disorder is known as coronary artery disease.

Patient with CAD usually present with exertional chest pain, or with dyspnea with exertion. In acute myocardial infarction, there is plaque rupture with platelet aggregation, and acute thrombus formation, which results in a sudden occlusion of coronary artery. These patients present with acute chest heaviness, diaphoresis, and nausea. Urgent PTCA is often required to limit myocardial damage.[2]

Cardiac rehabilitation is a complex, interprofessional intervention customized to individual patients with various cardiovascular disease such as ischemic heart disease, heart failure, and myocardial infarctions, or patients who have undergone PTCA or CABG.[3]

Cardiac rehabilitation has three phase: Warm-up, Aerobic Exercise, and Cool-down. In three phase of cardiac rehabilitation build cardiac muscle endurance and strength. Cardiac Rehabilitation is must for better results of successful surgery. Cardiac Rehabilitation plan according to FITT Protocol.

Case Presentation

45 years male admitted in emergency department with chest pain during gym workout. Weight is 76.8kg, Height is 170.5cm, BMI is 25kg/m^2. Blood reports, ECG, ECHO, and angiography done in investigation. In ECG, inferior wall MI was primary diagnosed with ST segment elevated. ST segment elevation settled with Thrombolysis.

In ECHO, left ventricle mid and basal inferior septum, infero-lateral wall are hypokinetic. Mildly depressed left ventricle systolic function. LVEF-45-50%. In Angiography, LAD-D1 shows 60% ostial stenosis, RCA- dominant vessel shows proximal 30-40% stenosis and mid RCA 99% stenosis. Final Diagnosis was CAD, PTCA. Patient underwent PTCA to RCA through right radial artery.

Patient taken tab. brilinta, ecosprin, roseday, cytogard, restyl, pruease medicine after discharge. Twelve days after surgery patient went for cardiac rehabilitation in physiotherapy department. On room air patient vitals was PR-63bpm,SPO2-98%, BP-120/82mmhg, RR-22bpm, RPE-0(MBS). Patient had complain of difficulty in continuous walking for 10 mins, stair climbing. No other symptoms like chest pain, breathlessness. No other history like smoking, tobacco chewing.

Management and Outcome:

Primary outcome was six minute walk test, distance ,vo_2max on first, fifth, and tenth day. Pre and Post exercise vitals taken for basic assessment. vitals observed on Telemetry. In Cardiac rehabilitation, planned according to FITT protocol.

First day: outcome measurement:

Six minute walk test: 28 laps

Distance: 840m

VO_2 max: 44ml/kg/m^2

Warm-up period:

All Upper limb and Lower limb big muscle flexibility ROM exercise, Segmental breathing exercise, Thoracic expansion exercise. Its taken 20 minutes.

Exercise Program:

According to patient resting heart rate calculated was Target heart rate. intensity depend on target heart rate. For aerobic exercise used walking, Treadmill, cycle, arm-ergometry. Alternative days use different types of aerobic exercise. Its taken 35 minutes.

Cool- down period:

All Upper limb and Lower limb big muscle stretching exercise, diaphragmatic breathing exercise, pursed-lip breathing exercise, relaxation exercise. Its taken 15 minutes.

On fifth day outcome measurement:

Six minute walk test: 32 laps

Distance: 960m

VO_2 max: 52 ml/kg/m^2

After fifth day of exercise program start strengthening exercise in large muscle with 1.5 kg weight. Increased frequency and time of same type and intensity program.

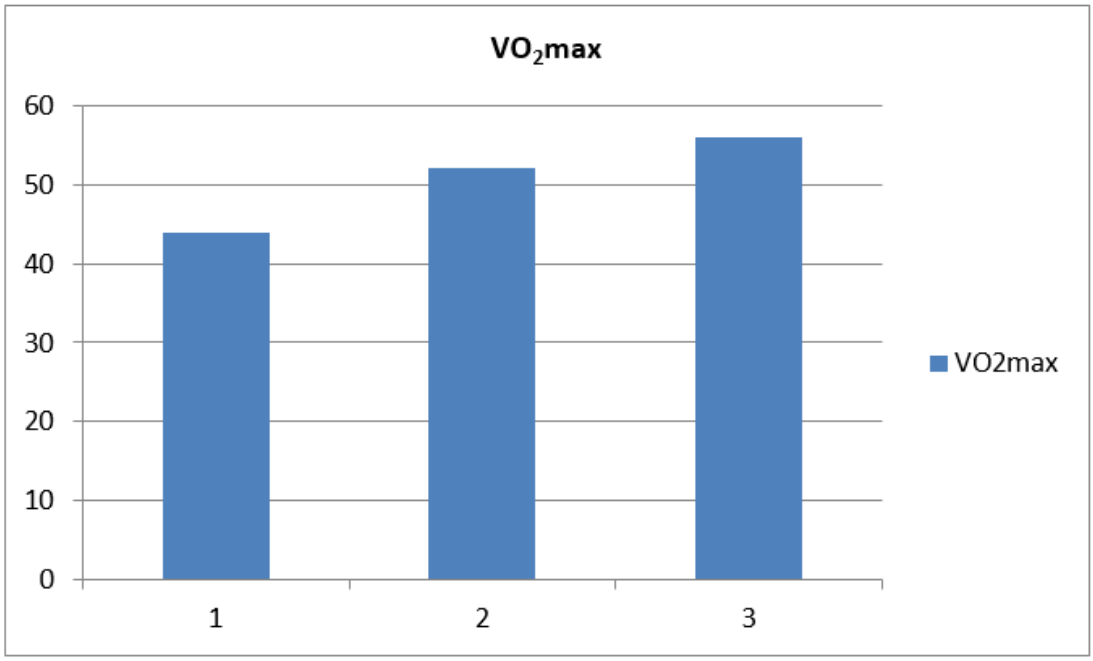
On Tenth day outcome measurement:

Six minute walk test: 52 laps

Distance: 1027m

VO_2 max: 56 ml/kg/m^2

Mean of Pre and Post exercise period vitals was Pre pulse rate: 58b/min, blood pressure:130/86mmHg,Respiratory Rate:21b/min,SPO2:98%, RPE: 0.Post pulse rate:75b/min, blood pressure: 129/80mmHg,Respiratory Rate:20b/min, SPO2:98%,RPE:0.



Graph 1: vo2 max on first, fifth, and tenth day.

Discussion

This study results suggested that cardiac rehabilitation was very helpful for successful PTCA. Maximal oxygen uptake of myocardium muscle was increased day by day because of cardiac rehabilitation. Muscle contraction ,relaxation, training, flexibility was part of cardiac rehabilitation.

In this study, calculated vo2 max use of six-minute walk test. Six –minute walk test is very accurate, cost- effective test to calculated maximum oxygen uptake.

Central and peripheral adaptations in oxygen transport and utilisation are training-modality dependant variables. Interval training has the potential to improve both central and peripheral components of VO2 max whereas continuous training (endurance training at the same speed/ intensity) is mainly associated with greater oxygen extraction. The systemic and cardiac specific effect of exercise (e.g. skeletal and cardiac muscle hypertrophy and hyperplasia, improved vascular flow, vasoreactivity, angiogenesis, insulin sensitivity, oxidative phosphorylation, stroke volume, cardiac output and cardiac protection by less ischaemic injury etc.). Exercise physiological knowledge can help patients to achieve higher VO2 max, less hospital admissions and a lower morbidity and mortality.[4]

Increased cardiac output is the most important cardiovascular response to physical activity. This is caused by an increase in heart stroke volume and heart rate which can reach about 95% of its maximum level. Oxygen consumption in the body depends on how fast and slow the cardiovascular system in delivering oxygen to tissues is, it is closely related, therefore VO2Max values can be limited by the cardiovascular system. Maximum oxygen consumption (VO2 Max) in several milliliters of oxygen per kg of a person's body weight according to their needs or body composition, therefore oxygen consumption in the

human body varies. For example, someone with a high body fat percentage requires a lower VO2 Max consumption. Therefore, reducing fat in the body can be one solution to increase maximum oxygen consumption without additional exercise. A trained person will have a lower resting heart rate than an untrained person. People who are trained will have a lower resting heart rate, which can result in higher VO2max values.[5]

Squires et. al., demonstrated that exercise training results in an improvement in systemic oxygen transport, a reduction in myocardial oxygen requirement for a given amount of work and a decrease in the extent of ischemia during physical activity.[6]

During exercise, cardiovascular parameters change to supply oxygen to working muscles and to preserve perfusion of vital organs. The vascular resistance and heart rate are controlled differently during physical activity. At the onset of exercise heart rate (and cardiac output) elevation is mediated mostly by central command signals via vagal withdrawal. As work intensity increases and heart rate approaches 100 beats/ min, sympthatic activity begins to rise, further increasing heart rate and plasma norepinephrine concentric and eccentric vessels in visceral organs.[3]

Conclusion

We concluded that cardiac rehabilitation is helpful for faster recovery after PTCA. Cardiac rehabilitation can change any cardiac surgery results. Its protocol based on patient's condition. Only cardiac rehabilitation can improve myocardium muscle strength. Proper protocol, frequency, training can improve patient's condition, willpower, decrease patient's exertion level and muscle strength. Cardiac rehabilitation also improve patient's mental and psychological status.

Limitation:

Use long term cardiac rehabilitation protocol.

Can use other test for vo2 max calculation.

Ethical clearance: Approved by Fortis Hospital ethical committee

Conflict of interest: None

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