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Effects Aerobic Exercise on VO2 Max in Phase 2 Rehabilitation Post Percutaneous Coronary Intervention (PCI) at Dr Moewardi Hospital

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Abstract

Introduction Coronary Heart Disease (CHD) is a disease that occurs due to the formation of atherosclerotic plaques in the lumen of blood vessels.

Case Presentation: Aerobic exercise was carried out for 2 months and evaluated every month. Aerobic exercise is carried out based on the Cardiovascular Rehabilitation Manual compiled by the Indonesian Association of Cardiovascular Specialists. Based on the Cardiac Rehabilitation Manual, patients who will be given aerobic exercise are examined first using the 6 minute walking test to determine the dose to be used for exercise. Exercise intensity using the target Heart Rate Reserve (HRR).

Management and Outcome: Aerobic exercise can increase VO2 Max from before being given aerobic exercise until the second month evaluation. This proves that Aerobic exercise can increase VO2 Max in coronary heart patients after Percutaneous Coronary Intervention.

Discussion: The mechanism underlying the increase in VO2Max due to the intensity of aerobic exercise in the elderly is an improvement in the adaptation mechanisms at the central and peripheral levels to exercise. The increase in VO2Max that occurs after endurance training in healthy elderly men is due to an increase in peak stroke volume and a lower CO difference, thereby increasing A-VO2Max..

Conclusion: After the patient on behalf of Mrs. S carried out a phase 2 rehabilitation program with Aerobic exercise or walking exercise for 2 months, the results obtained were a fairly good increase in VO2 Max in post-Percutaneous Coronary Intervention patients.

Keyword: Coronary Heart Disease (CHD), Percutaneous Coronary Intervention (PCI), Aerobic Exercise Effect on VO2 Max



Introduction

Coronary heart disease (CHD) is the leading cause of death from all cardiovascular diseases worldwide (Wilkin et al, 2017). Based on data from the WHO in 2012 it was stated that along with the increasing mortality rate of non-communicable diseases, the mortality rate of cardiovascular disease also increased. This is because cardiovascular disease is a type of disease that contributes to the largest mortality rate in the non-communicable disease group. The mortality rate for cardiovascular disease in the world in 2008 was 17 million deaths. This figure is also expected to increase from year to year to reach 25 million deaths by 2030 (WHO, 2012). In Indonesia, based on data from the Indonesian Ministry of Health (Depkes RI) in 2006 it was stated that the type of disease that contributed to the highest mortality rate in the cardiovascular disease group was coronary heart disease. Coronary heart disease contributes to the mortality rate of 26.4% of the total deaths in Indonesia (Depkes RI, 2006).

Khan et al in their research estimate that globally, CHD affects about 126 million people (1,655 per 100,000) which is about 1.72% of the world population. Nine million deaths are caused by CHD globally. Men are affected more often than women, and the incidence usually begins in the fourth decade and increases with age. We estimate that the current prevalence rate is 1,655 per 100,000 population and is expected to exceed 1,845 by 2030. The overall age-adjusted prevalence of CHD is 3.5%: men 4.8%, women 2.6%. Patients with CHD caused by physical inactivity were reported to be 17.5% and patients with a family history of CHD were found to be 18%. Other risk factors for CHD detected in this study were: overweight or obesity 59%, abdominal obesity 57%, hypertension 28%, diabetes 15%, and high total cholesterol 52% (Khrisnan et al, 2016). In Indonesia, based on data from the Basic Health Research (Riskesdas) in 2013, it was also stated that the prevalence of coronary heart disease in Indonesia based on a doctor's diagnosis was 0.5%, while the prevalence of coronary heart disease based on a doctor's diagnosis or symptoms was 1.5% (Ministry of Health). RI, 2013).

Coronary Heart Disease (CHD) is a disease that occurs due to the formation of atherosclerotic plaques in the lumen of blood vessels. This causes disruption of blood flow, thereby inhibiting oxygen delivery to the myocardium (Ysahjehan et al, 2020). To overcome these problems Percutaneous Coronary Intervention (PCI) is one of the main methods for the treatment of coronary heart disease (CHD), because in general, PCI has lower rates of periprocedural side effects and provide faster recovery (Sang-Cheol Cho et al, 2020). However, although reductions in cardiovascular disease mortality have been observed over the last decade, PCI still carries a significant risk of stent restenosis and recurrent ischemia during follow-up (chenying et al, 2018).

Cardiac rehabilitation is recommended for secondary prevention by emphasizing various approaches to cardiovascular risk management (Ambrosetti et al). Consistent physical exercise can be an integral part of cardiac rehabilitation (CR) (Kaminsky et al, 2016). For people diagnosed with CHD, physical exercise can improve their cardiorespiratory fitness, quality of life and reduce mortality and the number of rehospitalizations (Heran et al, 2011).

Aerobic exercise is one of the physical exercises that physiotherapists can give to patients during cardiac rehabilitation. Aerobic exercise can be done by swimming, jogging, cycling, and walking. According to Chul kim et al 2012 aerobic exercise performed with walking exercise can increase Vo2 Max in cardiac rehabilitation patients. Based on the



background above, it can be concluded that this study aims to determine the effect of aerobic exercise in increasing Vo2 in patients.

Case Presentation

The research sample was taken from one of the post PCI phase 2 cardiac rehabilitation patients at Dr Moewardi General Hospital. The patient in this study had the initials Mrs. S is 64 years old with a weight of 49 kg, height 150 cm, waist circumference 50 cm, and BMI 21.77 kg/m². The patient's blood pressure before the study was 122/63 mmHg, and the respiratory rate was 71 x/minute. When the patient first came to the rehabilitation room, the patient felt dizzy and a little weak, but the patient was able to walk on his own without assistance. Mets of the patient after 6MWT was 6, 91, but the patient had a history of a low percentage of Ejection Friction with a value of 30-40%.

Aerobic exercise was carried out for 2 months and evaluated every month. Aerobic exercise is carried out based on the Cardiovascular Rehabilitation Manual compiled by the Indonesian Association of Cardiovascular Specialists. Based on the Cardiac Rehabilitation Manual, patients who will be given aerobic exercise are examined first using the 6 minute walking test to determine the dose to be used for exercise. Exercise intensity using the target Heart Rate Reserve (HRR). In this study, the dose of exercise that will be used is:

1. First month training

In the first month the exercise dose is 40%-50% and a distance of 900-1200 m for 30-60 minutes/day, then the intensity of the exercise is HRR 112-117 x/minute or if the Rate of Perceived Exertion (RPE) scale is 12-13 (moderate), the exercise is done 24 sessions within 1 month when at home or can be modified to 6 sessions per week.

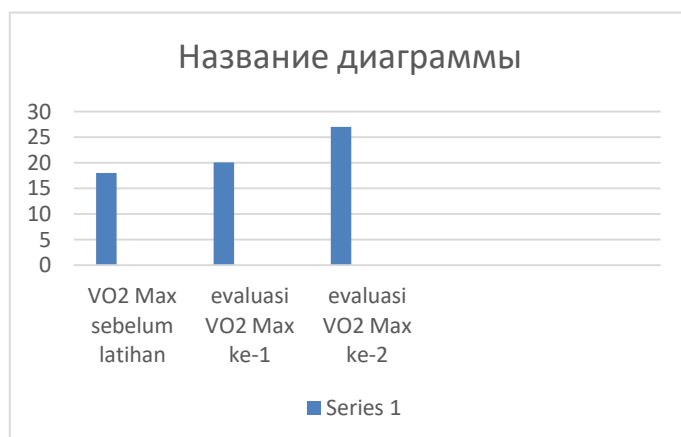
2. First month training

In the second month the training dose is 40%-50% and a distance of 1200-1800 m for 30-60 minutes/day, then the intensity of the exercise is HRR 112-117 x/minute or if the Rate of Perceived Exertion (RPE) scale is 12-13 (moderate), the exercise is carried out as many as 24 sessions within 1 month when at home or at home. modified to 6 sessions per week.

This type of aerobic exercise in cardiac rehabilitation is walking exercise according to the doses given above. The therapist asks the patient to comply with the procedures that have been given to the patient in order to get maximum results.

Management and Outcome

Hasil evaluasi setelah diberikan latihan aerobik dihitung dengan Vo2 max saat berjalan. Evaluasi dilakukan dibulan pertama dan kedua setiap pasien telah melakukan latihan aerobik selama 1 bulan sesuai prosedur yang diberikan terapis. Adapun hasil evaluasi Vo2 max (jalan) yaitu :



Gambar 1 Aerobic Exercise Evaluation

The graphic above shows an increase in VO₂ Max from before being given aerobic exercise until the second month evaluation. This proves that Aerobic exercise can increase VO₂ Max in coronary heart patients after Percutaneous Coronary Intervention

Discussion

In Aerobic exercise there are strength, endurance, flexibility, balance, speed, agility, stamina, coordination exercises which are important points in physical exercise. 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 (Pria et al., 2013) 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. A decrease in heart rate can occur after a person does routine or frequent physical exercise for a certain time, this is a form of adaptation of the body to physical exercise. As a result, trained people will work more effectively than untrained people (Faruk, 2013).

The mechanism underlying the increase in VO₂Max due to the intensity of aerobic exercise in the elderly is an improvement in the adaptation mechanisms at the central and peripheral levels to exercise (Pramuno., 2013). The increase in VO₂Max that occurs after endurance training in healthy elderly men is caused by an increase in peak stroke volume and a lower CO difference so that it can increase A-VO₂Max (Vigorito & Giallauria, 2014). With regular exercise, they will be able to take more oxygen from the capillaries, therefore they especially the elderly who have a good VO₂Max will be able to activate the physiological organs of the body so that the capacity of these organs can be maintained properly. 60-70% per maximum pulse (Wara, 2012)

Conclusion

After the patient on behalf of Mrs. S carried out a phase 2 rehabilitation program with Aerobic exercise or walking exercise for 2 months, the results obtained were a fairly good increase in VO₂ Max in post-Percutaneous Coronary Intervention patients. The disadvantage of this study is that it only uses 1 research sample and the patient's home



program does not receive special monitoring from a physiotherapist, so this study cannot be a strong reference. For further researchers, it is recommended to improve the quality of this research to the type of Quacy Experiment research and physiotherapists provide special monitoring when patients are given intervention.

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