CARDIOPULMONARY EXERCISE TESTING: UTILITY IN RESEARCH AND PATIENT CARE

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ABSTRACT: Cardiopulmonary exercise testing is a non-invasive physiological test which incorporates the conventional method of exercise stress test with a more advanced breath-to-breath ventilatory analysis. The physiological parameters obtained from the test help to illustrate the cardiovascular, respiratory and metabolic responses to physical exertion. Individual’s functional capacity and aerobic fitness is reflected by the value of maximal oxygen consumption (VO₂ max) obtained from the cardiopulmonary exercise test. This non-invasive and sophisticated test is regarded as a valuable assessment tool in research and clinical practice. Cardiopulmonary exercise test has been extensively utilized to define the mechanisms of exercise intolerance in various clinical disorders, to evaluate responses to therapy and indicate disease prognosis. Emerging data obtained from the use of the cardiopulmonary exercise testing in the research field, has led to its extensive clinical usage. It is now utilized as an integral part of the patients’ clinical evaluation in the field of respiratory and cardiovascular medicine, sports medicine, surgery as well as occupational and rehabilitative medicine. It has a clinical role in assessing patient's functional capacity, monitoring disease progression and response to therapy, predicting prognosis, and perioperative morbidity and mortality, as well as constructing and monitoring training and rehabilitative programs. This article aims to give an overview of the physiological profiles obtained from cardiopulmonary exercise testing, its methodological aspects, as well as its utility in research and clinical practice. (JUMMEC 2003-2005; 8: 9-22)

KEYWORDS: Cardiopulmonary, exercise, physiology, respiratory medicine, oxygen consumption

Introduction

Exercise is the most common form of physiological stress encountered by the body. It requires a coordinated interaction of virtually all body systems to effectively adapt to the physiological and metabolic demands incurred. The cardiopulmonary system is one of the crucial systems in the body which copes with the major demands of exercise, ensuring adequate oxygen delivery to the working muscles. Exercise test has traditionally been regarded as a valuable tool to evaluate cardiac perfusion and function under controlled conditions, due to its ability to detect cardiac dysfunction under stress, which may not necessarily be present at rest. Recently, the incorporation of ventilatory gas analysis into the conventional method of exercise testing has further expanded its utility in research and clinical field. Formal cardiopulmonary exercise testing is a non-invasive and sophisticated physiological testing technique, which includes the recording of the exercise ECG, heart rate and blood pressure responses to exercise, minute ventilation, and allows calculation of the subject's maximal oxygen consumption. It provides a comprehensive functional assessment, that helps to define the relative contribution of various human physiological systems (cardiovascular, pulmonary and muscle metabolism) in determining exercise performance.

At the early phase of exercise, there is a gradual increase in oxidation of substrate such as carbohydrate and fat for regeneration of high energy in the form of...