

Cardiopulmonary exercise testing

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CPET is the gold standard measurement of a patient's fitness. The oxygen consumption ($\dot{V}O_2$) and carbon dioxide production ($\dot{V}CO_2$) of the patient are measured while they undergo a 10-minute period of incrementally demanding exercise (usually on a cycle ergometer) up to their maximally tolerated level (Figure 21.9). CPET is based on the principle that, when a subject's delivery of O_2 to active tissues becomes inadequate, anaerobic metabolism begins; lactate is buffered by bicarbonate and the resulting CO_2 increases out of proportion to the escalation in physical difficulty and O_2 consumption. The 'anaerobic threshold' (AT) is the $\dot{V}O_2$ in mL/kg/min at which this occurs. Peak oxygen consumption is also measured. This is the end-product of a subject's combined respiratory, cardiac, vascular and musculoskeletal fitness, and subjects with either an AT below 11 mL/kg/min or a $\dot{V}O_2$ peak below 15 mL/kg/min are at higher risk of morbidity and mortality after major surgery. Patients who are found to be unfit can be enrolled in pre-habilitation. This involves supervised exercise over 4-6 weeks with the aim of improving the patient's AT and reducing their risk profile. Where CPET is not available, the low-cost incremental shuttle walk test (ISWT) is an attractive option. It depends on the patient's ability to walk at increasing speed over a flat surface. Patients who fail to achieve 350 metres on the ISWT have been shown to be at higher risk for oesophageal surgery. It correlates well with $\dot{V}O_2$ peak but does not identify all low-risk patients as it is subject to patient motivation and is affected by sex, age and height.

1 MET = 3.5 mL $\dot{V}O_2$ /kg/min (oxygen consumption by a 40-year

old, 70-kg man at rest) 1 MET = eating and dressing 4 METs = climbing two flights of stairs 6 METs = short run



10 METs = able to participate in strenuous sport Figure 21.9 Cardiopulmonary exercise testing (CPET). . Note

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