

GET MOVING WITH HEART FAILURE
Heart Failure Awareness Week 2017 · February 12-18, 2017

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Cardiopulmonary Exercise Testing: Assessing Functional Capacity Nurse Talking Tip Sheet

This Nurse Tip Sheet was developed by AAHFN as resource in facilitating patient education. It provides additional information so that the Nurse can supplement patient teaching with the corresponding Patient Tip Sheet. A list of resources is provided for additional information.

Background: The Cardiopulmonary Exercise Test (CPET or CPX) is an important stress test for the evaluation of patients with heart failure (HF). A CPET assesses how well the heart, lungs, and muscles are working individually, and how they are working together. Most exercise tests produce a single measurement; CPET quantitatively links metabolic, cardiovascular, and pulmonary responses to exercise. Since a CPET uses a stationary bicycle, this allows for a wider range of patients to complete an exercise stress test that may not otherwise be able.

Exercise intolerance is a cardinal manifestation of HF. CPET assesses maximum exercise capacity through measurement of peak oxygen uptake (VO_2). Strong correlations are found between maximal cardiac output, peak VO_2 and mortality risk. Peak VO_2 values are important to delineate the appropriateness of advanced HF interventions such as heart transplantation and ventricular assist devices. The full cardiopulmonary system is assessed during a CPET by measuring the amount of oxygen the body is using, the amount of carbon dioxide it is producing, the breathing pattern, and electrocardiogram (EKG).

The CPET can detect the following conditions:

1. **Heart Failure** – The inability of the heart to pump enough blood to meet the needs of the body's other organs (ex: diastolic heart failure, systolic heart failure).
2. **Myocardial Ischemia (Heart disease)** – Reduced blood flow to one or more parts of the heart due to coronary artery blockage or spasm. Blockage of either the large blood vessels (macrovascular) or small blood vessels (microvascular) can be detected by CPET.
3. **Heart Valve Dysfunction** – Valves do not open and close properly to promote the flow of blood inside the chambers of the heart (ex: mitral valve prolapse, stenosis).

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4. **Chronotropic incompetence** – The inability of the heart to increase the rate of contraction due to medication or intrinsic factors.
5. **Pulmonary Ventilation Disorder** – Lungs are not able to utilize enough air to meet the body's demands (ex: asthma, COPD, emphysema).
6. **Pulmonary Circulation Disorder** – Inability of the body to mobilize oxygen from the lungs into the bloodstream (ex: blood clot in lungs, pulmonary vascular disease, scarring in the lungs, heart failure).
7. **Muscle Metabolic Disorders** – Inability of the muscle cells to use oxygen from the bloodstream to produce energy for the working muscle tissues.
8. **Deconditioning** – Poor cardiovascular fitness that can be improved with exercise.

Besides detecting problems in multiple body systems, the CPET is also used to monitor the progression of known medical conditions and to determine responses to medical treatments. In comparison, traditional treadmill stress tests are primarily indicated for the detection of ischemia (decreased blood flow to the heart muscle).

The CPET is performed on a stationary bicycle. Many patients are more comfortable riding the bicycle than walking on a treadmill. During the test various pieces of equipment are used to monitor the body's response:

- **Face mask:** This monitors the oxygen used, carbon dioxide produced, and the breathing pattern. The mask is placed over the mouth and nose (similar to an airplane pilot's mask). It does not restrict breathing; the patient breathes in air from the environment.
- **EKG:** Ten stickers will be placed on the chest with monitoring wires attached, which are used to monitor heart rate and rhythm.
- **Blood pressure cuff:** The blood pressure is obtained at regular intervals and at multiple times during the test.
- **Pulse oximeter:** This is a small device that covers the fingernail and uses a light to measure the percentage of blood cells saturated with oxygen.

Procedure:

- Before exercise begins, pulmonary function testing (PFT) and pulse oximetry are performed. The baseline PFT provides pattern of breathing and volumes/capacities. The results of these tests are compared to the pattern of breathing and oxygen saturation during exercise.



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- The technician will fit all required equipment and assist the patient on the bicycle. While the patient is resting on the bicycle, the technician will explain the testing procedure in greater detail. At the end of the rest period, the patient will be asked to begin pedaling lightly for a few minutes, to warm up. The resistance on the bicycle will then slowly become more difficult as if going up a hill that gently keeps getting steeper and steeper. The test will continue until the patient has demonstrated maximum effort and can no longer continue, or unless there is an indication to stop related to patient symptoms, vital signs, or EKG changes.
- To obtain the most accurate results, it is important that the patient provides their best effort for as long as possible during the test. The exercise work load will be adjusted on an individual basis to help each patient give their best effort.
- The technician will encourage the patient to continue their best effort until the technician sees that the patient is unable to continue. If the technician detects that the patient is experiencing certain symptoms the test will immediately stop. After the test is over, the patient will pedal slowly to gently cool down while vital signs continue to be monitored.
- The patient will be monitored until the baseline vital signs have normalized and the patient is asymptomatic. After the patient has rested for several minutes, the technician will ask the patient to repeat the PFT to determine if exercise changes lung function.

Tips for a Successful Test:

- Encourage the patient to give his or her best effort and to exercise for as long and hard as possible
- The patient should keep his or her legs moving at the same speed, even when it becomes difficult
- The patient should avoid speaking during the test unless he or she experiences discomfort or pain
- The patient should inform the technician of any discomfort or pain at any point during the test

Patient Talking Points:

- The patient should not eat or drink (except water) for 3 hours before the test
- Exercise or physical labor should be avoided for 24 hours before the test
- Prior to the test, the patient should contact his or her doctor for advice regarding which medications should or should not be taken in preparation for the test



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- The patient should bring a list of current medications
- The patient should wear comfortable clothing and closed-toe shoes for testing
- A CPET may take 45 to 60 minutes to complete. The rest, exercise, and recovery lasts for a total of about 15-25 minutes, but the patient will only be exercising at high levels for 3-4 minutes. The remaining time is spent connecting and disconnecting the equipment, completing the health history, and performing the before and after exercise lung tests
- The results from the CPET will assist the patient's healthcare provider in further guiding the treatment plan

For Future Reference:

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