Exercise testing in survivors of intensive care—is there a role for cardiopulmonary exercise training?

Benington S, McWilliams D, Eddleston J, et al.


Bellarmine University Doctor of Physical Therapy Program by Jesse Koerner & Scott Gwinn

**Overall Purpose**
The study review was intended to determine if routine cardiopulmonary exercise testing (CPET) is safe and appropriate to determine cardiorespiratory function in intensive care survivors. In addition, it is import to determine the effects of an aerobic exercise program on the cardiorespiratory health of this population.

**Article by Benington S, McWilliams D, Eddleston J, et al**

**Purpose**
To describe the causes of exercise limitation in ICU survivors and to assess the practicality of routine cardiopulmonary exercise testing (CPET) in this patient population. CPET is a highly sensitive, non-invasive stress test that evaluates undiagnosed exercise intolerance and objective determination of functional capacity and impairment.

**Methods**
- 50 general ICU survivors
- Inclusion criteria: patients ventilated >5 days
- Exclusion criteria: <18 years old, inability to perform CPET
- Performed maximal cycle ergometer CPET within 6 weeks of hospital discharge
- Health-related quality of life was measured by SF-36

**Results**
- 50 patients completed CPET after hospital discharge with no adverse events
- Cardiorespiratory function was reduced in ICU survivors: peak VO₂ 56% ± 16% predicted and anaerobic threshold 41% ± 13% of peak pred VO₂
- Heart Rate Reserve at peak exercise 25% ± 14%
- Breathing Reserve at peak exercise 47% ± 19%
- Respiratory Exchange at peak exercise 0.96% ± 0.11%
- Ventilatory equivalents for CO₂ 39 ± 9

**Clinical Significance**
This study demonstrates the importance and appropriateness of CPET to determine cardiorespiratory health in ICU survivors. The results suggest physical therapy in the hospital and after discharge should specifically target cardiorespiratory fitness, as well as strength since leg fatigue was the major reason for terminating CPET.

**Supplemental Article 1:**

The aim of this study was to investigate pulmonary function and exercise capacity in a group of survivors of severe acute respiratory syndrome (SARS). Researchers looked at 44 SARS survivors at 3 months post-discharge from the hospital to analyze their cardiorespiratory function using CPET.

In conclusion, half of the recovered SARS patients had detected mild residual pulmonary function defects in 3 months after being discharged from the hospital. In 18 patients, VO₂max was below the lower limit of the normal range. 41% of patients fell below the bottom of normal range for maximum exercise capacity. Among analyzing the data, there were some findings of discrepancies with the Pulmonary Function Testing outcomes. “The discordance in the results of pulmonary function and exercise testing in this study supports the recommendation to use CPET in impairment evaluation, especially in patients with symptoms inconsistent with the degree of impairment defined by resting pulmonary function testing.”

**Supplemental Article 2:**

The aim of this study was to explore the effectiveness of a supervised, hospital-based aerobic exercise-training intervention on the anaerobic threshold and quality-of-life in ICU survivors.

Study found decreased AT, peak VO₂, SF-36 similar to the subjects in the study by Benington et al, which are well below population norms. Also, the researchers did not state that any adverse health effects occurred in the ICU survivors while completing the CPET. Results demonstrate that a 40-minute cardiopulmonary exercise program 2x/wk for 8 weeks had a small beneficial effect on anaerobic threshold (AT) compared to the control group. However, a retest at week 26 displayed similar AT measurements for both groups, which indicates the need to continue exercise.

**Final Conclusions**
The articles are relevant to physical therapy because the researchers studied the feasibility and safety of CPET as a tool for the objective assessment of exercise capacity in general adult ICU survivors and to target strengthening and functional mobility. The supplement articles demonstrated that ICU survivors present with decreased cardiorespiratory and health related quality of life measurements, which is consistent with the article by Benington et al. Also, it has been shown that CPET are appropriate and necessary in ICU survivors to determine cardiorespiratory health and develop individualized physical therapy programs. The results suggest physical therapy treatments should specifically target cardiorespiratory fitness, as well as strength since leg fatigue was the major reason for terminating the CPET. Overall, the results from these studies are encouraging and support the need for future programs and studies. This will aid in the evaluation of effectiveness and cost-effectiveness of interventions for ICU survivors.