ABSTRACT:

INTRODUCTION: Cardiac rehabilitation has not been extensively used in young adult patients with congenital heart disease. PURPOSE: To determine the effect of a cardiac rehab based exercise program on cardiac performance, myocardial oxygen demand, aerobic capacity and efficiency in young adult patients with congenital heart disease. DESIGN: We retrospectively reviewed the exercise evaluation, both pre and post cardiac rehab, in 11 young adult patients with congenital heart disease using the exercise lab database. METHODS: We evaluated the results from the standardized exercise testing protocols used before and after a cardiac rehab program. Results were compared using a paired t-test and significance was set at a probability of p<0.05.

RESULTS: The average age was 26 ± 10 years old. Post cardiac rehab, the rate pressure product (RPP) at submaximal exercise (20512 ± 8.9 vs. 2400 Metabolic Cart) and the maximal ventilatory equivalent for oxygen (VE/VO2) (39 ± 8.9 vs. 34.5) were significantly decreased. The maximal indexed oxygen consumption (VO2I) (18.5 ± 20.5 cc/min/kg), oxygen pulse (O2Pulse) (7.9 ± 8.8 vs. 5.9 ± 7.2 cc/beat) and exercise time (7.3 ± 1.7 vs. 8.1 ± 1.7 minutes) were significantly increased post cardiac rehab. There was no significant change in exercise intensity characterized by the respiratory exchange ratio (RER) (1.20 ± 0.14 vs. 1.15 ± 0.13).

CONCLUSION: In this group of young adult congenital heart disease patients, a formalized outpatient based cardiac rehabilitation program resulted in a significant decrease in the rate pressure product, an indicator for myocardial oxygen demand, at the submaximal exercise level. Additionally, a significantly decreased maximal ventilatory equivalent for oxygen was seen at maximal exercise post cardiac rehab representing improved aerobic efficiency. There was a significant increase in the maximal indexed oxygen consumption, exercise time and oxygen pulse post cardiac rehab without a change in maximal exercise intensity as shown by similar pre and post cardiac rehab respiratory exchange ratios. The cardiac rehab program appears to have improved cardiac performance and efficiency while increasing aerobic efficiency and capacity.

METHODS:

- We retrospectively reviewed our exercise lab database for pre and post cardiac rehabilitation exercise evaluations for our patients with congenital heart disease, 11 patients were identified with both pre and post cardiac rehabilitation exercise tests
- 8 Patients were evaluated with cycle ergometer testing (Lode Corival) and 3 patients were evaluated with treadmill testing (Trackmaster)
- Metabolic data was measured throughout the test with a ParvoMedics True Max 2400 Metabolic Cart
- A 12 Lead Electrocardiograph and heart rate were monitored and recorded every minute with a GE Case 8000 stress system
- Blood pressure was measured every minute using the auscultation method and an appropriate sized cuff
- Results were compared using a paired student t-test
- Significance was set at P<0.01

RESULTS:

- Patients: 3 males and 8 females, average age was 26 ± 10 years old, range 11 to 40 years old
- Patient height was 1.62 ± 0.12 meters; weight was 71.7 ± 15.5 kilograms
- Post cardiac rehab, the rate pressure product (RPP) at submaximal exercise (20512 ± 4056 vs. 18172 ± 3005) was significantly decreased.
- The post rehab maximal ventilatory equivalent ratio for oxygen (VE/VO2) (39 ± 6 versus 34 ± 5) was significantly decreased.
- The post rehab maximal indexed oxygen consumption (VO2I) (18 ± 5 versus 20 ± 5 cc/min/kg) was significantly increased.
- Post rehab maximal oxygen pulse (O2Pulse) (7.9 ± 2.0 versus 8.9 ± 2.0 cc/beat) was significantly increased.
- Exercise test time (7.3 ± 1.7 versus 8.1 ± 1.7 minutes) was significantly increased post cardiac rehab.
- There was no significant change in exercise intensity characterized by the respiratory exchange ratio (RER) (1.20 ± 0.14 vs. 1.15 ± 0.12).
- Average sessions between tests was 23.4 ± 8.8

Maximal Exercise Variables

(N=11)

<table>
<thead>
<tr>
<th></th>
<th>Exercise Time (Min)</th>
<th>Heart Rate (BPM)</th>
<th>Systolic Blood Pressure (mmHg)</th>
<th>Respiratory Exchange Ratio</th>
<th>Indexed VO2 (cc/min/kg)</th>
<th>VE/VO2 Ratio</th>
<th>Oxygen Pulse (cc/beat)</th>
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</thead>
<tbody>
<tr>
<td>Pre Program</td>
<td>7.3 ± 1.7</td>
<td>164 ± 37</td>
<td>161 ± 37</td>
<td>1.20 ± 0.14</td>
<td>18 ± 5</td>
<td>39 ± 6</td>
<td>7.9 ± 2.0</td>
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<tr>
<td>Post Program</td>
<td>8.1 ± 1.7</td>
<td>165 ± 34</td>
<td>159 ± 24</td>
<td>1.15 ± 0.12</td>
<td>20 ± 5</td>
<td>34 ± 5</td>
<td>8.9 ± 2.0</td>
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<tr>
<td>* P&lt;0.01</td>
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CONCLUSION:

In this group of young adult congenital heart disease patients, a formalized outpatient based cardiac rehabilitation program resulted in a significant decrease in the rate pressure product, an indicator for myocardial oxygen demand, at the submaximal exercise level. Additionally, a significantly decreased maximal ventilatory equivalent for oxygen was seen at maximal exercise post cardiac rehab representing improved aerobic efficiency. There was a significant increase in the maximal indexed oxygen consumption, exercise time and oxygen pulse post cardiac rehab without a change in maximal exercise intensity as shown by similar pre and post cardiac rehab respiratory exchange ratios. The cardiac rehab program appears to have improved cardiac performance and efficiency while increasing aerobic efficiency and capacity.

No Financial or Regulatory Disclosures