A case study of the effects of aerobic training on exercise capacity in patients with advanced cirrhosis

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ABSTRACT

Advanced cirrhosis results in decreased muscle mass, aerobic capacity and a reduced quality of life. Aerobic exercise is known to improve these variables, which, may result in higher scores on tests that predict the success of a liver transplant. The study investigated the effects of an eight week, once weekly aerobic intervention on muscle mass, aerobic capacity and quality of life in patients with advanced cirrhosis. A randomized control trial (N=2) was employed and patients were recruited from the University of Calgary Pre-Liver Transplant Nutrition Clinic. Six patients were eligible; one agreed to enrolment. The subject (F, aged 66) underwent pre-testing, involving body composition analysis (DXA scan), quality of life questionnaire and a six-minute walking test. The intervention occurred at the University of Calgary Jack Simpson Track (200 m) with increased walking by 2 min. per week. The study is 80% completed. Results demonstrate an increased walking speed and duration suggesting improved exercise tolerance.

BACKGROUND

- The consequences of liver cirrhosis are: impaired liver function, increased resistance to blood flow within the liver (portal hypertension) and liver carcinoma.[1]
- It can also result in a decrease in muscle mass, aerobic capacity and a poor quality of life.[1,2]
- Aerobic training has been found to improve aerobic capacity, muscle mass and quality of life patients with liver disease.[3,4,5]
- Healthier patients tend to score higher on tests that determine if the patients should receive a liver transplant.[6,7]
- There is limited research on the effects of exercise in advanced cirrhosis patients and those on the liver transplant list.[8]

PURPOSE

The study purpose was to investigate the impact of a progressive aerobic intervention program on muscle mass, aerobic capacity and quality of life in patients with advanced cirrhosis.

STUDY DESIGN

A randomized control trial (RCT) was employed. Patients were recruited from the University of Calgary Pre-Liver Transplant Nutrition Clinic. Six patients were eligible (N=2); one agreed to enrolment. No randomization occurred and the design effectively became a case study (n=1).

METHODS

Pre and post testing included:

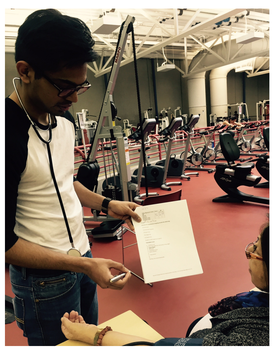
- Height, weight, (calculated BMI) Blood pressure, and heart rate (HR)
- DXA scan to determine body composition (lean and fat mass)
- SF36-V2 questionnaire[10] to determine quality of life (QOL)
- Six minute timed walking test[19] (picture 1) with pre-post BP and HR (immediately after exercise, post 1 and 3 minutes; picture 2) to determine a baseline aerobic capacity. Participant was asked to rate her perceived exertion (RPE) using the Borg Scale [9] immediately after the exercise bout (picture 3; results in Table 2).

Intervention

- The duration of the walking was increased by 2 minutes each week for 8 weeks following the a six minute baseline (Table 1).
- Walked on the inside lane of the 200m track at the University of Calgary Jack Simpson Track. During the six min. test the participant was asked to refrain from talking and to walk at her own pace.

1. Walking test

2. BP and HR post exercise



3. RPE post exercise

STUBJECT CHARACTERISTICS

66 year old female (ht. 153.0 cm, WT. 81 kg, %BF 25) with a prolapsed mitral; diagnosed with Hepatitis C, 33 years ago following a blood transfusion after complications from a C-section.

Medication list: Salbutamol- Asthma, Aldactone- Excess aldosterone, Metformin- Type II diabetes, Furosemide- Fluid build up, swelling, Spironolactone- Fluid retention, Lactulose- Constipation, Citalopram- Antidepressant, Humalog mix 25- Type II diabetes, and Zenhale- Asthma.

Table 1. Laps times in minute and RPE during the walking intervention

Week	Time (min.)	Laps	Mean Lap time	RPE
Pre	6	1.75	0.2917	2
1	8	2.50	0.3125	2
2	10	3.00	0.3000	3
3	12	3.75	0.3125	3
4	14	4.50	0.3214	3
5	16	5.25	0.3281	2

Table 2. BP and HR recording pre and post exercise

Week	BP (systolic/diastolic)				HR (bpm)			
Exercise	Pre	Post	Post 1 min	Post 3 min	Pre	Post	Post 1 min	Post 3 min
Pre Test	126/58	168/38	148/48	124/58	-	-	-	-
1	122/50	168/38	146/48	126/42	84	94	88	84
2	136/52	162/50	152/54	150/52	90	96	92	84
3	148/50	170/48	162/46	158/48	80	84	80	84
4	146/38	172/42	150/42	152/38	88	96	88	84
5	148/48	170/50	152/48	156/48	92	104	92	88

RESULTS AND DISCUSSION

- The preliminary results demonstrate that the participant has maintained her lap speed (lap time) with the increased duration which, suggests an improvement in her exercise tolerance and aerobic capacity.
- The subject constantly talks about how much better she feels after beginning this program suggesting an increase her overall vitality. She is enthusiastic when she arrives and very engaging during the sessions with conversation.
- Although the program was short, it has demonstrated efficacy in improving the subject's health.

Limitations

- The University of Alberta has completed a RCT with patients who have advanced liver cirrhosis. Despite this successful study it was very difficult to get ethical approval for an intervention with patients from the University of Calgary Pre-Liver Transplant Nutrition Clinic. We also were unable to secure the lab in the Libin Cardiovascular Institute to complete VO_{2max} testing where a crash cart and on call physicians with advanced life support training are available.

Future Directions

- The addition of a questionnaire regarding health perceptions may be useful given the exceptional health outlook this subject had.

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