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Development of a Rowing Ergometry Test for whole body VO₂peak in McArdle Disease.

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Introduction

In those individuals with McArdle Disease moderate- to good-conditioning is most often seen in lower body musculature. Testing of VO₂peak, a marker of reduced risk for all disease and death, has most often been undertaken for lower body exercise in this population. A test for whole body VO₂peak could still identify all-cause health risks whilst also identifying deficits in upper body conditioning specific to McArdle. This would serve the further purpose of identifying areas for future development of individual health whilst also educating the sufferer. There is considerable potential, therefore, to further improve function, well-being and quality of life.

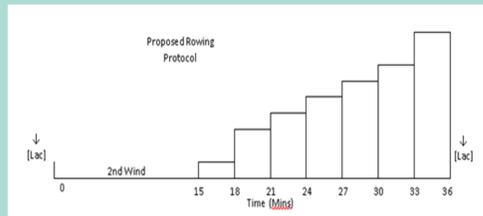
Aim: to design a rowing exercise protocol to assess whole body VO₂peak in McArdle Disease.

Challenges: To design a whole body test-

- 1: which does not elicit contracture
- 2: which facilitates attainment of criteria recognised as consistent with reaching maximal oxygen consumption. These are: a plateau in O₂ consumption, attainment of age-predicted HR_{max}, RER > 1.15, [lactate]_{blood} > 8mM. Note: the former two only can be used as the latter two require fully functioning CHO metabolism which is not possible in McArdle Disease.
- 3: with resultant VO₂peak data of sufficient stability to warrant further development of a database using this methodology.

Methods

Three individuals with McArdle Disease (2 males, 1 female, age 35-55yrs) provided written informed consent to be involved in protocol development and to exercise to age-predicted maxHR (220-Age). The initial protocol (right) was used as a starting point with the full intention of being flexible enough to make any required changes to overcome the challenges identified

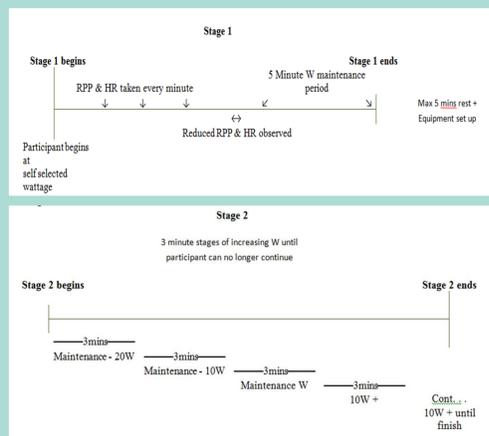


This included changes to warm-up to ensure 'second wind' attainment, in-test changes to handgrip to avoid contracture. This procedure was undertaken with all 3 individuals present together on the same day to ensure a consensus was reached for a standardised test protocol which we are confident can be applied to all.

Standardised Protocol which resulted

The result is a two stage protocol; stage 1 for attainment of second wind and id of the starting power output for stage 2. Stage 2 is the incremental test to age-predicted HR_{max} and attainment of VO₂peak.

Note stage 2 starts 5 min after end of Stage1 with 3min at 20W less than at end of Stage 1. Then there is 3min at 10W less, then 3 min at the same W from the end of Stage 1. Every 3 min is then at 10 W higher than the previous 3 min effort and this is continued until the person cannot maintain chosen rpm.



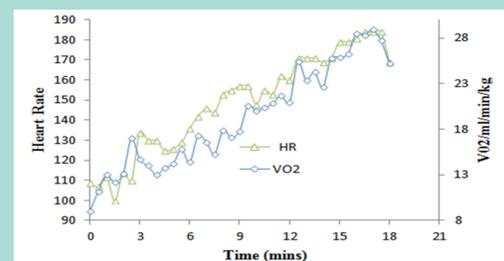
Maximal Oxygen Uptake

Generally described as VO₂max but here VO₂peak is the term used as, by definition, a VO₂max test must elicit max between 8-16 min. This is not possible with this population for H&S reasons to ensure attainment of second wind and reduce the risk of muscle contracture.



Results

All three individuals successfully navigated both the developmental phase of the test and the maximal endpoint providing greater than age-predicted maximal HR and VO₂peak data. All attained VO₂peak values between 25-30 ml/kg/min which appear to be higher than compared with cycle ergometry. There were no adverse events. The figures below are the data for each individual.



Discussion & Conclusion

This work constitutes 'proof of principle' by demonstrating that it is possible to have individuals with McArdle Disease exercise to maximal heart rate in whole body exercise on a rowing ergometer without causing any adverse event and successfully obtain VO₂peak data. This can then be used to identify differences in conditioning between upper and lower body musculature and so develop a plan to improve individual function, well being and quality of life. There are several steps which now need to follow:- test-retest to establish reliability of the protocol, testing of multiple individuals to develop a database of VO₂peak data for rowing in McArdle.