Elaboration of tool to be used to measure underwater Oxygen consumption with rebreathers

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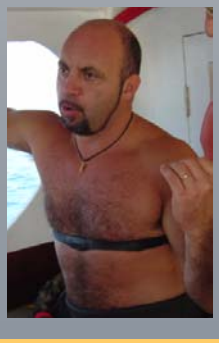
Background

In water measurement of VO_2, VCO_2, respiratory rate,RER etc….is a matter of major technical difficulties, this has been done in wet hyperbaric environments but data are lacking to evaluate the metabolic cost in real Open Water dives. Our purpose is to elaborate a reliable tool to do so.

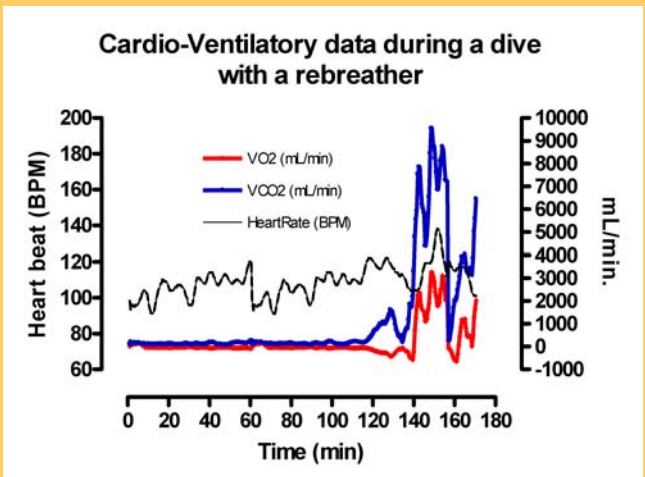
Methods

A Commercially available VO_2 self powered open circuit evaluation Tool (Medgraphics : VO2000) has been adapted to be used underwater.The pneumo-tachograph as well as the O_2 and CO_2 sampling inlets have been modified to be set on the mouthpiece of a rebreather (CCR) (Voyager aquatek). The rebreather model has been chosen because it allows the precise setting of the PO_2 any time during the dive. The VO2000 has been located into a waterproof plastic cylinder and the telemetric measurement of the respiratory data was started before the cylinder was sealed. A Polar heart beat monitor was coupled to the respiratory data sampling to allow oxygen pulse evaluation and effort estimation. The respiratory quotient has been calculated and reported to a standardized VO_2 maximal effort testing previously performed in our lab.



Results

A single dive at 40 m depth has been measured, the dive was on a Croatian wreck and had no peculiarities. The results are shown on the graph. The VO_2 that we found was by far greater that could have been guessed.



Conclusions

We conclude that the metabolic cost of innocent dives should be considered greater than believed.

An in water evaluation of the metabolic cost is an important step forward.