EXPLOITING AEROBIC FITNESS TO REDUCE RISK OF HYPOBARIC DECOMPRESSION SICKNESS

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INTRODUCTION: Decompression sickness (DCS) is multifactorial. But we hypothesize an aerobically “fit” person is less likely to experience hypobaric DCS than an “unfit” person given that fitness is essential as part of the decompression algorithm (prebreath, PB). Aerobic fitness is peak oxygen uptake (VO2pk, ml/kg/min). RESULTS: Treadmill or cycle protocols were used over 15 years to determine PB (exercise PB) or resting PB under resting conditions prior to ascent in an altitude chamber, and 2) PB that included exercise for some part of the PB. There were 165 exposures (mean VO2pk 40.9 ± 7.6 ml/kg/min with 25 cases of DCS in the second. Similar incidence of the DCS (19.2% vs. 14.9%) and VGE (45.5% vs. 44.8%) between the two classes indicates that decompression stress was similar. The strength of association between outcome and VO2pk was evaluated using univariate logistic regression. RESULTS: An inverse relationship between PB outcome and VO2pk was evident, but the relationship was stronger when exercise was done as part of the PB (exercise PB, coef. = -0.058, p = 0.07; rest or no PB, coef. = -0.005, p = 0.86). There was no relationship between VGE outcome and VO2pk (exercise PB, coef. = -0.003, p = 0.81 rest or no PB, coef. = 0.004, p = 0.99). CONCLUSIONS: A significant change in probability of DCS was associated with fitness only when exercise was included in the denitrogenation process. We believe a fit person that exercises during PB efficiently eliminates dissolved nitrogen from tissues.

CONCLUSIONS / DISCUSSION

The expression of signs and symptoms of decompression sickness (DCS) are dictated by many factors, both subject-specific and environment. Aerobic fitness, as VO2 peak (ml O2/kg / min), may be linked with resistance to DCS and venous gas emboli (VGE) (6). It is not possible to distinguish a “fit” person from an “unfit” person based on resting oxygen (O2) consumption, both consume about 3.5 ml/kg / min.

So why should aerobic fitness be of any value during denitrogenation (prebreath, PB) prior to ascent in an altitude chamber and unfit persons rest during the ascent?

Hypothesis: Exercise during the PB is a necessary condition to understand if aerobic fitness is associated with hypobaric DCS and VGE outcomes.

METHODS

Two general classes of experiments that include VO2pk information are available from the NASA Hypobaric Decompression Sickness Database:

165 exposures with 25 cases of DCS where no PB or PB under resting conditions was performed prior to ascent in an altitude chamber, and

172 exposures with 25 cases of DCS where exercise was performed during the PB prior to altitude.

TABLE I: Summary of Information from Two Classes of Experiments about Hypobaric DCS

<table>
<thead>
<tr>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Mean VO2pk</th>
<th>Mean Age</th>
<th>Mean Exposure</th>
<th>Ambulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>337</td>
<td>251</td>
<td>86</td>
<td>39.9</td>
<td>32.3</td>
<td>60.3</td>
<td>52.6</td>
</tr>
<tr>
<td>285</td>
<td>216</td>
<td>69</td>
<td>40.9</td>
<td>32.9</td>
<td>61.4</td>
<td>53.4</td>
</tr>
</tbody>
</table>

Table I shows summary information from the two classes of experiments done to understand more about hypobaric DCS. The similarity of the DCS (19.2% versus 14.9%) and VGE (45.5% versus 44.8%) incidence between the two classes indicates that the decompression stress was similar in both cases.

An identical analysis performed on the dichotomous VGE outcome showed there was no association between PB and incidence of VGE regardless if exercise was done during the PB.

REFERENCES