INTRODUCTION: Decompression sickness (DCS) is multi-factorial. We hypothesize the aerobically "fit" person is less likely to experience hypobaric DCS than an "unfit" person given that fitness is exploited as part of the denitrogenation process. Aerobic fitness is peak oxygen consumption, both consume about 3.5 ml/kg/min.

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 un-fit subjects rest during the PB.

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 ascent.

Figure 1: Linear regression using 165 exposures where 25 of 165 exposures resulted in DCS (15.1%) after protocols that had no PB period or included rest during the PB where most subjects (75%) ambulated at altitude. Logistic regression coefficient for VGE was 0.009 with p-value of 0.09. Inset shows a particular "visual" association between VO2pk and the DCS outcome.

However, if exercise by a percentage of your VO2pk during PB as a means to accelerate denitrogenation, it appears that if all else is equal, you are at lesser risk for DCS if you are fit than if you are unfit, as seen in Fig. 2.

Figure 2: Linear regression using 172 exposures (165 from PRP and 7 from NASA) where 25 of 172 exposures resulted in DCS (14.5%) after PB protocols that included exercise during the PB where all subjects did not ambulate. Logistic regression coefficient for VO2pk was 0.008 with p-value of 0.01. Inset shows a "visual" inverse association between VO2pk and the DCS outcome.

PO(DCS) outcome is also not associated with fitness unless fitness is exploited as part of the denitrogenation process (exercise PB, coef. = -0.058, p = 0.07; rest or no PB, coef. = -0.005, p = 0.86).

Exercise is a necessary condition for fit and unfit persons to reduce their risk of DCS.

PO(DCS) outcome is not associated with fitness regardless if exercise is done during the PB (exercise PB, coef. = -0.003, p = 0.89; rest or no PB, coef. = 0.09, p < 0.05).

Exercise was not a necessary condition for fit and unfit persons.

PO(DCS) outcome is not associated with fitness unless fitness is exploited as part of the denitrogenation process (exercise PB, coef. = -0.058, p = 0.07; rest or no PB, coef. = -0.005, p = 0.86).

Exercise was not a necessary condition for fit and unfit persons.

Figure 3: Exploitation of exercise PB results from (2). Once "acceptable risk" is defined for a particular activity, then an exercise PB prescription is created based on your VO2peak.

Figure 4: Data from (6) shows modest inverse relationship between altitude DCS susceptibility and VO2max from 42 women and 130 men. Results apply to a combination of no PB, PB under resting conditions, or PB under exercise conditions, which may account for some of the variability. The SSR on the y-axis is a measure of DCS susceptibility, the greater the value the more susceptible the subject (see 6 for details).

REFERENCES