DECOMPRESSION SICKNESS AFTER AIR BREAK IN PREBREATHE DESCRIBED WITH A SURVIVAL MODEL

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BACKGROUND: Data from Brooks City-Base show the decompression sickness (DCS) and venous gas emboli (VGE) consequences of air breaks in a resting 100% O₂ prebreathe (PB) prior to a hypobaric exposure. METHODS: DCS and VGE survival times from 95 controls for a 60 min PB prior to 2-hr or 4-hr exposures to 4.37 psia are statistically compared to 3 break in PB conditions: a 10 min (n=40), 20 min (n=40), or 60 min break (n=32) 30 min into the PB followed by 30 min of PB. Ascent rate was 1,524 meters / min and all exposures included light exercise and 4 min of VGE monitoring of heart chambers at 16 min intervals. DCS survival time for combined control and air breaks were described with an accelerated log logistic model where exponential N₂ washin during air break was described with a 10 min half-time and washout during PB with a 60 min half-time.

RESULTS: There was no difference in VGE or DCS survival times among 3 different air breaks, or when air breaks were compared to control VGE times. However, 10, 20, and 60 min air breaks had significantly earlier survival times compared to control DCS times, certainly early in the exposures.

CONCLUSION: Air breaks of 10, 20, and 60 min after 30 min of a 60 min PB reduced DCS survival time. The survival model combined discrete comparisons into a global description mechanistically linked to asymmetrical N₂ washin and washout kinetics based on inspired pN₂. Our unvalidated regression is used to compute additional PB time needed to compensate for an air break in PB within the range of tested conditions.
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ABSTRACT

This study describes the early onset and rapid increase in cumulative VGE incidence in both the control and air break data. The hazard function for the control data distinguishes the different break in PB durations. The hazard function for the control data is expressed as a rate (hr⁻¹). It is computed log likelihood from survival analysis regression, p – value is from Likelihood regression model is a quantitative way to define O2 payback time. Our approach to compute O2 payback time is not appropriate outside the range of tested conditions. Our regression model has not been prospectively validated, so our conclusions are hypotheses rather than operational recommendations.

INTRODUCTION

Few data are available to understand the DCS and VGE consequences of an air break in an otherwise normal resting 100% O2 PB, and none are available after PB includes exercise. Our approach to compute O2 payback time is not appropriate outside the range of tested conditions. Our regression model has not been prospectively validated, so our conclusions are hypotheses rather than operational recommendations.

RESULTS

We used an accelerated log logistic survival model accounting for asymmetrical N2 washout and washin to describe DCS survival times in data where 1/hr0.5, 0.5, and 0.25 hr air breaks occurred at 30 min into a 45 min PB duration. Results for the control data are near statistical significance than the control DCS failure times at p<0.03. And the 20-min and 60-min air break DCS failure times in our four-hr matched exposure time data are different than the control DCS failure times (p<0.03). The 20-min and 60-min air break DCS failure times in our four-hr matched exposure time data are near to statistical significance than the control DCS failure times at p<0.06 (8). Note that our approach to compute O2 payback time is not appropriate outside the range of tested conditions. Our regression model has not been prospectively validated, so our conclusions are hypotheses rather than operational recommendations.

REFERENCES