PREDICTED RISK OF A 25% INCIDENCE OF DCS IN THE UW SHEEP MODEL OF DIVERS AND SUBMARINERS

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Introduction:

Scientific, recreational and operational scuba divers and submariners experiencing a saturation hyperbaric exposure and emergency decompression face the risk of decompression sickness (DCS). Because nitrogen is especially soluble in fatty tissue, overall body weight is also a likely determinant of DCS risk. We used the intact UW sheep model to test the observed risk of three clinical DCS manifestations and overall lethality after a 24-h exposure to pressure of 19 - 132 fsw (1.5 – 5.0 atm abs) and air decompression in "heavy" and "light" sheep to evaluate whether body weight is an important risk factor in decompression.

Materials and Methods:

Sheep (22-129 kg ±10.85 SD) underwent air exposure to 19 -132 fsw for 24-h followed by rapid decompression "dropout" (30 fsw/min). We analyzed decompression events observed in all ewes subjected to this protocol (n=1120) over a 28-year cumulative series by logistic regression. Four outcome variables were evaluated for each sheep: limb DCS, respiratory DCS, central nervous system DCS (CNS-DCS) and mortality. Sheep were subdivided into two groups based on weight as "light" sheep ≤90 kg (n=456 events) and "heavy" sheep >90 kg (n=664 events).

Goal of study:

These findings provide a practical tool for estimating DCS risk in humans from outcomes in sheep, especially in decompression profiles too risky to test with humans. This model supports the hypothesis that species of similar body mass have similar DCS risk.

Conclusion:

- Increased exposure pressure showed a strong dose-response for all manifestations of DCS and lethal outcomes with provocative decompression potentially faced in "drop-out" escapes from a disabled submarine and saturation habitat.
- Increased body weight resulted in a greater risk of RDCS, limb DCS, and lethal outcomes, but not CNS-DCS.
- The UW sheep model findings implicate obesity as an important risk factor in RDCS (the chokes) and lethal outcomes in submarine and saturation habitat escape.

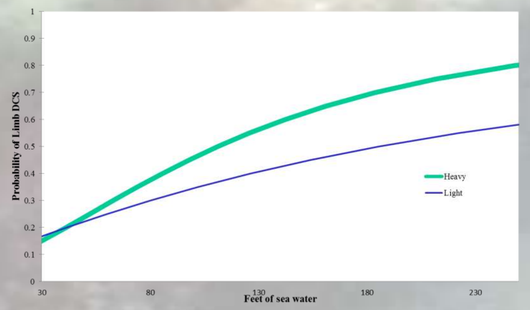

Figure 1. Limb DCS results

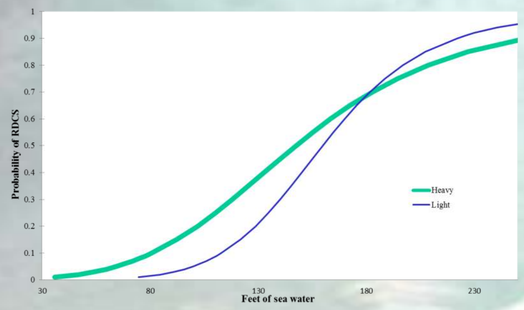

Figure 2. Respiratory DCS results.

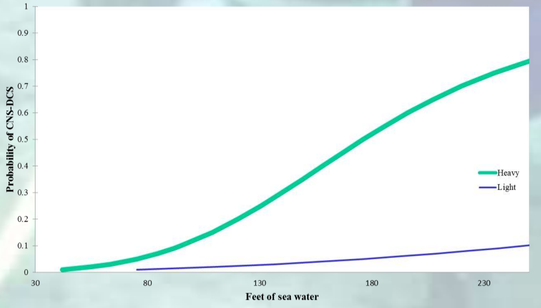

Figure 3. Central Nervous System DCS results.

Results:

Clinical signs	"HEAVY" SHEEP	"LIGHT" SHEEP
Limb DCS	52	60
Respiratory DCS	110	135
CNS - DCS	131	>132
Mortality	>132	>132

Table 1. Depth that creates a 25% likelihood of DCS outcomes for UW sheep model after a 24-h hyperbaric air exposure and drop-out decompression

UW sheep model in research chamber

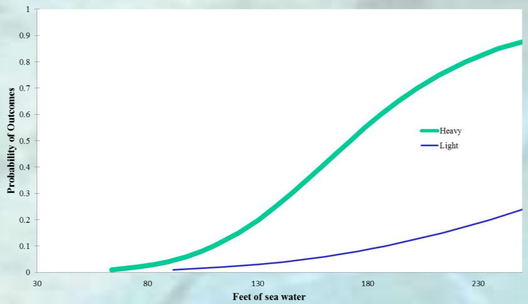

Figure 4. Mortality results.

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