PREDICTION FOR DISSUB RESCUE USING 90 KG SHEEP MODEL DROPOUT DECOMPRESSION FROM 43 FSW

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Background:

Disabled submarine (DISSUB) survivors are expected to achieve inert gas tissue saturation. There is human data for dropout decompression from saturation up to 33 fsw and for 90 kg sheep as shallow as 60 fsw. Gaps in knowledge that will impact triage in a DISSUB are apparent at depths from 33 fsw to 60 fsw. The goal of this study to explore dropout decompression in the 90 kg sheep from 43 fsw and to compare those results to human data.

Materials and Methods:

Ten adult sheep (79.4 kg ±11.5 SD) underwent dry chamber air exposure at 43 fsw (2.2 ATA) for 24 hours. Animals breathed chamber air with oxygen maintained at 21% and CO_2 < 0.05 surface equivalent percent and had access to water ad lid throughout this period. At 24 h sheep were decompressed at 30 feet/min (0.9 atm/min), a Navy fleet diving standard ascent rate for human exposures. Upon surfacing, the animals were observed for 4-hours for signs of DCS. One month later, bone scans of the radii and tibiae were done. Alizarin complexone fluorochrome was injected IV to visualize dysbaric osteonecrosis (DON). Necropsies further defined the severity of DON.

Results:

All sheep survived accelerated decompression. Respiratory DCS developed in two animals, but no signs of CNS-DCS were observed. All pairs of sheep shared definite signs of limb bends within 15 min of surfacing. All animals developed DON with 100% agreement between bone-scan (hot-spot) and gross pathology abnormalities, all indicative of active bone remodeling.

Figure 1. UW sheep model of the diver and submariner.

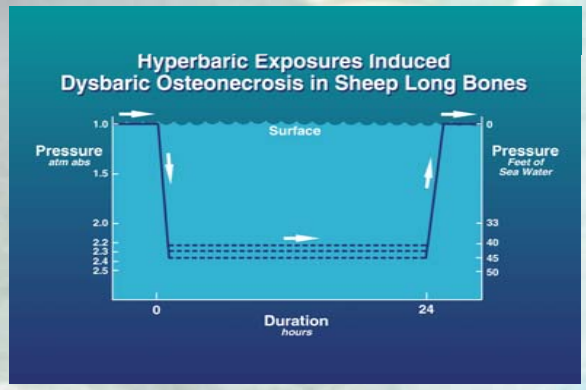

Figure 2. Dry chamber air exposure at 43 fsw for 24 hours.

Figure 3. The classic sign of limb bends in sheep.

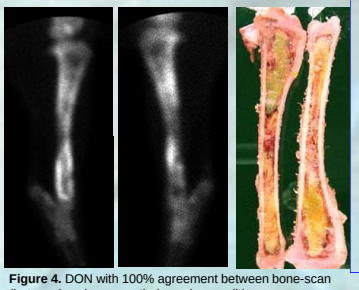

Figure 4. DON with 100% agreement between bone-scan (hot-spot) and gross pathology abnormalities.

Discussion and Conclusions:

This is preliminary results and the data generated from this study will provide an evidence-based tool for triage, DCS incidence prediction and therapy in DUSSUB escape and rescue.

Saturation Depth, fsw	Sheep, N	Limb DCS	CNS – DCS	RDCS	Lethal DCS
43	10	10	0	2	0

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