Improving Prediction for DISSUB Rescue Using 70 kg Swine Dropout Decompression from 30-50 fsw

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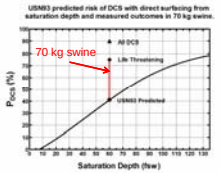
Background: DISSUB survivors are expected to achieve inert gas tissue saturation. Human dropout data from saturation as DEEP as 33 fsw, and 70 kg swine as SHALLOW as 60 fsw is available. The dramatically different prediction estimates demonstrate data gaps for 33-60 fsw. USN93 grossly underpredicts DCS based on 70 kg swine incidence. Whether the difference is species differentiation or an underprediction in humans, comparing the incidences at similar depths provides useful analysis for research in dropout scenarios and developing rescue strategies.



•Objectives:

- Explore dropout decompression in the 70 kg swine from 30 to 50 fsw saturation.
- Compare 70 kg swine results to existing human data from 25.5 - 33.0 fsw
- Provide evidence-based tool for triage and therapy in DISSUB rescue/escape

Methods: Male Yorkshire swine (70 kg) were randomized to one of three experimental groups, pressurized to 50, 40, or 30 fsw for 22 h, decompressed at 30 fsw/min, and observed for 2 h. Symptom onset was recorded to the nearest minute. Survivors were sacrificed at 24 h, weighed and sent for necropsy.

•Summary:

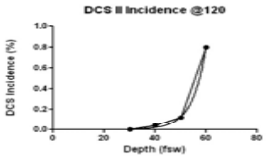
- There was no DCS for swine at 30 fsw compared to 17%-23% incidence from historical human data at 25.5-33 fsw saturation; n=106 dives, 18 DCS (17%) plus 24 "marginal cases" (22%)
- The 2-fold observed incidence in DCS in the swine at 60 fsw is even more concerning for the drastic increase in severe Type II DCS
- If swine are indeed more resistant to DCS at 30 fsw it is reasonable that the same would hold true at 40, 50 and 60 fsw

Swine: 0% DCS incidence at 30 fsw

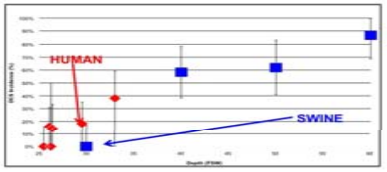
Group	n	Type I DCS	Type II DCS
30 fsw	18	0 (0%)	0 (0%)
40 fsw	24	14 (58%)	1 (4%)
50 fsw	21	13 (62%)	3 (14%)
60 fsw	15	13 (87%)	12 (73%)

F-statistic for the ANOVA of the mean weights corresponded to a P-value of 0.3781, indicating no difference between groups

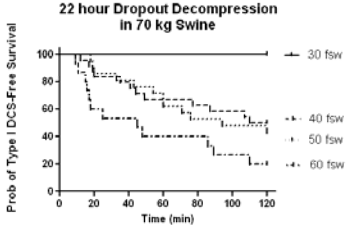
Type II DCS Incidence increases exponentially from 30 to 60 fsw in Swine



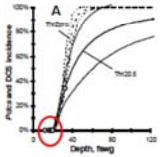
Observed DCS incidence from dropout decompression less in swine than in humans at 30 fsw



22 hour Dropout Decompression in 70 kg Swine



No incidence of human DCS from dropout decompression of 20 fsw or shallower [3]



[3]Van Liew, Flynn UHM 2005, Vol. 32, No. 6 pp409-419.

Observed 70 kg swine DCS incidence matches more closely to Van Liew model

Model/ Data	Human observed DCS incidence	70 kg swine observed DCS incidence	Van Liew UHMS 2005 Predicted DCS incidence	USN 93 Predicted DCS incidence
20 fsw	0%		0%	9%
30 fsw	17%	0%	17%	17%
40 fsw		58%	50%	25%
50 fsw		62%	60%	33%
60 fsw		87%	72%	41%

Conclusions

- USN 93 prediction model appears to under predict human DCS incidence from saturation dropout as compared to the 70 kg swine model
- The 70 kg swine model appears to more closely follow the Van Liew/Flynn model (UHMS 2005)
- Triage planning for DISSUB scenarios should consider the possibility of a large increase in DCS (Type I) incidence with a change in saturation dropout depth from 30 to 40 fsw and a large increase in severe DCS (Type II) with a change from 50 to 60 fsw.

Acknowledgements

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