

ABSTRACT

Surgical Training for Torso Exsanguination in Weightlessness and Difficult Oceanic Conditions

Background: Exsanguination is the leading preventable cause of post- traumatic death, a risk faced by civilians, soldiers, sailors and astronauts alike. Immediate intervention is mandatory. Space adventure, difficult sea states, and austere environments all have similar identifiable problems including the need for hemorrhage control by non-surgeons in and outside of the body cavity.

Objective: Develop the surgical task trainer for difficult repetitive training for US Northern Command Partners

Design/Methods: The visceral compartment of the human worn partial task surgical simulator (Cut-suit) was contained within a custom-made, sealable surgical “bathtub” on board both a small National Research Council of Canada jet. 10 damage control laparotomies were performed within 168 parabolas in microgravity. A new class of naval vessel designed for “shallow water” littoral combat was simulated at the US Navy NSWC Bio dynamics Laboratory. 36 procedures were performed at calm sea, sea state 3, and sea state 4.

Results: Blood loss was easily measured by the delivery system thus easily telling the effectiveness of the trainer and simulation platforms. At simulated sea, there was no statistical difference identified between the twelve procedures at calm seas versus either sea state 3 or 4. Blood flow at each state was reduced 35% and the topped. Sea state roughness did not alter the ability to perform hepatic hemorrhage control. In parabolic microgravity, all open damage control laparotomies were performed in the allotted time. Blood loss at 1G was 408.2 ML (SD 102) vs Zero G 307.6 ML(SD 178.1)

Conclusion: Previous conclusions that surgery is not possible at any sea state other than sea state 1 are not supported. The results of this study have generated a 21-day at sea study to continue this research. All damage control surgery was completed in microgravity with data available by meeting date. It is now time to combine the remote training capabilities with non-surgeons to determine if non-surgeons can truly become proficient at damage control. This surgical phantom created a training/research tool to further studies of torso exsanguination.

Outcome Measures	Evaluation	
Suture (3-0 Silk, Interrupted)	4	
Blood Loss (from start of task to start of bowel repair)	Elapsed Time: 98	Calculated Flow Rate .168 L/min
	Blood Lost: 275	
Blood Loss (from bowel repair to end of task)	Elapsed Time: 631	Calculated Flow Rate .028 L/min
	Blood Lost: 300	
Total Elapsed Time	729	
Total Blood Lost	575	
Overall Performance	4	

