

**LBC06**

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Subclavian Central Venous Access Mixed Reality Simulator: Preliminary Experience

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**Objective:** Part-task simulation trainers offer a promising alternative to bedside teaching to learn subclavian central venous (SC-CV) access through practice for the acquisition of clinical skills. The objective of this study was to determine the effectiveness as a learning tool of a novel Central Venous Access Mixed Reality Simulator, which can be viewed at [http://simulation.health.ufl.edu/research/cv1\\_intro.wmv](http://simulation.health.ufl.edu/research/cv1_intro.wmv). In the simulator, the tip of an actual needle attached to a syringe is tracked by a magnetic sensor relative to the physical and virtual components of the 3D simulator and allows the procedure and needle tip trajectory to be visualized for guidance and/or after action review (debriefing). Compared to existing central venous access trainers, this new simulator will detect iatrogenic pneumothorax.

**Methods:** Anesthesiology residents and attending physicians were selected to perform three runs on the simulator. Levels of training included trainees ranging from residents in PGY1 to PGY4, fellows, and faculty. Participants completed 1) a pre-intervention questionnaire about previous subclavian central venous line placement, 2) simulation run #1 (without the use of the visualization software) established the participant's baseline knowledge and skills, 3) a teaching intervention by the same instructor followed by simulation run #2 - with the use of the simulator's mixed reality (MR) visualization software, and 4) simulation run #3 - a final test using the simulator without the visualization software. A post-intervention questionnaire about the realism of the simulator was administered to the participants. The main test parameters were time to complete SC-CV access and CVLScore, a composite score of efficiency and safety scores automatically generated by the simulator's scoring algorithm at the end of a training session.

**Results:** From run #1 to run #3, average CVLScore was reduced by 23 points in all participants (N=28) and a reduction in average time (62.4 sec) to obtain SC-CV access was observed (see Appendix A, Table 1). We performed repeated measure ANOVA on the outcomes from the three waves of data collection with follow-up pairwise dependent sample t-tests. There were reductions in average time (F=14.26, p<.0001), the number of attempts (F=10.77, p = .0001), skin punctures (F=6.59, p = .004) and SCCVL score (F=14.59, p < .0001) (see Table 1). For all outcomes, there were significant differences between Run 1 and Run 2 and between Run 1 and Run 3, but not between Run 2 and Run 3 (p < .05).

The increased success rate from 82.1 to 92.9% was not significant (p = .08). Complication rates for pneumothoraces and subclavian arterial punctures were reduced from 11% to 7% and 13% to 7%, respectively. On a five point scale (1=strongly disagree to 5=strongly agree), on average participants agreed that the SC-CV access simulator was realistic (M=4.1) and participants strongly agreed that the simulator should be used as a training/educational tool (M=4.8).

**Conclusion:** Our preliminary data indicate that the UF Mixed Reality Simulator offers a realistic representation of SC-CV access. Although there is a trend toward better performance with experience, the effect of PGY-Level on performance variables was not statistically significant. This is however preliminary data and we planned a priori increasing the sample size at each level of training. We also plan to test emergency medicine and internal medicine residents and attendings. This new device could be implemented into residency training programs in multiple disciplines to help training in subclavian venous access.

Figure 1

Appendix A - Table 1 [SC CVL Score (range best score 0 - worst score 100)]

Variable	N	Mean (SD)	Run 1		Run 2		Run 3			
			Min	Max	Min	Max	Min	Max		
Time (seconds)	28	307.64 (103.92)	13.00	378.00	36.79 (41.65)	7.00	184.00	35.71 (46.09)	35.70	46.30
Number of Attempts	28	8.46 (7.32)	1.00	22.00	3.32 (3.31)	1.00	11.00	4.39 (5.21)	4.30	5.30
Number of Skin Punctures	28	3.61 (2.96)	1.00	14.00	2.14 (1.63)	1.00	6.00	1.89 (1.62)	1.90	1.60
SC CVL Score	28	46.99 (36.71)	36.70	1.30	16.91 (18.91)	0.70	67.60	19.31 (28.00)	19.30	28.00
Success (%)	28	82.14 (39.00)	0.00	1.00			92.86 (26.23)	92.90		26.20