Central Venous Catheter Preparation Virtual Reality Simulator For The Care Of COVID-19 Patients

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Introduction

The placement of a central venous catheter (CVC) is one of the most common procedures performed on critically ill patients. Correctly preparing for this procedure, especially when the patient is COVID-19 positive, is as crucial as proficiently inserting the catheter itself. However, conventional training for this preparation often is perfunctory since it requires the use of much needed, and often limited, disposables (e.g., gowns, gloves, masks, antiseptics) as well as the use of high-fidelity manikins and realistic clinical settings. In this study, we developed a virtual reality (VR)-based environment where learners can practice donning PPE and applying the proper sterile technique in preparation for CVC placement in a COVID-19 patient. Utilizing VR simulators instead of conventional methods has known impacts, such as fewer resources needed, more quantitative training data available, and 24/7 availability and accessibility.

Methods and Procedure

- In the simulation, prior to entering the patient's room, learners don the proper PPE to care for a COVID-19 patient and collect necessary supplies needed for proper CVC placement.
- After completing the donning PPE (Fig. 1), trainee can proceed to the room which has the necessary equipment and a patient who is already intubated and ready for the procedure.
- The learner can adjust the bed to optimize access to the patient. Moreover, there are ChloraPreps and absorbent chux pads to further prepare the patient (Fig. 2).
- Once the patient is positioned and prepared, the ultrasound machine is used to assess the inferior jugular vein to ensure it is patent for the procedure (Fig. 3).
- After preparing the patient, the learner opens the CVC kit, doffs their non-sterile gown and gloves, and dons the sterile gown and gloves from the kit.
- While our simulation ends here, the learner is now at a stage where they can continue with preparation of the procedural site and conduct the CVC placement.



Figure 1: Fully Donned Avatar



Figure 2: Applying ChloraPrep



Figure 3:Using Ultrasound Machine

Conclusion & Future Work

- We have developed a VR-based environment for medical trainees to practice proper PPE donning and doffing and sterile technique prior to CVC insertion in a COVID-19 patient.
- The use of VR simulators compared to current conventional training methods has several benefits, including requiring fewer resources, generating more quantitative training data, and being always available and accessible.
- We have gathered initial face validation data from three critical care attendings and six resident learners and are in the process of conducting a formal study to test the learning effects of using our VR-based simulation for CVC placement.
- While our simulation ends after completing the preparation, we also plan to develop the procedural site to allow trainees practice the placement of CVC.

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