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Improving Proficiency in Central Venous Catheter Insertion: Standardized Simulation Based Training for Internal Medicine House Staff

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Background
Central venous catheter (CVC) placement is often a necessary procedure in critically ill patients. In the U.S. alone over 5 million CVCs are placed annually. Frequently, there is no standardized training program for house staff and CVC placement training is done “on the job” under the guidance of another resident deemed to be competent to perform the procedure. Even in programs where simulation training is utilized, there is a lack of standardization of this training. This lack of systematic training can lead to significant variation in procedural technique and ability to place CVCs. Complications have been reported in 15-20% of patients, which leads to significant increases in hospital cost, morbidity and even mortality [1,2]. The American Board of Internal Medicine strongly recommends utilization of simulation training to obtain competency in CVC placement, prior to performing the procedure on a patient [2], and the Accreditation Council for Graduate Medical Education mandates that internal medicine residents demonstrate competence in this procedure.

Recent literature suggest that a standardized simulation-based training workshop can improve proficiency in CVC insertion [2]. Training includes both an online pre-test module that reviews anatomy and procedural techniques, hands-on training, and a post-test simulation practical for proficiency. Skills acquired include adherence to sterile technique, familiarity of the CVC kit, and the use of ultrasound in real-time placement of a CVC. Some simulation based programs also include education on dealing with unforeseen complications, as well as the proper procedure for removing a CVC.

Methods
House staff, including internal medicine residents and critical care fellows, will be complete a formalized training program including an online module, a simulation training session, and a proficiency simulated exam to assess competency in CVC placement. The curriculum will include a series of didactic lectures and videos, as well as simulation center training models. First, house staff will undergo a pre-test to assess their ability to safely place a CVC. This will involve a monitored simulated CVC insertion under the supervision of a faculty member or critical care fellow who had previously demonstrated proficiency in this technique. They will be graded on a pass/fail metric using a predefined checklist of critical steps assessing sterility, safety, and success.

Then house staff here will be a dedicated simulation curriculum to teach multiple aspects of the CVC insertion. The first component will be an online component which reviews anatomy, informed consent, sterile gowning and technique, and a review of the procedure highlighting critical steps of the procedure. The hands-on portion of the training will focus on sonographic acquisition of a safe location and real-time guidance of the needle tip into the vessel, choosing the appropriate equipment, insertion using a series of universal check points, and confirmation of placement.

Finally, after completing the curriculum, house staff will then be assessed for competency with a post-test practical demonstration on a simulation model again using a pass/fail metric.

Objectives
The objectives of this study are to assess residents’ pre-workshop ability and comfort with CVC placement and, subsequently undergo a standardized online didactic and hands-on clinical training simulation workshop, and subsequently undergo a proficiency test using simulation models to assess competency. The goal of a standardized training module is to create a universal approach to CVC placement in our institution and improve comfort and technical ability of house staff. We hypothesize that this will reduce complications and improve patient care and safety.

Figure 1: CVC Training Checklist

Figure 2: Post-Test Proficiency Evaluation

Figure 3. Ultrasound Images during CVC Insertion

References