Supraclavicular Approach to Subclavian Central Venous Catheterization: Ultrasound Guidance vs. Landmark Approach with a Simulation Training Model

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ABSTRACT

Study Objectives: Ultrasound guidance of central venous catheterization (CVC) is increasingly preferred over the traditional anatomic landmarks technique as a means to improve overall placement success rate and patient safety. Currently, there is limited data available that compares these two techniques when applied to the infrequently utilized supraclavicular approach to subclavian CVC. Our objective is to conduct the first known protocol to evaluate emergency medicine residents' subjective and objective experiences with the supraclavicular approach to subclavian CVC comparing anatomic landmarks and ultrasound-guided techniques utilizing a high-fidelity simulation training model.

Methods: This is a prospective, randomized, crossover study of an educational intervention of 43 voluntarily enrolled emergency medicine residents spanning four training year groups. We measured and compared participants' objective performance outcomes in placing the supraclavicular CVC by anatomic landmarks and ultrasound-guided techniques. We also measured and compared the participants' self-reported pre- and post-procedure familiarity, confidence, and valuation of medical simulation trainers as tools to gain procedural competence.

Results: Although not statistically significant a trend towards a reduced number of attempts required to achieve central venous aspiration with ultrasound guidance as compared to using anatomic landmarks was observed ($p < 0.069$). However, participants' overall time to successful CVC aspiration comparing anatomic landmarks versus ultrasound-guided techniques revealed no advantage for either technique ($p < 0.798$). An overall improvement was observed when comparing all participants' pre- and post-procedure subjective assessments of familiarity with and confidence in performing the supraclavicular approach to subclavian CVC with both techniques ($p < 0.001$). Furthermore, the reported valuation of medical simulation trainers as tools to gain procedural competence was significantly improved ($p < 0.001$).

Conclusion: Our data revealed that compared to the anatomic landmarks technique, the ultrasound-guided technique tended to reduce the number of attempts required for successful subclavian vein aspiration, but did not demonstrate a statistically significant advantage in time to successful venous aspiration for either approach technique for this CVC procedure. Our data also revealed that a high-fidelity medical simulation task trainer is valued by emergency medicine residents as an effective tool in increasing their familiarity, confidence, and subjective procedural competence with the supraclavicular approach to subclavian CVC, regardless of the approach technique (anatomic landmarks and ultrasound-guided). Although further studies are required, instruction of the supraclavicular CV C approach seems feasible and may offer the potential to enhance emergent resuscitations and, ultimately, improve patient outcomes.
Impact of Handheld Sonar Devices on SCUBA Diver Rescue

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ABSTRACT

Objective: Investigate if handheld sonar device can significantly reduce the median duration to locate a simulated missing diver. A secondary objective of the study is to determine the effect a rescue adjunct has on a searching diver’s level of confidence in performing a search for a missing diver.

Methods: This IRB approved prospective, randomized, cross-over study used a voluntary convenience sample of ten SCUBA divers. Participants conducted both standard and modified search to locate a simulated, missing diver. The standard search utilized a standard SCUBA search pattern that started at the point at which the missing diver was last seen. The modified search used a commercial receiving sonar beacon to augment the search. For each of the search methods, successful completion of the search was defined as locating the missing diver within 30 minutes.

Results: A total of 20 dives were completed. Using a standard search pattern the simulated downed diver was found by only 1 diver (10%), taking 18 minutes and 45. In the SONAR assisted search group, the simulated downed diver was found by all 10 divers (100%) with an average search time of 2 minutes and 47 seconds (SD 1 minute 20 seconds). Using the nonparametric Related Samples Wilcoxon Signed Rank Test, the actual times between the sonar group and the standard group were significant (P-value < 0.01). Using paired samples t-tests, The Sonar group increased in confidence after using the sonar than before using the sonar (P-value = 0.000) whereas the std group decreased in confidence (not statistically significant, P-value 0.111).

Conclusions: Handheld SONAR significantly reduces the median duration to locate a missing downed diver as well a increasing user confidence in there ability to find a missing downed diver when compared to standard search and rescue techniques.
Procedural Sedation with Propofol: A Retrospective Review of the Experiences of an Emergency Medicine Residency Program 2005-2010

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ABSTRACT

Objectives: To evaluate the types and rates of adverse events associated with the use of propofol for procedural sedation by physicians from our emergency medicine residency program and compare those adverse event rates with those rates already published for all moderate and deep sedatives for procedural sedation, to include propofol.

Methods: This study was a retrospective chart review of all 215 procedural sedations performed with propofol in our ED from June 2005 to December 2010. The mean patient age was 29 years (SD 22.1; range 1 – 91). Adverse events were compiled and examined from chart data and compared to similar published studies on adverse event rates using propofol.

Results: Ten (4.65%) of the 215 patients experienced adverse events related to procedural sedation with propofol. Our frequency of adverse events was not statistically different from the published rate for all moderate and deep sedatives (P-value 0.407). Of all the adverse events, hypotension was the most common, occurring in five of the 215 patients (2.33%). Three (1.40%) of the 215 patients experienced brief hypoxia, with two (0.93%) of three patients requiring jaw thrust airway repositioning. Two (0.93%) of the 215 patients developed brief apnea that required brief bag-valve-mask assisted ventilation. No patient required any advanced airway management. All 215 patients recovered completely from the procedural sedation and were discharged from the ED in stable and improved condition.

Conclusions: The adverse event rates from our study correlate with those of numerous earlier as well as recently published studies of moderate and deep sedatives, including propofol. The disciplined use of propofol by emergency physicians should continue in order to provide ED patients with the best available management options and care while additional focused and larger scale research is conducted to definitively confirm the premise that emergency physicians can continue to safely perform procedural sedation with propofol.
Do Patients Want A Pelvic Examination? An Emergency Department Patient Survey Incorporating Pre-test Probability and Desire for Informed Consent

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ABSTRACT

Background: Pelvic examinations can be physically and psychologically unpleasant and are frequently performed without patient input. Studies demonstrate pelvic examinations are unreliable. They can be difficult to perform in a busy ED, often requiring added resources.

Study Objectives: Assess patients’ willingness to undergo pelvic examination given likelihood of finding useful information, discover desire for formal consent, identify threshold for mutual avoidance of pelvic examination.

Methods: A written survey was administered to females in a teaching hospital ED. Participants were surveyed regarding willingness to accept pelvic examination given various pretest probabilities of a useful finding and whether physician should seek consent.

Results: 304 surveys collected with 99% response rate. Average participant was 28 y/o and underwent 12 pelvic examinations. With high likelihood of a positive finding (>50%), 96%(95%CI 94-98%) desired a pelvic examination. With a moderate likelihood (25-50%), 90%(95%CI 86-93%) desired the examination. With a low likelihood (5-25%), 58%(95%CI 52-64%) desired the examination. With a very low likelihood (<5%), then 32%(95%CI 27-38%) desired the examination. Participants felt physician should verbally ask permission before performing a pelvic examination in 96% of surveys.

Conclusion: As likelihood of a positive finding decreases, participants are less willing to undergo pelvic examination. With a low likelihood of a positive finding, a substantial number of women would not want an examination. With a very low likelihood of a positive finding, the majority of women would not want an examination. Patients overwhelmingly want an informed discussion before having a pelvic examination.
Impact of Topic Preparation Prior to a Chief Complaint Specific Emergency Medicine Simulation Training Day

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ABSTRACT
Introduction: Emergency medicine (EM) training programs such as ours utilize chief complaint based simulation training to teach core concepts. It is unknown whether advance topic notification increases the effectiveness of these sessions. In this educational process improvement initiative we sought to further understand how to best use simulation as an educational tool by describing the resident objective performance and subjective value of topic notification prior to a chief complaint based emergency medicine simulation training session.

Methods: EM residents training at Madigan Army Medical Center (Fort Lewis, WA) scheduled to participate in a chief complaint based medical simulation exercise were randomized to two groups and one of two chief complaint topics. In a cross-over manner, participants had the opportunity to prepare for one topic three days in advance while serving as the unprepared control group for the other topic. A pre-test, immediate post-test, and delayed post-test covering both topics was given, and questions regarding the subjective value of topic preparation was presented via 9-point Likert scales.

Results: Twenty-five EM residents participated and were notified of one of the two chief complaints. Thirty-six percent of residents who were notified of a chief complaint topic prepared specifically for it, and prepared for it an average of 57 minutes more than for a typical simulation day. No differences in test scores between the groups was observed (p>0.05). Overall, participants did not feel more prepared as a team member for the chief complaint they were notified of (p>0.05). However, they felt that the ability to prepare for a simulation training session significantly enhanced its educational value (p<0.05). Seventy-six percent of residents reported that in the future they would do topic specific preparation if given the opportunity.

Discussion: Residents at our EM program valued the opportunity to prepare specifically for a chief complaint driven simulation training day, while only a minority did additional topic specific preparation. Topic notification did not appear to increase participants’ relevant test scores. However, understanding residents’ attitudes toward simulation teaching methods such as topic notification may increase the impact and perceived worth of these sessions.
Does Transmission of 12-lead Electrocardiograms via Smartphone Devices Allow for Accurate Diagnosis of ST-elevation MI (STEMI)?

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ABSTRACT

Objective: Evaluate efficacy of using smart phones in transmission of 12-lead electrocardiograms between ED physicians and out-of-house interventional cardiologists in diagnosing ST Elevation Myocardial Infarction.

Methods: This is an IRB approved, prospective, randomized crossover pilot study to determine the ability to make clinical decisions based on photographed EKG's that have been transmitted via smart phone to an interventional cardiologist. Our study used four staff Interventional Cardiologists who each received 20 different EKGs organized into two groups of ten EKGs. EKGs were gathered from EKG books; ten clinically proven STEMI's and ten normal EKGs were used. EKGs had confounding factors to include presence of bundle branch blocks, LVH, poor quality (unstable baseline and lead reversal), or prior myocardial infarction. Cardiologists were asked whether they think the EKG represents a STEMI and would activate the cardiac catheterization laboratory. Each Cardiologist read EKGs in different groupings, in paper form or photographed and sent via a smart phone.

Results: When reading both paper EKGs and EKGs on the smart phone, the overall cardiologist accuracy was 87.5%, and the kappa between the smartphone group and the paper EKG group, the kappa was 0.688 (p<0.000029). With reading paper EKGs, cardiologist were 82.5% accurate, kappa of 0.488 (p <0.0321). While reading EKGs on smart phone they were 92.5% accurate, kappa 0.893 (p <0.00017).

Conclusions: The transmission of 12 lead electrocardiograms using smart phones between Emergency Department physicians and out-of-house interventional cardiologists can be accurately and effectively used to determine cardiac catheterization laboratory activation. This could potentially decrease delays in treatment decision making, as well as decreasing “door-to-balloon” time.
A Prospective Emergency Physician Evaluation of a Novel Surgical Cricothyroidotomy Tool in Simulated Combat Environments and the Emergency Department

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ABSTRACT

**Study Objectives:** Cricothyroidotomy occurs with an estimated emergency department (ED) frequency of 0.5% of all intubations and the loss of airway is the third most common cause of preventable death on the modern battlefield. Investigation of ergonomically simplified airway equipment has been proposed as a potential means of improving pre-hospital combat care. The CRIC is one such device, resembling a multi-tool containing the essential procedural devices in a single housing and meant to be operated with one hand and minimal movements from the surgical field. We sought to investigate the performance of a novel cricothyroidotomy CRIC device compared to the traditional surgical method by US Army emergency physicians in both simulated combat environments and the emergency department setting.

**Methods:** US Army staff and resident emergency medicine physicians at Madigan Army Medical Center familiar with the procedure of surgical cricothyroidotomy were familiarized with the CRIC device. Participants were randomized to device and simulated setting order and performed cricothyroidotomies in the standard manner and with the CRIC device via the TraumaMan surgical simulator in three simulated settings: the ED, a day combat environment, and a night combat environment. Differences in procedural completion for the two methods in different settings were compared by two-way ANOVA. The occurrence of major and minor procedural complications, and questions presented as 5-point Likert scales to describe participants’ preferences of cricothyroidotomy methods were compared by chi square analysis.

**Results:** 20 participants completed all simulated scenarios with both cricothyroidotomy methods. Time to incision, time to procedural completion and rate of major complications never differed significantly between the standard surgical method or the CRIC device (p>0.05). The rate of minor complications was significantly higher for the CRIC device in the night combat setting (p<0.05). In the simulated ED setting, 60% of participants preferred the standard surgical method (CI ± 21.5%), while in the simulated combat settings 50% of participants preferred each device (CI ± 21.9%). 55% of participants “strongly agreed” or “agreed” to a statement characterizing the standard surgical method as more likely than the CRIC tool to be successful in the simulated ED environment. In regards to procedural efficiency and potential complications in both all setting, or procedural success in the simulated combat environment, the majority of participants did not respond in positive, neutral, or negative manners to the Likert scale questions. Responses also did not differ significantly between simulated settings (p>0.05).

**Conclusion:** In our study we observed similar significant metrics of performance between devices in all simulated settings. In most regards, participants did not seem to
prefer one device over another in simulated ED or combat settings. It is uncertain to what degree a relative lack of participant familiarity with the CRIC device may have impacted the observed rate of minor complications in the night combat environment. Another notable limitation of this study is the uncertain degree to which these results might translate to actual patients or real environments in the ED or on the modern battlefield. As simulation can only approximate reality, future studies may examine the relative performance of this device on animal or other high fidelity human models for cricothyroidotomy.