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# Can residents detect errors in technique while observing central line insertions?



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Simulation; Error;

Resident;

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#### Abstract

**BACKGROUND:** Procedural teaching and the ability to detect and correct errors are important components of surgical education. This study evaluates whether review of an instructional video will improve residents' ability to detect errors. We hypothesized that clinical experience and confidence do not correlate with ability to detect errors.

**METHODS:** Participants were randomized to 2 groups: the study group viewed an instructional video demonstrating correct technique, whereas the control group did not view the instructional video. Forty general surgery residents described errors in technique during an ultrasound-guided right internal jugular vein catheterization pre and post randomization.

**RESULTS:** Participants who viewed the video improved their error identification rate by 72.6% (P < .001). No correlation between postgraduate year or confidence in error detection and the actual ability to detect errors was noted (r = .17 and r = .14 respectively).

**CONCLUSIONS:** Experience and seniority may not be sufficient to detect procedural errors during central line insertion. Instructional videos improve error recognition. Published by Elsevier Inc.

Graded responsibility and repetitive clinical exposure are pillars of modern Halstedian surgical training.<sup>1</sup> Given progressively restrictive duty hours, many residency programs supplement training through simulation. This training paradigm is gaining acceptance and indeed becoming mandatory at some institutions.<sup>2</sup>

The authors declare no conflicts of interest.

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Central venous catheter (CVC) insertion is a common procedure in hospitalized patients. There are approximately 15 million catheter days per year in the United States accounting for an estimated additional \$37,000 in health care cost per central line-associated blood stream infection (CLABSI).<sup>3</sup> In response, hospitals started to incorporate protocols and procedural bundles to decrease complications related to central line insertion.<sup>4,5</sup> Although many hospitals have instituted simulation  $programs^{6-8}$  to initially teach insertion technique, residents still garner technical proficiency during supervised patient care. In addition, training and performance in simulation may not translate directly to procedural expertise in the operating room or at the bedside.<sup>9</sup> Although it is generally assumed that technical errors during insertion are immediately noted and corrected by the supervisor (often a senior resident), no evidence

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supports this notion. The ability to recognize a technical error is not only important for patient safety but may also better reflect true procedural mastery. Some have observed that trainees may benefit more from recognition of errors rather than observing correct technique alone.<sup>10,11</sup>

The purpose of this study is to determine if review of an instructional video will improve residents' ability to detect errors in technique. We hypothesized that clinical experience and self-confidence with central line insertion does not correlate with ability to detect errors in technique.

# Methods

# Study participants

Forty of 77 eligible general surgery residents at the Yale-New Haven Hospital (YNHH) participated. All eligible residents were invited to participate during a weekly didactic session. There were 9 PGY1, 15 PGY2, 7 PGY3, 4 PGY4, and 5 PGY5 residents in the study.

#### Survey assessment of participants

General surgery residents watched a video containing 21 errors in technique during an ultrasound-guided right internal jugular vein catheterization. Residents were individually asked to list any errors they observed during the presentation by written assessment (Supplementary Fig. 1). These errors are previously reported in literature and accepted as standard in many hospitals.<sup>12</sup> Participants were then randomized to 2 groups: the study group viewed an instructional video demonstrating correct technique, whereas the control group did not view the instructional video. The correct technique video outlines the proper steps in CVC insertion both through demonstration and textual display. Both groups then rewatched the video containing errors and were asked to list any errors they observed again. Pre and post randomization, Likert scale (1 to 5 scale, 1 strongly disagree, 5 strongly agree) surveys were also completed addressing participants' confidence in error detection, ability to teach central line insertion, and willingness to watch an annual refresher instructional video. Selfreported estimates regarding the number of central lines performed since starting residency (grouped to brackets of 25) were also obtained. This study was approved by the human investigation committee and qualified for an educational exemption.

#### Statistical analysis

Statistical analysis was performed using SPSS 23.0 software (SPSS Inc, Chicago, IL). Chi-squared and student *t* test analyses were used for categorical and continuous variables, respectively. Pearson's correlations were used to evaluate relationships between Likert survey responses and error detection ability.

#### Results

#### Study participants

Although we have a total of 77 eligible residents, 40 were available for the study session due to clinical duties and duty hour restrictions. A total of 40 (51.9%) general surgery residents participated in the survey, among whom 21 (53%) viewed the educational video. Participants in the control and instruction video-viewing groups were well matched by both average postgraduate year (PGY) level (P = .92) and average total years (to account for research years) in residency (P = .86). No statistically significant differences were noted between the educational video viewing and nonviewing groups with respect to number of participants with less than 25 CVC insertions (57% vs 63%, P = .70) or 25 to 75 CVC insertions (43% vs 31%) P = .46), perceived confidence in line placement (3.76 vs 4.05, P = .49), reported ability to detect technique errors (3.76 vs 3.95, P = .58), or confidence in ability to teach central line placement (3.33 vs 3.63, P = .46; Table 1).

## **Educational video intervention**

Residents who viewed the educational video demonstrating correct technique in central line placement significantly improved their number of errors detected (5.6 vs 9.9, P < .001), whereas there was no statistically significant improvement (5.2 vs 6.3, P = .31) in those whom did not view the educational video (Fig. 1). The most common errors detected by residents involved breaks in sterile technique (90% pretest, 82.5% post-test), breaks in sterile technique while gowning and gloving (77.5% pretest, 82.5% post-test), and letting go of the guidewire (72.5% pretest, 72.5% post-test; Table 2). Error detection rates were not significantly correlated to PGY level (r = .17) or reported procedural confidence (r = .14). There was a weak positive correlation noted between experience in CVC placement and error detection rate (r = .3).

## Comments

This study evaluated the effect of watching a correct technique video on error detection rate. Based on this single institution study, resident experience or self-perceived confidence by postgraduate year level has no correlation with the ability to detect errors in technique. Although there was moderate positive correlation between the volume of central lines inserted and error detection rate, the absolute errors detected was less than 50%. This finding may call into question the concept that seniority and procedural volume alone are sufficient for supervision of central line insertion.

Error detection rate improved significantly for the study group with a 76% increase in absolute errors detected after reviewing a correct technique video. However, the mean Download English Version:

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