CHEST

Original Research

SIMULATION TRAINING

Initial Airway Management Skills of Senior Residents*

Simulation Training Compared With Traditional Training

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Background: **Scenario-based training (SBT) with a computerized patient simulator (CPS) is effective in teaching physicians to manage high-risk, low-frequency events that are typical of critical care medicine. This study compares the initial airway management skills of a group of senior internal medicine residents trained using SBT with CPS during their first year of postgraduate training (PGY) with a group of senior internal medicine residents trained using the traditional experiential method.**

Methods: **This was a prospective, controlled trial that compared two groups of PGY3 internal medicine residents at an urban teaching hospital. One group (n = 32) received training in initial airway management skills using SBT with CPS in their PGY1 (*ie*, the simulation-trained [ST] group). The second group (n = 30) received traditional residency training (*ie*, the traditionally trained [TT] group). Each group was then tested during PGY3 in initial airway management skills using a standardized respiratory arrest scenario.**

Results: **The ST group performed significantly better than the TT group in 8 of the 11 steps of the respiratory arrest scenario. Notable differences were found in the ability to attach a bag-valve mask (BVM) to high-flow oxygen (ST group, 69%; TT group, 17%; $p < 0.001$), correct insertion of oral airway (ST group, 88%; TT group, 20%; $p < 0.001$), and achieving an effective BVM seal (ST group, 97%; TT group, 20%; $p < 0.001$).**

Conclusions: **Traditional training consisting of 2 years of clinical experience was not sufficient to achieve proficiency in initial airway management skills, mostly due to inadequate equipment usage. This suggests that SBT with CPS is more effective in training medical residents than the traditional experiential method.** ***(CHEST 2007; 132:1927–1931)***

Key words: medical simulation; residency education; resuscitation skills; scenario-based training

Abbreviations: ACLS = advanced cardiac life support; BVM = bag-valve mask; CPS = computerized patient simulator; PGY = postgraduate year; SBT = scenario-based training; ST = simulation trained; TT = traditionally trained; UT = untrained

Residency training has traditionally relied on the apprenticeship model for training physicians. This experiential learning, or "learning by doing" dominates the culture of residency training.[1] The "see one, do one, teach one" method of training is not appropriate in high-risk, low-frequency events such as cardiac arrest or respiratory arrest.

Simulation training offers a controlled, safe, and reproducible environment in which to practice clinical interventions during high-risk events.[2] It has also been shown to be effective in acquiring clinical skill proficiency[3–7] and improving performance in actual clinical situations.[5]

Although residency training programs are increasingly offering training of critical skills using simulation technology, the use of simulators is not yet a standard component of residency training.[8] A likely reason for this has been the belief that traditional educational approaches have been successful. For example, resuscitation skills, including initial airway

management, are assumed to be acquired from advanced cardiac life support (ACLS) courses and enhanced during traditional experiential training. Some studies[9–16] have questioned this belief. The present study compares the skills of simulation-trained (ST) residents with residents trained by the traditional experiential method using a validated model of initial airway management training.

Materials and Methods

Subjects and Study Design

This study was approved by the Committee on Scientific Activities of Beth Israel Medical Center (New York, NY); all subjects gave informed consent before participating in the study. The study took place at Beth Israel Medical Center, an urban teaching hospital and the Manhattan campus for Albert Einstein College of Medicine. All third-year residents had received ACLS certification before beginning residency and had renewed their ACLS certification at the end of their second year.

We studied two separate groups of internal medicine residents at the beginning of their third year of postgraduate training (PGY). Data were collected in July of 2 consecutive years, enabling comparison of these groups. In July 2003, we tested all PGY3 residents (n = 32) for skill in initial airway management using scenario-based training (SBT) with a computerized patient simulator (CPS). This resident group had never received formal SBT with a CPS at any time during their residency. This group was designated as the traditionally trained (TT) group. In July 2004, we tested all PGY3 residents (n = 30) for skill in initial airway management using identical testing methods. This resident group had undergone SBT with a CPS in initial airway management in July 2002 as part of a mandatory training program that began that year and only targeted PGY1 residents. This group was designated as the ST group. Group assignment is summarized in Figure 1.

In order to compare the performance of TT residents with residents who had no experience in initial airway management, in July 2003 we tested all PGY1 internal medicine residents (n = 49) who had just started postgraduate training. These residents were designated as the untrained (UT) group.

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Description of SBT With CPS

We used the identical setup, testing, scoring, and training as in our previous studies.[4,5] We briefly describe the procedures as follows.

Simulation Setup

The testing of residents was standardized and performed in a hospital room that was dedicated to simulation training. The CPS control computer was concealed behind a curtain. The testing team consisted of a computer operator and two researchers who played the roles of floor nurses. These nurses acted consistent with standard nursing practice but could not lead the study subject with suggestions. The CPS unit (SimMan; Laerdal Medical Corporation; Wappingers Falls, NY) was a human-sized mannequin lying supine on a hospital bed. The CPS had realistic features, such as a palpable pulse, chest wall excursion, and audible breath sounds. Vital signs were displayed on a bedside monitor and could be assessed by physical examination. The adequacy of ventilation with a bag-valve mask (BVM) was sensed and was graphically represented on the concealed computer screen. The computer operator programmed clinical scenarios and recorded the response of the subject for later analysis.

Testing Procedure

All residents were individually escorted to the training room by a trained simulation instructor. During a standardized introduction, the trainer demonstrated the capability of the mannequin and informed the resident that all of the equipment on a typical hospital floor as well as two nurses were available for assistance. The resident exited the room and was then called in to the bedside of the simulated patient as the first responder in an emergency situation.

The CPS was set to apnea with an oxygen saturation of 80%, a BP of 80/60 mm Hg, and a heart rate of 80 beats/min in sinus rhythm. This scenario simulated a respiratory arrest that had not yet progressed to cardiac arrest. If the actions of the resident did not result in successful BVM ventilation, the oxygen saturation declined followed by bradycardia and progressive hypotension. Full cardiac arrest then occurred in 3 min. Unsuccessful BVM ventilation was defined as the omission of any of the seven essential tasks of initial airway management (Table 1). Four nonessential tasks were also measured; however, omission of any of these items still permitted successful resuscitation.

Scoring

Immediately after testing, the two researchers portraying nurses independently completed a standardized scoring sheet based on their observations and the data recorded by the computer operator. The scoring sheet is based on Table 1; each task was scored as either completed or not completed. Discrepancies were resolved by consensus. In a previous study,[4] blinded video-based scoring of resident performance produced identical results as consensus observational scores. In the present study, we did not use video-based scoring or examine interrater variability.

Teaching and Debriefing Protocol

Training consisted of a 30-min session that began with testing the resident during the standardized CPS scenario of respiratory arrest in which they were expected to perform seven essential tasks and four nonessential tasks of initial airway management.