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Basic airway skills acquisition using the American College of Surgeons/Association for Surgical Education medical student simulation-based surgical skills curriculum: Initial results

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ABSTRACT

Background: The ACS/ASE Medical Student Simulation-Based Skills Curriculum was developed to standardize medical student training. This study aims to evaluate the feasibility and validity of implementing the basic airway curriculum.

Methods: This single-center, prospective study of medical students participating in the basic airway module from 12/2014–3/2016 consisted of didactics, small-group practice, and testing in a simulated clinical scenario. Proficiency was determined by a checklist of skills (1–15), global score (1–5), and letter grade (NR-needs review, PS-proficient in simulation scenario, CP-proficient in clinical scenario). A proportion of students completed pre/post-test surveys regarding experience, satisfaction, comfort, and self-perceived proficiency.

Results: Over 16 months, 240 students were enrolled with 98% deemed proficient in a simulated or clinical scenario. Pre/post-test surveys (n = 126) indicated improvement in self-perceived proficiency by 99% of learners. All students felt moderately to very comfortable performing basic airway skills and 94% had moderate to considerable satisfaction after completing the module.

Conclusions: The ACS/ASE Surgical Skills Curriculum is a feasible and effective way to teach medical students basic airway skills using simulation.

1. Background

A significant paradigm shift occurs approximately midway through medical school, taking students from classroom-based instruction to clerkship-based clinical learning. This transition can be fraught with challenges and stress for the learner.[1] On the other hand, this transition, among many, has been noted to be an important part of identify formation and professional maturation of students,[1,2] and can serve as a powerful motivator for acquiring new knowledge and skills.[3]

Simulation training to promote acquisition of technical skills and development of clinical reasoning are being increasingly used in the today's surgical education domain to combat the external forces impacting the system. Rapidly evolving medical knowledge and technology is an ever-present driver to keep the modern curricula accurate. Changes in patient safety practices, hospital value-based reimbursement,[4] work hour limitations, and reduced number of surgical team members in the hospital at any given time affect the clinical educational climate, and can affect the level of autonomy and time spent teaching residents and medical students alike.[5,6] In addition, a degree of heterogeneity exists across medical student experiences despite the best efforts of clerkship directors due to the wide range of clinician preceptors, patient case-mix, hospital attributes, and learner-specific traits. These factors make it difficult to ensure that learners across the country are learning and retaining a standard set of basic surgical skills.

In response to these factors, the American College of Surgeons (ACS) and Association of Program Directors in Surgery (APDS) created a National Skills Curriculum[7] to standardize surgical skills modules and provide structured simulation-based instruction in a

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classroom environment for surgery residents. Simulation is a tool that can be used to bridge the gap created by these challenges, providing a safe, standardized, and reproducible educational exercise for medical students as they transition to clerkship-based learning. An extension of this curriculum was developed by the ACS and Association for Surgical Education (ASE) to include 25 modules with the intent to provide a universal and structured modular curriculum for medical students pursuing any future career across the nation.[8] To study the effectiveness and feasibility of this curriculum, the ACS/ASE Medical Student Simulation-Based Skills Research Collaborative (SRC) implemented a multi-institutional study in 2014 at 17 sites, with 10 sites ultimately collecting data. Three skills were selected for study at these institutions: knot-tying, suturing, and basic airway management.

The primary aim of our study was to determine the feasibility and effectiveness of implementing the basic airway portion of this curriculum into an existing medical school surgical skills curriculum at a single institution and to report the initial results. Secondarily, we sought to evaluate the effect of prior experience on student performance in the assessment, the internal validity of the instructor-rating tool, and to evaluate the relationship between student perception of proficiency compared to rater assessment of proficiency.

2. Methods

This study was reviewed by the Minnesota Institutional Review Board and determined to be exempt. All senior (3rd and 4th year) medical students at a single institution participating in the ACS/ASE SRC multi-institutional study from December 2014 through March 2016 were approached for enrollment. Senior medical students participated in the Basic Airway Module on a rolling basis throughout the school year as a part of their surgical skills curriculum. Instructors for the curriculum consisted of general surgery residents who had completed at least 3 years of general surgery residency (EA, CJ, SM, ER, JS, JH, BB, SM, MB). All instructors were given a training module in person by the first author on the ACS/ASE skills curriculum along with paper and online access to the ACS/ASE Basic Airway Management Module; accessible at https://www.facs.org/education/program/simulation-based with a registered user log-in. The Instructor Rating Tool used to grade students was also obtained from this standardized curriculum.[8]

Learners each participated in a single session that began with 30 min of didactics on basic airway positioning, 1- and 2-handed bag-valve mask ventilation, and use of airway adjuncts as detailed in the ACS/ASE curriculum.[8] Students then had 15 min of hands-on practice in a small group setting, followed by a 15-minute individual assessment during a simulated clinical scenario with a manikin. Proficiency was determined with a standardized performance-rating tool, which was accessed as a questionnaire (Qualtrics, Provo, UT) on an iPad. This rating tool included 3 sections. A checklist of skills performed detailed the technical aspects of basic airway management (15 points possible). The global performance was rated on a scale of 1–5 and corresponded with a range of learner abilities from “unable to perform basic airway maneuvers” as 1 and “performed basic maneuvers in a single, fluid attempt” as 5. The global and checklist scores were combined to form a total score (20 possible points). The final letter grade was given for learner's overall abilities: 1) needs review (NR), 2) proficient in a simulated scenario with or without assistance (PS), and 3) proficient in a clinical setting (CP). A proportion of learners completed pre-curricular surveys regarding prior experience with basic airway skills, prior intubation experience, and self-perception of proficiency with similar category options as the instructor (NR, PS, or CP). After module completion, learners completed post-assessment surveys of comfort with the skill and satisfaction with the training modules. They were also able to indicate their self-perception of proficiency with a letter grade that corresponded with the instructor's options for final letter grade (NR, PS, or CP).

Data analysis was performed using SPSS v23 software (IBM, Armonk, NY). Pearson bivariate correlation was used to compare the 3 elements of the performance-rating tool (checklist score, global score, and letter grade) to determine internal validity of the grading tool. Pearson correlations and chi-square testing were also used to compare the letter grade given by the rater and the student's post-test perception of proficiency. Changes in students' pre- to post-test self-perception of proficiency were analyzed with chi-square testing. Pearson correlation was also used to evaluate the relationship between pre-curricular experience and letter grade. Data are presented as mean ± standard deviation, except where indicated. Statistical significance was set at $p < 0.05$.

3. Results

Two-hundred forty learners completed the module during the 16 month study period. The majority of the learners were 3rd year medical students (95%) and the remaining were 4th year students (5%). The mean total score (global score plus checklist score) was 17.8 ± 2.4 out of 20 possible points. As indicated by the rater letter grade, 3% (6 students) required further review, 49% (118 students) were deemed proficient in a simulated scenario, and 48% (116 students) were deemed proficient in a clinical scenario.

One-hundred thirty learners completed pre-curriculum and post-test surveys. Four of these learners had missing instructor evaluations or did not present for assessment. Of the remaining 126 students, 94% (119) reported any prior experience with bag-valve mask ventilation, though only 25% (32) had any prior experience using this skill in a clinical setting. A qualitative breakdown of prior learner experience is presented in Table 1. All students reported being moderately to very comfortable with basic airway skills after curriculum completion. Additionally, 30% (38) had moderate and 63% (80) had considerable satisfaction with the module.

To evaluate the learner's change in perception of proficiency after module completion, we compared the pre-curriculum survey to the post-test survey. As seen in Fig. 1, there was a significant improvement in pre-to post-test perception of proficiency ($p < 0.01$). All except 1 learner perceived that they had an improvement in proficiency after module completion.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the 3 parts of the standardized instructor-rating tool. A positive correlation was

Table 1
Medical students' prior experience with basic airway skills.

Any prior experience on model or patient	**n = 126**
Yes	94% (119)
No	6% (7)
Previous formal instruction	
Yes	90% (113)
No	9% (11)
No Response	1% (2)
Experience with patients	
None	73% (92)
Minimal (0-10)	21% (26)
Moderate (11-50)	5% (6)
Considerable (51+)	0% (0)
No Response	1% (2)
Prior experience with intubation?	
Yes	11% (14)
No	88% (111)
No Response	1% (1)