


Trends in Surgical Critical Care Training Among General Surgery Residents: Pursuing an Ideal Curriculum

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Rebecca M. Jordan, DO¹, Lauryn A. Ullrich, DO¹, Alexandria Decapua-Guarino, DO¹, and Brian Klock, MD¹

Abstract

Background: The Accreditation Council for Graduate Medical Education (ACGME) provides no specific guidelines for surgical critical care (SCC) training during general surgery residency. Growing emphasis is placed on this experience with increasing case requirements and dedicated SCC content on board certification exams.

Methods: A digital survey was distributed to ACGME-accredited general surgery residencies via email. Respondents reported number and setting of critical care months during residency and rated comfort level within 5 critical care principles and overall satisfaction with their SCC experience. Study cohorts were formed to compare experiences and competencies between respondents based on setting, months, postgraduate year (PGY) level, and formal surgical intensive care unit (SICU) experience. Differences between cohorts were compared using the Mantel-Haenszel test ($P < .05$).

Results: Seventy-three residents responded with 45% training at academic centers versus 46% in community hospitals. Approximately 50% completed a formal SICU rotation, while 9% reported no dedicated critical care rotation during residency. Overall, 78% felt satisfied with their SCC experience. Residents training at academic centers were more satisfied overall and felt more comfortable with ventilator management. Those who completed 5 or more months of critical care training reported greater confidence with intravenous sedation and ventilator management, while residents having a formal SICU rotation felt more confident with vasopressor and ventilator management.

Discussion: Variability remains within SCC training among general surgery residents with perceived benefits seen in training at academic centers and completing a formal SICU rotation. Although limited, these findings offer a foundation for developing an effective SCC curriculum.

Keywords

surgical critical care, general surgery residency, graduate medical education

Introduction

Over the past 4 decades, surgical critical care (SCC) has emerged as a primary component of general surgery training with specialty fellowship certification offered by the American Board of Surgery (ABS) starting in 1989.^{1,2} Growing emphasis has been placed on SCC experience as critical care case requirements have increased in recent years; a minimum of 40 critical care cases are required for graduation and up to 10% of the American Board of Surgery Qualifying Exam (ABS QE) is dedicated to SCC.^{3,4} However, the Accreditation Council for Graduate Medical Education (ACGME) provides no specific guidelines for SCC training during

general surgery residency with no minimal rotation requirements.

There is limited published data regarding optimal delivery and duration of SCC experience in the general surgery residency curriculum. Napolitano et al found that

¹Department of General Surgery, Geisinger Wyoming Valley, Wilkes Barre, PA, USA

Corresponding Author:

Rebecca M. Jordan, DO, Department of General Surgery, Geisinger Wyoming Valley, Wilkes Barre PA 1000 East Mountain Blvd Wilkes Barre, PA 18711, USA.
Email: michellejordan09@gmail.com

on average, residents applying to sit for the ABS QE completed 3.1 months of SCC rotations during residency, although this varied over a range of 0-15 months.⁵ Furthermore, with the ACGME implementing the 80-hour workweek and an ongoing shift toward specialization, dedicated time residents spend in the intensive care unit is declining with overlapping coverage being provided by residents from other specialties and midlevel practitioners.²

Over the past few years, the SCC curriculum at our institution saw major changes with the loss of a dedicated SCC rotation. With these changes in mind, we sought to evaluate how residents in ACGME-accredited general surgery programs acquire SCC training, and how their experience affects overall comfort level within critical care principles. With this information, we hoped to identify aspects of SCC training that may be incorporated into a new and improved curriculum at our institution.

Methods

A digital survey was created using an online platform to investigate general surgery resident's SCC experience. The survey was distributed to all ACGME-accredited general surgery residency program coordinators via email. Further dissemination to residents was left to their discretion. Residents were asked whether the majority of their training took place at an academic center or a community hospital, the number of months spent during residency on a dedicated critical care rotation, and the setting of that experience (medical intensive care unit [ICU], surgical ICU [SICU], or both). Further questions included postgraduate year (PGY), location of SCC experience (base hospital, outside facility within their hospital system, etc.), and if a formal SICU rotation was completed. Residents were then asked to rate their comfort level within 5 critical care principles using the Likert scale (5 = very comfortable), including ventilator management, vasopressor management, intravenous sedation, central line placement, and end-of-life discussions. Finally, residents rated the overall satisfaction with their critical care experience using the Likert scale, with 5 representing very satisfied. The email correspondence was sent only once. Surveys remained available from January 28 to April 30, 2019.

Descriptive statistics were used to summarize the survey respondent's PGY, SICU experience, and other background information. All responses were reported as frequency (n) and percent (%). Several study cohorts were formed to compare experiences and competencies between respondents based on (1) setting of SCC experience, (2) PGY level, (3) months of SCC training, and (4) formal SICU rotation experience. Differences between study cohorts were compared using the Mantel-Haenszel

test, with P values $<.05$ considered significant. All tests were 2-sided, and all statistical analyses were performed using SAS 9.4 (SAS Institute, Inc., Cary, NC, USA).

Results

There was a total of 73 respondents, of which 2.1% ($n = 2$) were surgical preliminaries, 13.7% ($n = 10$) PGY1, 24.7% ($n = 18$) PGY2, 24.7% ($n = 10$) PGY3, 16.4% ($n = 12$) PGY4, 13.7% ($n = 10$) PGY5, and 2.7% ($n = 2$) PGY6. Thirty-three (45.2%) trained at a large academic center, while 34 (46.6%) were at a community-based hospital. Four (5.5%) spent time in a medical ICU with some SCC, while 23 (31.5%) spent time in a dedicated SICU with some medical ICU experience. Thirty-two (43.8%) residents completed a formal rotation in a SICU, while 7 (9.6%) reported no dedicated critical care rotation during residency. Fifty-two (71.2%) received SCC training at their base hospital, while 92% ($n = 67$) reported caring for critically ill patients during overnight call (Table 1).

Overall, 78% felt satisfied or very satisfied with their SCC experience. Compared with those at a community hospital, residents who trained at an academic center were more satisfied with their critical care experience ($P = .0053$) and were statistically more comfortable with ventilator management ($P = .0017$). There was no difference in comfort level in vasopressor management ($P = .0629$), central line placement ($P = 0.3371$), intravenous sedation ($P = .6431$), or end-of-life discussions ($P = .286$) based on the type of center. Residents from PGY 4-6, compared with PGY 1-3, felt more comfortable with central line placement ($P = .0046$), intravenous sedation ($P = .003$), vasopressor management ($P = .0019$), and end-of-life discussions ($P = 0.0127$) with no difference in confidence with ventilator management based on PGY ($P = .2397$). Those who completed 5 or more months of critical care training versus those who completed 4 months or less, reported greater confidence with intravenous sedation ($P = .0443$) and ventilator management ($P = .0229$). Finally, residents who completed a formal SICU rotation felt more satisfied with their SCC experience ($P = .0039$) and were more comfortable with vasopressor ($P = .0343$) and ventilator management ($P = .0176$).

Discussion

In 2009, the ACGME introduced the Critical Care Index Cases log to provide evidence of resident involvement in the management of a variety of critical care patient needs.⁵ To satisfy ACGME requirements, graduating general surgery residents must log a minimum of 40 cases, recently increased from 35, involving at least 2 of 7 critical care tenants: ventilator management, hemorrhage (nontrauma), hemodynamic instability, organ failure,

Table 1. Survey Questions with Response Frequencies.

Survey question and responses	Frequency, n (%)
What is your current PGY in residency?	
Surgical preliminary year	2 (2.7)
PGY1	10 (13.7)
PGY2	18 (24.7)
PGY3	18 (24.7)
PGY4	12 (16.4)
PGY5	10 (13.7)
PGY6	2 (2.7)
Other	1 (1.4)
In what setting was most of your surgical critical care experience obtained?	
Large academic center	33 (45.2)
Community-based hospital	34 (46.6)
Both large academic and community-based hospital	6 (8.2)
Did you rotate primary within a medical or SICU? Did you complete a formal SICU rotation?	
Medical ICU and some surgical critical care	4 (5.5)
Dedicated SICU and some medical critical care	23 (31.5)
Formal SICU	32 (43.8)
Equal SICU and medical ICU	6 (8.2)
No dedicated ICU rotation	7 (9.6)
Not specified	1 (1.4)
Did you complete any critical care rotations outside of your base hospital?	
No, at my base hospital only	52 (71.2)
Yes, at my base hospital and other hospitals within my health system	12 (16.4)
Yes, at a hospital larger than my base hospital, not within my health system	5 (6.9)
Yes, At a hospital larger than my base hospital, within my health system	2 (2.7)
Other	2 (2.7)
Trauma hospital	1
At my base hospital and at a hospital not in my health system	1
Did you care for critically ill patients during night and weekend call?	
Yes	67 (91.8)

Abbreviations: SICU, surgical intensive care unit; ICU, intensive care unit; PGY, postgraduate year.

dysrhythmias, invasive monitoring, and/or nutritional support.³ Despite these requirements, the ACGME offers no guidelines for setting or duration or content of SCC training.

Our results suggest that residents who train at academic centers are more satisfied with their SCC experience compared with those at community hospitals. However, this only translated to increased comfort with ventilator management. The benefits of training at an academic center have been explored before. Falcone and Charles found that between 2002 and 2012, trainees from general surgery residency programs affiliated with the military outperformed both academic and community general surgery programs on the ABS QE, ABS Certifying Exam, and ABS combined index, while academic programs performed better than community programs.⁶ These results differed from previous studies that did show higher pass rates from residents training at academic programs, however, not statistically significant.⁷ Multiple

factors may play a role in these disparities. Academic programs are often larger in size, may provide more resources in the form of staff and equipment, and likely attract more academically competitive applicants. The diversity of training in the United States will likely persist, making it important to identify factors that may be applied universally to general surgery residency programs.

A formal SICU rotation, that is, a dedicated month spent in an SICU, also resulted in improved overall satisfaction and greater confidence with vasopressor and ventilator management. This type of rotation may be difficult to arrange for smaller, community programs. However, it seems some programs overcome this by sending residents to a larger hospital both within and outside of their hospital system.

As one may expect, a higher PGY level was associated with greater comfort in managing most of the critical care tenants. Interestingly, there was no difference seen in

comfort with ventilator management based on the year of residency training. A similar, single-institution study evaluating residents within a large hospital system, found that PGY1-5 residents completed an average of 9.3 ± 4.5 weeks of SCC experience with more senior residents expressing increased comfort in managing SCC diseases and performing procedures.¹ Napolitano et al showed that the number of SCC months for graduating residents ranged from 0 to 15 months, with 3 on average and the majority spent during the PGY 1 and 2 years.⁵ Our population reported a range from 0 to 32 months with a mean of 5.4 months and a mode of 4 months. More than 5 months of SCC experience did translate to increased comfort with sedation and ventilator management; however, it did not result in greater satisfaction. There clearly remains great variability in time spent receiving SCC training among general surgery programs, but the advantage of increased time is not clear.

Ventilator management is 1 of the 7 ACGME key SCC concepts. However, discomfort with ventilator management was consistent among all groups in our study. Current work-hour restrictions, medicolegal issues, and the growing complexity of caring for critically ill patients have been identified as barriers for residents' learning key concepts and developing autonomy with ventilatory management during ICU rotations.⁸ With these constraints, simulation training is growing as a viable option, found by multiple studies to be a valuable addition to standard didactic teaching.⁹ Yee et al developed a mannequin-based, mechanical ventilation boot-camp found to improve critical actions in simulated patients with acute respiratory distress syndrome and atelectasis with mucous plugging, in addition to a 2-fold increase in resident confidence with ventilator management.¹⁰ For smaller community programs with limited critical care access, or for those programs reporting no dedicated critical care rotation, focused didactics with a simulation-based curriculum may help residents gain knowledge and comfort in ventilator management.

There are several limitations to this study. First, there is the subjective nature of a survey study. The response rate was low compared with potential recipients. We hypothesize that this may be due to a lack of interest or time among residents but may also be secondary to low distribution as this was left to the discretion of the program coordinators. Second, responses may have varied based on participants' understanding of the questions. The definition of academic center versus community hospital was not clearly described in the survey and may vary among respondents. Additionally, residents were asked to report if they completed a formal SICU rotation, that is, at least 1 dedicated month in an SICU setting. It is possible as this was not clearly defined and perhaps more than who reported such experience, did, in

fact, complete a formal rotation based on that definition.

While limited, this study offers a foundation for future efforts to evaluate SCC delivery and curriculum while providing resident perspective on their critical care experience. Future efforts should be made to evaluate SCC experience using objective measures such as the American Board of Surgery In-Training Exam scores or ABS QE scores, which offer a critical care score breakdown.

Conclusions

SCC training among general surgery residents in the United States remains quite variable. Ventilator management seems to be particularly challenging to trainees and may require a more focused curriculum with or without simulation. Further investigation is needed to identify the ideal number of months a trainee should spend in an ICU setting, with academic training and a formal SICU rotation providing valuable experience to general surgery residents.

Declaration of Conflicting Interests

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