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Feasibility and Benefit of Incorporating a Multimedia Cadaver Laboratory Training Program into a Didactics Curriculum for Junior and Senior Surgical Residents

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OBJECTIVE: As operative experience in general surgery decreases and work hour limitations increase there is less exposure of surgical residents to advanced vascular and trauma exposures. Many institutions have demonstrated benefits of cadaver laboratory courses. We have incorporated a multimedia cadaver laboratory course into our general surgery residency didactics curriculum with the objective to demonstrate a benefit of the program as well as the feasibility of incorporation.

STUDY DESIGN: This is a prospective study at a tertiary care institution including general surgery residents within our residency program. A curriculum was designed, requiring residents to complete multimedia learning modules before both a trauma cadaver laboratory and vascular exposure cadaver laboratory. Outcome measures included self-efficacy/confidence (precourse and postcourse 5-point Likert surveys), knowledge (net performance on precourse and postcourse multiple choice examinations), and resident perception of the curriculum (postcourse 5-point Likert survey). Data were analyzed using ANOVA paired *t*-tests.

RESULTS: For the vascular cadaver laboratory, resident knowledge improved overall from an average of 41.2% to 50.0% of questions correct ($p = 0.032$) and self-efficacy/confidence improved by 0.59 from 1.52 to 2.11 out of 5 ($p = 0.009$). Median confidence is 1.37 out of 5 and 2.32 out of 5, before and after course, respectively. Wilcoxon nonparametric test reveals a $p = 0.011$. Resident's perception of the usefulness of the laboratory evaluation was 3.85 out 5. There were 85.71% agreed that the laboratory is useful and 14.29% were disagree. The *Z*-score is −0.1579 (means 0.1579 standard deviations a score of 3.85 below the benchmark). The percentile rank is 56.27%. The coefficient of variation is 24.68%.

For the trauma cadaver laboratory, resident knowledge improved overall from an average of 55.89% to 66.17% of questions correct ($p = 0.001$) and self-efficacy/confidence improved by 0.75 from 1.68 out of 5 to 2.43 out of 5 ($p = 0.011$). Median confidence level is 1.41 out of 5 before the training course and 2.64 out of 5 after the training course. Wilcoxon signed rank test gives a p value of 0.008. Resident's perception of the usefulness of the laboratory evaluation was 3.94 out 5. There were 72.22% agreed that the laboratory is useful and 27.78% were neutral. The *Z*-score is −0.098 (means 0.098 standard deviations a score of 3.94 below the benchmark). The percentile rank is 53.90%. The coefficient of variation is 15.48%.

CONCLUSIONS: Incorporating a multimedia cadaver laboratory into a residency education didactics curriculum was both feasible and beneficial for resident education. We demonstrate an improvement in knowledge and self efficacy/confidence following both cadaver laboratory courses. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2018 Published by Elsevier Inc. on behalf of the Association of Program Directors in Surgery)

KEYWORDS: cadaver laboratory, surgical resident education, surgery residency, surgical simulation, trauma simulation

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INTRODUCTION

Due to improvements in preoperative diagnostics and nonoperative management in trauma with increased endovascular interventions, the number of open trauma and vascular surgeries performed is steadily decreasing, with less than 25% of trauma patients receiving immediate operations.[1-5] A national survey by Esposito et al. found the median annual number of major trauma operations by a practicing surgeon to be about 50, and a 20-year review by the Accreditation Council for General Medical Education (GME) showed trauma operations to have decreased by nearly 50% over the time period of their study, and major vascular repair cases have dropped even more quickly, down more than 50% since 2002.[6,7]

Alongside this decrease in volume of trauma cases, changes in medical policy have reduced the ratio of cases residents work on. Hour restrictions have reduced work hours to 80/wk from previous levels of over 100/wk.[8-12] Moreover, higher patient expectations, increased emphasis on quality and safety in patient care, and tighter cost controls have reduced opportunities for resident surgeons to develop their craft.[13-15]

Together, these factors have resulted in some alarming statistics; according to the American Board of Surgery, graduating residents have, on average, performed less than 1 neck exploration for trauma, treated less than 1 cardiac injury, and performed 0 brachial artery exposures.[7] More generally, surgery residents sometimes see as few as 2 major trauma cases per year.[16] In a field which has historically been reliant on experiential education, and in which experience is still strongly correlated with self-efficacy, the lack of real-life exposure is a major issue.[17-20]

Fortunately, steps have been taken to address the issue. Simulations have become widely incorporated into surgical training programs , and have increased surgical accuracy and efficiency in some studies.[13,21-24] However, some argue that, although simulations can provide practice performing a specific procedure, they do not teach expeditious and safe dissection of anatomical features.[25] Open simulators are being explored to rectify this shortcoming, but remain unable to provide authentic biological feedback.[25-28] Ultimately, although many residents appreciated the value of practicing new instruments and procedures in a simulation, residents and physicians alike are generally skeptical of the ability of simulations to make up for the loss of real experience.[21]

At our institution we have developed a multimedia cadaver course, incorporated into our general surgery resident education conference. The goal of our program is to combine the successful ideas from other programs with effective methodology to complement current courses. Our curriculum is longitudinal, with multiple cadaver laboratories integrated into didactics each year throughout the entirety of a 5-year residency. The objectives of this study are to evaluate the benefit of utilizing multimedia learning resources as adjuncts to the cadaver laboratory training sessions and demonstrate the feasibility of incorporating this curriculum into our general surgery resident didactics curriculum.

METHODS

Study Design

This is a prospective study at a single tertiary care institution. Subject recruitment included all general surgery residents from the Medical College of Georgia at Augusta University with an average of 5 residents per year ranging from postgraduate year (PGY1) to PGY5. Excluded from the study were residents on night float, residents that were postcall, and residents that failed to complete all prelaboratory quizzes and assessments. A trauma cadaver laboratory was conducted in October, 2015 using 4 fresh cadavers with 11 junior residents, 10 senior residents, and 2 faculty participated. The same setup was applied to a vascular cadaver laboratory in February, 2016 using 4 fresh cadavers with 8 junior residents, 5 senior residents, and 2 faculty participated. Junior level residents included PGY1 to PGY2 residents and senior level residents included PGY3 through PGY5 residents.

Cadaver Laboratory Curriculum

A curriculum was designed, requiring residents to complete multimedia learning modules before cadaver laboratories. A the curriculum was provided before training laboratories, which included videos and reading assignments. Videos were compiled from both the SCORE curriculum as well as videos created by senior surgical residents in the anatomy laboratory. During resident didactics conference the week before the cadaver laboratory, supplemental videos were watched and handouts containing the additional reading assignments and video links were distributed. Each resident completed a prelaboratory survey that included the number of times a procedure had been performed and their confidence level in performing the procedure. Each resident also completed a prelaboratory quiz to evaluate surgical knowledge before the cadaver laboratory. Both trauma and vascular cadaver laboratories consisted of one full day training course with an average of 5 residents per cadaver (1 from each training level) performing assigned trauma and vascular procedures and exposures under the supervision and guidance of faculty. Following the completion of the cadaver laboratory courses, residents completed a postlaboratory survey evaluating their confidence level in performing the procedure, a postlaboratory quiz, and a postlaboratory survey regarding the usefulness of the laboratory.