Value of Cardiothoracic Rotations for General Surgeons

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ABSTRACT

Background

In an era of reduced work hours and integrated residency programs, general surgery residents are experiencing decreased cardiothoracic (CT) exposure with unclear implications on their future practice.

Methods

General surgeons who completed residency between 1999 and 2014 were surveyed to assess the relationships between CT exposure during residency and use in current practice for nonthoracic surgeons. The survey was sent to 254 general surgery program coordinators who were asked to forward it to an estimated 1300 former residents.

Results

Ninety-four surgeons responded (representing a 7.2% response rate), with a trend showing reduced time on CT rotations from 1999 to 2014. There was not a significant association

between rotation length (less than 2 months versus greater than 2 months) and CT exposure. The data highlights relationships between CT exposure and relevance to current practice. Importantly, diaphragm surgery is one of the most used CT procedures by general surgeons (53% report current use), yet most residents reported inadequate training exposure during CT rotations (exposure rating = -0.38). In contrast, most residents received adequate exposure to lung cancer care (exposure rating = 0.064), yet it represents the least used skill by currently practicing general surgeons (21% report current use).

Conclusion

Rotations are becoming shorter for general surgery residents, and there is waning interest in the field of CT surgery. It is therefore important to adequately prepare non-CT surgeons by teaching them essential skills

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during their CT rotations. We found that rotation length is less important than content for providing adequate CT exposure. Our data also reveals discrepancies between residents' exposure to CT procedures during their training and utilization of

those procedures in current practice. We hope this data can guide curriculum reform by identifying these discrepancies and influencing targeted, data-driven approaches to optimize CT exposure for general surgeons.

Introduction

There is a demonstrated need to formalize and revise the curriculum for surgical residents.¹ National data reported by the Accreditation Council for Graduate Medical Education (ACGME) indicates that general surgery residents are facing decreased exposure to a variety of cases, potentially exacerbated by time restrictions.² Residents also self-report a lack of competence echoed by surgical fellowship directors indicating that incoming general surgery graduates are inadequately prepared in many ways.³⁻⁴ This calls to question the feasibility and relevance of current case volume benchmarks and suggests a need for curricular reform. The Surgical Council on Resident Education (SCORE) curriculum is limited in that it merely identifies a comprehensive list of competencies but does not distinguish between them based on utility or relevance to future practice. Furthermore, case volume and case diversity are impacted by factors such as duty-hour restrictions and program size.⁵ General surgery curricula must be evaluated to assess for the preparation of residents for future practice despite time restrictions.

The growth of surgical subspecialties creates a need to evaluate the content of specific general surgery rotations for pertinence and effectiveness. There are specific concerns with the content of cardiothoracic (CT) rotations. The average CT rotation is currently estimated to be between 2 and 3 months long and exposes residents to comprehensive aspects of cardiac disease, lung and esophageal cancer care, and CT ICU. Interest in cardiothoracic surgery (CTS) programs has been steadily declining since 1994, with CTS facing the greatest actual and projected decline in practitioners of all specialties

from 2005 to 2020.⁶ Corresponding with this reduction in interest, there has been an anecdotal reduction in the exposure to CTS during 5-year general surgery residencies with respect to shorter CT rotations and fewer opportunities to observe CT procedures. In the past, much of the general thoracic surgery performed nationally was by non-CT general surgeons.⁷ For example, between 1996 to 2005, only 5-10% of 4 index thoracic operations were performed by thoracic surgeons while more than 50% were performed by general surgeons.⁸ This calls to question whether residents, especially those not specializing in CTS, are getting adequate exposure to CTS for their future practice needs. Increasing exposure to CTS and increasing procedures that align with resident career goals are suggested solutions to this issue.⁹⁻¹⁰ However, prior to increasing procedure exposure for all general surgery residents to CTS, current exposure should be evaluated for its relevance to eventual non-CT surgeons.

This pilot study investigates the curriculum of general surgery residents on CT rotations related to graduation year and use in future practice. We hypothesized that CT exposure is decreasing over time for general surgery residents and that much of the curriculum is not relevant to their future practice. We assess the relationships among time spent on CT rotations, exposure to CT procedures, and relevance of CT procedures to practicing non-CT surgeons. Data gathered from this study could be useful for guiding reform of CT rotations to maximize exposure to necessary procedures while de-emphasizing less relevant components. These findings could also serve as a framework for greater curricular reform involving other surgical subspecialty rotations.

Methods

To assess the current CT rotation curricula quality in general surgery residency training programs, we developed and conducted a survey of graduates from accredited US general surgery residency programs from 1999 to 2014. A 19-question survey was forwarded to all 254 general surgery coordinators listed in the Fellowship and Residency Electronic Interactive Database Access (FREIDA) as of March 2014, requesting them to forward this to their recent graduates. Former residents were asked to describe current practice setting, procedure exposure in residency training, and use in current practice on a Likert scale. Specific procedures/diseases were chosen from the SCORE curriculum,¹¹ defining the current CT curriculum for general surgery residents. In addition, respondents were asked about rotation length, quality of mentorship, and overall rotation satisfaction. This survey was presented to and validated by a small focus group to assess survey quality. Participation in the survey was voluntary and anonymous. A completed response was considered as consent to participate.

The surveys were forwarded to approximately 1300 residents. The total number of residents was approximated based on the class size and the number of years surveyed of the 17 programs from which at least a single response was received. The data was voided of current residents and practicing CT surgeons. Responses to rotation length were categorized into those that rotated less than 2 months and those that rotated more than 2 months for each graduating class from 1999 to 2014. Responses pertaining to the level of exposure to CT procedures and disease management skills were consolidated into those that reported “enough” exposure (about right/too much) and those that reported “not enough” exposure (none/a little). Exposure ratings were also calculated for each CT procedure or disease management skill by assigning “not enough” a value of -1 and “enough” a value of +1 in order to average the values across all respondents. Data were analyzed using StataC 13. A linear regression was used to

analyze the data on rotation length as a function of time. Frequency distributions for categorical variables (rotation length and procedure exposure) were examined to identify patterns and trends among the graduate respondents. Specifically, frequency distributions were converted to a 2×2 contingency table for each procedure and analyzed using a Fisher’s exact test for statistical significance (defined as $p < 0.05$). This study was reviewed and approved by the institutional review board (HUM 00077605).

Results

There were a total of 94 respondents analyzed, giving an approximate response rate of 7.2%. Demographic information is shown in Table 1. Of the respondents, 71% were male, with the majority of graduates (57%) graduating between 2010 and 2014. Most respondents (74%) reported that they continued training in fellowship or subspecialty programs.

Respondents were asked how long they rotated on the CT service at an intern or more advanced level (Figure 1). There was a downward trend (slope = $-2.15\%/year$; $r^2 = 0.21$) in the percentage of residents who rotated on CT service for more than 2 months, suggesting that the length of training on CT rotations has gradually declined from 1999 to 2014.

The association between CT rotation length and CT exposure was examined. Respondents rated their level of exposure to various CT procedures and disease management skills (Table 2). The percentage of respondents who reported “enough” exposure (about right/too much) in each cohort (respondents who rotated for less than 2 months compared to those that rotated for more than 2 months) is presented for each procedure (Figure 2). No significant differences in perceived adequacy of exposure were identified among those that spent less than 2 months on CT rotations compared to those that spent more than 2 months on CT rotations.

Exposure ratings were used to quantify the level of exposure for each CT procedure and

TABLE 1. Demographic Information

	No.	%
Gender		
Male	67	71
Female	27	29
Year of graduation		
1999 to 2004	13	14
2005 to 2009	27	29
2010 to 2014	54	57
Was fellowship or subspecialty training pursued?		
Yes	70	74
No	24	26
Current practice setting		
Rural	8	9
Urban	27	29
Private practice—hospital employee	25	27
Private practice—independent group/solo practice	25	27
Academic center	29	31
VA/government hospital	7	7
Academic affiliated position (resident/student)	16	17
Locum tenens	2	2

disease management skill (Figure 3). Chest tube placement, empyema/pleural effusion management, and thoracotomy incisions received an overwhelmingly positive exposure rating (0.91, 0.55 and 0.45, respectively), indicating adequate exposure. In contrast, SVC syndrome, mediastinal tumors and cysts, and diaphragm surgery all received an overwhelmingly negative exposure rating (-0.55, -0.40 and -0.38, respectively), indicating inadequate exposure.

Respondents reported their use of CT procedures or disease management skills in their

current practice setting (Table 2). The most utilized CT procedures and skills by non-CT surgeons are chest tube placement (75%), empyema/pleural effusion management (55%), diaphragm surgery (53%), vascular disease management (51%), and thoracotomy incisions (51%). These responses were stratified to highlight the level of exposure to those procedures and skills while on CT rotations (Figure 4). More than half of respondents (53%) reported currently practicing diaphragm surgery, yet only 40% of those report having “adequate exposure.” Moreover, less than one-third of

TABLE 2. Level of Exposure and Use in Current Practice by Procedure

Procedure	Level of Exposure				Use in Current Practice		
	None	Too Little	About Right	Too Much	Not at All	Occasionally	Frequently
Thoracotomy incisions	3	23	66	2	46	34	14
Chest tube placement/ management	1	3	76	14	23	33	38
Empyemas/ pleural effusions	0	21	70	3	42	36	16
Cardiothoracic ICU management	11	31	46	6	54	28	12
Cardiac disease	13	36	43	2	49	25	20
Lung cancer care	4	40	48	2	74	15	5
Esophageal can- cer care	9	38	44	3	60	26	8
Mediastinal tumors and cysts	13	53	27	1	73	16	5
SVC syndrome	28	45	21	0	65	24	5
Diaphragm surgery	17	48	28	1	44	31	19
Minimally invasive chest surgery	8	39	45	2	63	18	13
Vascular dissection/ anastomoses	11	35	41	7	46	28	20

FIGURE 1. Cardiothoracic Rotation Length During Nonintern Years.

Respondents were asked how long they were on a CT rotation at a nonintern level. This figure represents the percentage of respondents who had more than 2 months on CT rotation during their general surgery residency training (slope = -2.15; $r^2 = 0.21$).

FIGURE 2. Adequacy of Exposure by Length of Rotation. Percentage of non-CT surgeons reporting adequate exposure to the procedures given by the SCORE curriculum stratified by those who received >2 months on CT rotation vs those that received $\leq$ 2 months (chest tube placement and management: $p = 1.0000$; empyemas/pleural effusions: $p = 0.849$; thoracotomy incisions: $p = 0.3606$; cardiothoracic ICU management: $p = 0.2135$; lung cancer care: $p = 0.6769$; vascular dissection/anastomoses: $p = 0.1417$; esophageal cancer care: $p = 0.5286$; minimally invasive chest surgery: $p = 0.8360$; cardiac disease: $p = 0.4043$; diaphragm surgery: $p = 0.6800$; mediastinal tumors and cysts: $p = 1.0000$; SVC syndrome: $p = 0.313$).

FIGURE 3. Adequacy of Exposure by Procedure. Respondents were asked to rate their level of exposure to various procedures as either “enough” (“about right” or “too much” exposure) or “not enough” (“none” or “a little” exposure). Responses of “enough exposure” were quantified with a value of 1, while “not enough exposure” was quantified with a value of -1. Average values were calculated for each procedure, yielding the above exposure ratings. From left to right, procedures are listed from least to most exposure, respectively.

FIGURE 4. Use of Procedure in Current Practice and Training Exposure. Percentage of graduates who reported use of each procedure in their current non-CT practice. Responses were further broken down by the proportion of those who received “adequate exposure” vs those who received “inadequate exposure.”

respondents reported currently treating SVC syndrome (31%), mediastinal tumors & cysts (22%), or lung cancer (21%).

Discussion

There is variable exposure to different CT diseases/procedures within a general surgery trainee’s CT rotations. Historically, non-CT surgeons have needed to be trained in these fields. The adequacy of residents’ current exposure to CT surgery in the era of decreased CT interest and integrated residencies has not been previously studied. Our findings present new knowledge on general surgery graduates’ perceptions about the adequacy of their training exposure to specific cardiothoracic procedures, as well as graduates’ utilization of these procedures in current practice. Furthermore, these findings highlight novel discrepancies between training exposure and utility for specific procedures. Some of these discrepancies may be accounted for by case volume. For example, lung cancer care, which was overexposed relative to its low proportion of use in practice, is highly prevalent among thoracic case volume according to Society of Thoracic Surgeons data.¹² Other discrepancies, however, may be due to a lack of awareness that a procedure is over- or underexposed.

Our data shows that the length of CT rotations has declined since 1999. We did not find a significant association between rotation length and CT exposure. We found that residents received the most exposure to procedures such as chest tube placement, empyema/pleural effusion management, and thoracotomy incisions, whereas they received the least exposure to SVC syndrome, mediastinal tumors and cysts, and diaphragm surgery. We also found that only a minority of surgeons received adequate training exposure to diaphragm surgery despite a majority of surgeons utilizing the procedure in current practice. Finally, we found that lung cancer care is relatively overexpressed despite being the least utilized of all 12 procedures that were analyzed.

The demographics of our respondents appear to correspond to published data on general surgery graduates.¹³ Our respondents represent a wide breadth of practice settings and locations as demonstrated in Table 1. The data from our study can guide curriculum reform of general surgery training and specifically cardiothoracic rotations, toward more adequate exposure to procedures that practicing surgeons use most often. Other subspecialties can also benefit from reproducing the methodology that was used in this study. In particular, a significant portion of integrated

vascular surgery and integrated plastic surgery training, like integrated thoracic surgery, includes general surgery. Our recommendations below are based on maintaining case volume and case diversity as suggested by the ACGME, ABS, and SCORE, while simultaneously maximizing exposure to the most necessary procedures by de-emphasizing disproportionately exposed areas.

Based on our survey, we recommend the following changes to CT curricula. (1) The length of CT rotations should be sustained at 2 months. Study data indicates a trend toward shorter rotations from 1999 to 2014 but did not find any significant difference in the perceived adequacy of exposure to CT procedures when rotating on CT services for more than 2 months versus less than 2 months. This suggests that residents can still receive adequate exposure to important CT procedures and disease management skills with CT rotations shorter than 2 months. (2) Exposure to lung cancer care should be reduced to allow for more exposure to diaphragm surgery. A majority of our respondents report adequate exposure to lung cancer care during training and lung resections comprise 38% of thoracic case volume;⁸ yet, lung cancer care represents the least used skill by general surgeons in practice (21% report current use). In contrast, a majority of surgeons utilize diaphragm surgery, but only a minority of them received adequate training exposure to it. This change will help minimize the discrepancy between exposure during training and utilization in current practice. (3) Increased exposure to vascular surgery should be emphasized. Our data shows that vascular surgery is relatively underexposed during training despite being commonly used in current practice. (4) Early training on the CT rotation should have an emphasis on procedures that are maximally utilized in practice by a majority of general surgeons: chest tube placement, empyemas/pleural effusions, and thoracotomy incisions.

Future studies will need to be performed before curriculum reforms are implemented. For example, this study used purely subjective metrics (ie, Likert

scale) to assess whether residents received adequate exposure to procedures. Other studies are needed to assess objective and quantitative metrics of exposure (such as operative volume). One important advantage of using a subjective metric is that it acts as a crude measure of competency, which may not necessarily be related to operative volume.¹⁴ Competency-based practice in surgical subspecialties has anecdotally been a topic of interest among residency programs. Decreased operative volume and duty hour restrictions have bolstered the case for using competency-based metrics to evaluate residents for internal promotion and preparedness for practice. Unfortunately, consensus is still lacking on how to properly define competency or how to assess it. Future studies will be needed to establish validated metrics of competency before its use in curriculum reform can be more widespread.

One limitation of this study is that the methodology lends itself to several sources of bias. The use of program coordinators to distribute surveys at their own discretion introduces sampling bias due to study participants being selected through a nonrandom process. It could be possible that our methodology oversamples graduates of academic programs compared to community-based programs because participation in our survey has an academic incentive. The approach of forwarding the survey through program coordinators also prohibits an accurate calculation of the response rate since we are unable to determine how many former residents received the survey. The low (estimated) response rate also introduces nonresponse bias because respondents may differ from nonrespondents in their reported answers. Finally, the retrospective nature of the study introduces an element of recall bias whereby respondents who use a procedure in current practice may be more likely to cite inadequate exposure during training compared to respondents who do not use the procedure. The extent that surveyed respondents represent all recent graduates of general surgery programs is inferred from the amount of

responses, as well as the diversity of programs, specialties, and practice settings represented in the demographic dataset.

Conclusion

Fewer general surgeons are choosing to pursue CT surgery because of waning interest in the field. In addition, general surgery rotations (and especially CT rotations) are getting shorter, possibly due to duty hour restrictions. It is important to adequately prepare non-CT surgeons by teaching the skills essential to their future careers during their CT rotations. Our data shows that rotation length matters less than content for providing adequate exposure to CT procedures and skills. We recommend a shift toward shorter, more focused rotations that optimize exposure to the procedures that general surgeons are most likely to utilize in future practice.

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