

Preparing for transition from medical school to intern year of integrated cardiothoracic surgical residency

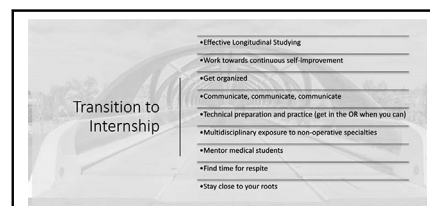


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In medicine, we constantly undergo transitions. As providers, we must grow into new roles and responsibilities at various stages of our careers, learning to both navigate associated challenges while continuing the journey of life-long learning (Figure 1). Of all transitions, the progression from being a medical student to resident is one of the most stark and formative leaps in our careers. Significant efforts have been allocated in academia to better understand this process and to provide beneficial resources and advice.

Although traditional cardiothoracic (CT) surgical training has required general surgical qualification followed by subsequent 2- or 3-year CT fellowship training, integrated 6-year (I-6) programs have emerged as a popular alternative in the past decade because they provide earlier and more direct exposure to the field right after graduating from medical school. In 2021, there were 121 applicants competing for 46 available positions in the United States, and this growth trajectory is expected to continue.

Transitioning to an I-6 residency after medical school entails a unique set of challenges for aspiring CT surgeons. In part, I-6 programs demand an accelerated convergence of surgical skills and knowledge base in general, vascular, cardiac, and thoracic surgery, as well as interventional



This manuscript was prepared by the Thoracic Surgery Residents Association (TSRA).

CENTRAL MESSAGE

Eight residents who recently finished their internship at their respective I-6 programs identified core areas of challenges related to transitioning from medical school to I-6 residency.

PERSPECTIVE

Transitioning to an I-6 residency after medical school entails a unique set of challenges for aspiring CT surgeons that differ from other residency paths and are only just now being identified. I-6 programs demand an accelerated convergence of surgical skills and knowledge base in general, vascular, cardiac and thoracic surgery, as well as interventional cardiology, heart failure, and cardiac imaging.

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cardiology, heart failure, and cardiac imaging. In a similar vein, some of the more traditional challenges associated with starting residency, such as learning to navigate a new system, including team dynamics, hospital workflow, and work-life balance, are complicated by the fact that I-6 residents rotate through multiple departments as off-service trainees. Because there is currently a paucity of literature on how to succeed during this transition, here we present a list of important considerations and advice for applicants. In conjunction with the Thoracic Surgery Residents Association (Figure 2), a committee of 8 residents who recently finished their internship at their respective I-6 programs were organized on a voluntary basis by senior trainees

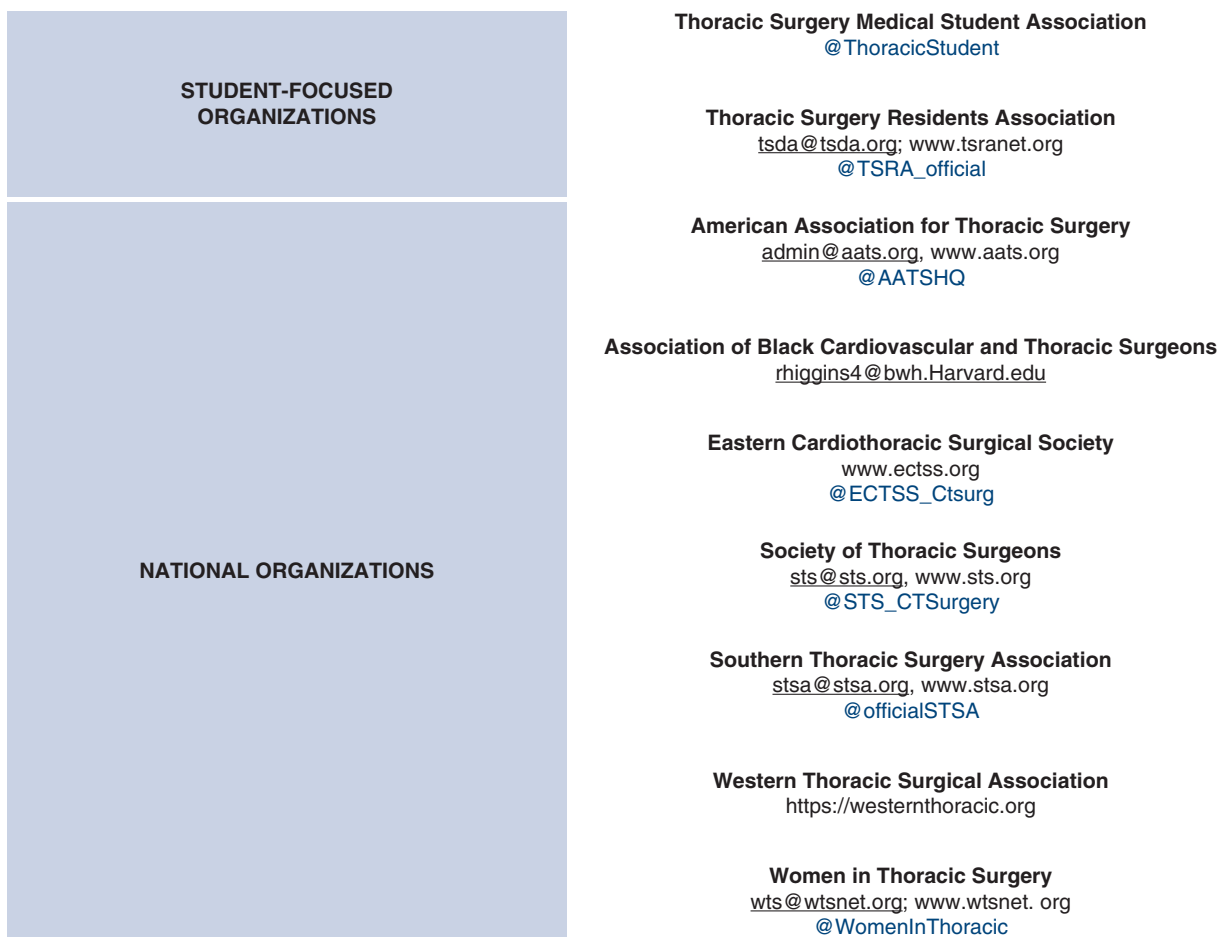


FIGURE 1. List of national organizations that offer various resources in trainee education.

from both I-6 and traditional pathways, as well as an attending surgeon. Core areas of challenges related to transitioning from medical school to I-6 residency were identified.

THE INTERN ROLES

Traditionally, the intern is the workhorse of the team, often the first to know about changes in patients' clinical status and to see and triage patients in the emergency department. The intern is a care coordinator, advocate, documenter, teacher of medical students, and (lest we forget) a surgeon in training. Transitioning to residency entails successfully adopting this multitude of roles.

Starting a New Life, Learning a New System

An intern must quickly grow proficient in navigating a new hospital system in addition to taking on a new set of responsibilities. It is helpful to invest time early in the year to learn the intricacies involved with the new workflow, including the electronic medical record (EMR) system, the hospital map, and a list of important contacts, that will

help you become more efficient in the long term. Before your first day, consider driving to the parking lot of the hospital and practice getting from there to the call room, work offices, clinic, operating room (OR), and intensive care units (ICUs).

In addition, be intentional about building a new foundation as you begin this chapter. Surgical internship can be physically and mentally demanding. Finding a support system early on, including family, co-residents, friends outside of medicine, neighbors, community sport teams, musical groups, or others with whom to share experiences, is immensely helpful. It is in your best interest to engage with the community around you and develop this support system.

Getting into the Mindset of Continuous Self-Improvement

A career in CT surgery is a humbling marathon that requires a mindset of continuous reflection and self-improvement. The motivation to improve must be intrinsic, not extrinsic. At the end of each day, it is important to reflect



FIGURE 2. In conjunction with the Thoracic Surgery Residents Association, a committee of 8 residents who recently finished their internship at their respective I-6 programs were organized on a voluntary basis by senior trainees from both I-6 and traditional pathways, as well as an attending surgeon to identify core challenges related to transitioning from medical school to I-6 residency. *OR*, Operating room; *I-6*, integrated 6-year.

on things that were learned, things that went well, and how to improve further. As you develop further and accumulate more autonomy in training and beyond, only you can establish and enforce your own standard. You must become your own toughest critic and coach.

Learn from everyone, including attending surgeons, other residents, advanced practice providers (APPs), bedside nurses, and most importantly, patients. Starting from a blank slate, one can glean a new insight from every conversation as long as they apply a humble mindset. In fact, one will most likely encounter new, creative, unexpected ideas or pieces of information from those who are younger, and, therefore, may have a different approach toward technology or innovation, or those who come from other disciplines, who may have a refreshing, outside perspective.

When encountering new challenges, it is beneficial to ask trusted junior or senior residents for advice early on. In doing so, you will often find that many have similarly struggled in those areas during their intern years. When you make an error, admit it, even though this may be challenging. Becoming the best-possible clinician one can be is only possible when one learns to accept mistakes as a necessary and inevitable component of one's growth. The challenges of internship can expose feelings of vulnerability and insecurity in any trainee that can exacerbate the fear of making mistakes or being humiliated. However, to err is human. The question is not how we can avoid mistakes, but rather, what we choose to do once we have made them. Mistakes can be a source of valuable lessons and clinical growth, as well as the impetus to cultivate the humility

required to endure future years of training and beyond. We cannot allow fear of mistakes or embarrassment to discourage us from asking important questions early on.

Although you may encounter abrasive feedback from time to time, try your best to take in the insights without hardening, arguing, or growing defensive. Learning to navigate the hierarchy, after all, is an important part of your education.

Organization

In most institutions, a surgical team will “run the list” (ie, go over updates and action items for each patient) after morning rounds. Following this, most other team members will spend the day in the OR. The intern, who may also be operating, assumes the responsibility of ensuring all patient tasks are completed during the day. These include calling consulting services, placing orders, finishing patient notes, and taking care of floor tasks (eg, dressing changes, pulling drains, etc). The key to ensuring no tasks are missed is to write everything down, regardless of how minuscule a task or update may seem. Interns are often pulled in many directions at once, and it is far too easy to forget tasks or confuse patients while managing large services. It also helps to be slightly paranoid about making sure that patient care is moving forward.

All consults should be triaged and chart-checked by the intern to determine the level of urgency. It is important to “trust but verify” the information provided by a consulting team, as other services may not see and recognize surgical emergencies reliably. The general steps to dealing with a

consult are to call back a consult page, alert the team, look up the patient in the EMR and add them to surgical team's list of patients, evaluate and assess the patient, officially go over the patient and come up with a clinical plan with fellow or attending on call, call primary team to give recommendations, complete any urgent tasks, and complete the documentation.

Communication

The surgical intern must learn to become an excellent communicator. Interns are primarily responsible for conducting the floor work and have the greatest amount of interaction with different teams and staff. They work in close contact with the APPs; communicate with case managers, social workers, and pharmacists; and are the first line of contact for nurses and other consultants. The intern is often the first to know about changes in a patient's clinical status, consults for new patients, and recommendations from consulting teams. It is important to learn early on how each team and fellow communicates: some will want text updates when a task is complete, whereas others prefer to run the list in person multiple times a day. New consults must be communicated with the team immediately, even if this involves staffing the consult by going into the OR. Documentation is extremely important. Record in the EMR all issues such as patient problems/calls, procedures, and any information that all the caregivers would need to know.

Overcommunication is much better than undercommunication, especially early on. Never be the only one on the team to know a vital piece of information about a patient. Follow the principle of independent thought, not independent action. Attendings and senior fellows want to be informed of new updates in a timely manner. The intern must not be afraid to communicate when they are worried about a patient and/or do not know what to do. Often, recognizing one's limitations and asking for help will be looked upon favorably by a team, builds the team's trust in the intern, and ensures timely and safe patient care.

Paging etiquette is essential for an intern to master early on. Pages should be returned as quickly as possible. Any concern about patient care should be evaluated *in person*. Nursing concerns are important, since they often notice subtle changes in a patient's status more astutely than members of the surgical team, who may see the patient once or twice a day. It helps to ask nurses "Is there something about which you are concerned?" or "Is there something you think I am missing?" to better understand and evaluate nursing concerns, especially in the beginning of intern year and build team-based rapport.

Working With Medical Students

For most, intern year will be the first time assuming a leadership role. There may be several medical students on

the team. Interns can engage them in patient care by delegating tasks (eg, pulling drains, writing notes, calling consulting services) with adequate supervision. Students can also be taught how to perform basic procedures such as placing and removing simple stitches or staples and prepping patients in the OR (eg, placing sequential compression devices, Foley catheters, Bovie pads). Sufficiently training students will eventually help the entire team become more efficient. Interns can also provide formative education to students who may be interested in CT surgery. Teaching students the basic principles of CT surgery related to cardiopulmonary bypass or the management of aortic pathology may inspire them to join the field.

Finding Time for Respite

Balancing your time and energy during residency, especially during the first year, is a daunting task that can seem unachievable. In addition to aforementioned tasks, as an intern you may feel pressured, both intrinsically or extrinsically, to pick up new projects, to help write papers, and to perform other jobs outside your normal workday. It is of utmost importance to find some time for yourself by drawing boundaries, especially surrounding your health and relationships. Residency is a marathon, not a sprint; you will burn out quickly if you do not make time for yourself outside of the hospital. Finding that appropriate level of balance in your first year may take some time as well as effort, although it remains a crucial part of your training. You need to take care of yourself in order to take care of your patients.

Common Operative Experiences of Interns

Integrated CT surgery interns generally spend between 4 and 6 months on CT surgery and cardiac-related rotations, such as cardiac anesthesia, cardiac surgery ICU, thoracic surgery, and cardiology. On cardiac surgical rotations, interns may learn to perform or assist with sternotomies and sternal closures, extracorporeal membrane oxygenation cannulation, cannulation for cardiopulmonary bypass, setup and operation of the cardiopulmonary bypass, conduit harvests (eg, saphenous vein or radial artery), and heart procurements for transplants. Some programs give priority to junior residents on procurement opportunities, which is a great experience in learning how to open the chest, dissect, cannulate, and prepare the organs for the recipient. On thoracic surgery services, interns may learn to set up for thoracoscopic or robotic cases, to open and close thoracotomies, and to first-assist cases such as wedge resections, pleurodesis, and esophagogastroduodenoscopy. Overall, interns can also expect to acquire competency in common procedures such as placing and removing chest tubes, performing bronchoscopy, and inserting venous and arterial lines using Seldinger technique and ultrasound guidance.

Interns should also learn to manage, and eventually place, intra-aortic balloon pumps.

While on general surgery services, junior CT trainees can expect to have an operative experience similar to that of their general surgery peers, which broadly range across a variety of soft-tissue pathologies (melanomas, lipomas, etc), port placements for chemotherapy, abdominal entry and closure, first assisting, and large portions or the entirety of laparoscopic appendectomies and cholecystectomies. These general surgery cases provide an excellent opportunity for trainees to become comfortable in the OR with basic skills such as suturing, tissue handling, and laparoscopic skills. General surgery attendings often have more experience than CT attendings in teaching junior residents these basics and can offer nuanced suggestions to refine your operative skills.

Preparing for operative cases can be one of the most valuable learning avenues. The night before the case, review the patient's history, the operation including the indications, the key steps, and the possible complications. A helpful suggestion has been to have one notecard per patient with key points of their history, current pathology, and planned surgery that you can keep in your pocket for quick reference before going into the OR. Reading operative reports, especially from the same surgeon performing the same procedure, and watching surgical videos can help you anticipate the flow of the procedure. It is important to understand the rationale behind every minute surgical step and it often helps to record these learning points in physical or virtual journals, depending on learning style. Do not hesitate to reach out to other trainees or the attending to chat about the upcoming case a day or so in advance.

Try to take notes after every case or keep an operative diary. Sketch the relevant anatomy and needle angles. Over time, you can build a collection of notecards that describe each of the most commonly performed cases and the nuances of each attending that performs them.

Operative Etiquette

When entering the OR, introduce yourself. It is important that the circulator and scrub nurse know who you are. Ask if

they would like you to grab your own gown and gloves. Pay attention to the APPs and your senior residents as they prep for cases and assist as much as possible. Learning how to drape based on attending preference is important and is something that will improve as you do it more. Similarly, when the case is complete, help with breaking down the drapes, getting the patient transferred to their hospital bed, and taking them to recovery/the ICU to complete sign-out. When writing postoperative orders, be sure to ask your senior residents and/or faculty as appropriate. Do not assume that all standard postoperative medications are appropriate. It may feel silly to ask if a patient can have a certain medication postoperatively (eg, aspirin), but until you are comfortable with the conduct of the service and perioperative care, it is better to ask.

Asking questions is always encouraged—just be cognizant of timing. Specifically, try to limit unnecessary questions at critical portions of the case. Your time in the OR may be limited as an intern. Take these opportunities you are given to sew to hone your skills and pay attention to fine details. Each experience, even if it is closing skin, is a chance to work on one or more areas for improvement, be it instrument handling, efficiency, or cosmesis. At the end of the case or soon after, ask for feedback from your seniors and faculty—both positive and areas for improvement. As you advance in your training, you can use these conversations to highlight specific goals you may have for growth in the OR.

Technical Preparation and Practice

Technical mastery is achieved through endless practice. This is an important reminder that empowers all trainees. The key to becoming a competent CT surgeon is largely up to the dedication and mindset of the trainee. As opportunities to operate are relatively limited in junior years of training, trainees can maximally hone their dexterity and muscle memory by practicing outside of the OR. If you receive feedback during a procedure, you can practice afterwards until it becomes second nature. This is an important component of procedural learning and is exceptionally high yield during early years of training, when practicing can

TABLE 1. Overview of procedures performed by integrated cardiothoracic surgery residency interns by rotation, as reported by study respondents

Cardiac	Thoracic	General surgery	ICU and procedures
Sternotomy and closure	VATS entry	Lumps and bumps	Chest tube placement
CBP cannulation	Thoracotomy and closure	Port placement	Bronchoscopy
ECMO cannulation	VATS wedge resection	Lap appendectomy	Line placement
CBP setup ("pump run")	VATS pleurodesis	Lap cholecystectomy	IABP placement
Conduit harvests	EGD and intervention	Abdomen entry and closure	Intubation
Transplant procurements	Robot setup	First-assisting	

ICU, Intensive care unit; VATS, video-assisted thoracoscopic surgery; CBP, cardiopulmonary bypass; ECMO, extracorporeal membrane oxygenation; IABP, intra-aortic balloon pump; EGD, esophagogastroduodenoscopy.

help hone basic mechanical skills involved in the operation, before learning the more nuanced, cognitive considerations of operating during later years.

Practicing can take place in many different settings and manners. Practicing at home alone may be more comfortable, both emotionally and logistically, than operating at the hospital or at an in-person wet-lab session, but it does not offer as much immediate feedback as to avoid forming unproductive habits. To some degree, this can be mitigated by using video chat platforms or recordings. Also, more decentralized teaching schemes that leverage peer-to-peer

teaching across various levels of training can also make the process more involved and efficient. Various models currently exist that range in degrees of fidelity and cost, as well as the types of procedures they can simulate. Practicing should be graduated much like intraoperative learning, and comprehensively address open as well as endovascular skills.

In order to be a CT surgeon in our continually evolving field, you must be skilled in open as well as endovascular techniques. The fine motor skills of open surgery can be practiced at home with surgical instruments and basic

TABLE 2. Summary of helpful resources in cardiothoracic surgical training

Text	Text-based	Author(s)
<i>Sugarbaker's Adult Chest Surgery</i>	Daniel Sugarbaker, Raphael Bueno, Bryan Burt, Shawn Groth, Gabriel Loor, Andrea Wolf, Marcia Williams, Ann Adams	
<i>Atlas of Minimally Invasive Thoracoscopic Surgery (VATS)</i>	Ali Mahtabifard, Robert McKenna, Scott Swanson	
<i>Kirklin/Barrett-Boyes Cardiac Surgery: Morphology, Diagnostic Criteria, Natural History, Techniques, Results, and Indications</i>	John Kirklin, Nicholas Kouchoukos	
<i>Sabiston & Spenser's Surgery of the Chest</i>	Frank Sellke, Pedro del Nido, Scott Swanson	
<i>Operative Cardiac Surgery</i>	Thomas Spray and Michael Acker	
<i>Key Questions in Cardiac Surgery</i>	Narain Moorjani, Nicola Viola, Sunil Ohri	
<i>Cardiac Surgery in the Adult</i>	David Adams, MD	
<i>Perioperative Care in Adult Cardiac Surgery</i>	Robert Bojar, MD	
<i>The ICU Book</i>	Paul Marino, MD	
<i>TSRA Review of Cardiothoracic Surgery</i>	Various	
<i>TSRA Clinical Scenarios in Cardiothoracic Surgery</i>	Various	
<i>TSRA Decision Algorithms in Cardiothoracic Surgery</i>	Various	
<i>TSRA Primer of Cardiothoracic Surgery</i>	Various	
<i>TSRA Operative Dictations in Cardiothoracic Surgery</i>	Various	
<i>Atlas of Surgical Operations</i>	E. Christopher Ellison, Robert Zollinger	
<i>The ABSITE Review</i>	Steven Fiser	
<i>Cardiovascular Physiology</i>	David Mohrman, Lois Jane Heller	
<i>Current Surgical Therapy</i>	John Cameron, Andrew Cameron	
<i>Pearson's Thoracic and Esophageal Surgery</i>	Alexander Patterson, Griffith Pearson, Joel Cooper, Jean Deslauriers, Thomas Rice, James Luketich, Antoon Lerut	
Multimedia-based		
CTSNet		
Multimedia Manual of Cardiothoracic Surgery (MMCTS)		
Behind the Knife		
STS Learning Center		
STS University Videos		
DeBakey CV Education Cardiovascular Fellows' Boot Camp		
TSRA podcast		
Question banks		
TSRA Online Question Bank		
TSRA Multiple Choice Review of Cardiothoracic Surgery		
Self-Education, Self-Assessment in Thoracic Surgery (SESATS)		

ICU, Intensive care unit; TSRA, Thoracic Surgery Residents Association; ABSITE, The American Board of Surgery In-Training Examination; STS, The Society of Thoracic Surgeons.

supplies. In contrast, endovascular skills require a different type of practice. They require fewer fine motor skills but still require gross motor skills and intimate knowledge of the steps of the operation. Reviewing these steps can be practiced from home the same way you might for open surgery. In addition, taking every opportunity that presents itself to place ultrasound-guided IVs, central lines, arterial lines, and assisting in extracorporeal membrane oxygenation all allow you to practice gaining vascular access and wire skills that are essential to succeeding in cardiac surgery today.

Studying

Interns should strive to learn at least one new bit of knowledge daily and record this in a personal journal. Select a CT surgery textbook and adopt the habit of studying a few pages daily. This eventually culminates into deep knowledge on the subject as topics are reinforced by scenarios encountered daily in the OR or floor (Table 1). Another helpful strategy, especially for in-service training examinations, is to solve a few questions daily on well-recognized question banks such as Self-Education, Self-Assessment in Thoracic Surgery (ie, SESATS). Didactics, especially for CT surgery, are often interactive and thus require proper preparation. At a minimum, read through the relevant chapters in a concise source such as the *TSRA Review of Cardiothoracic Surgery* beforehand. If time allows skim or read the landmark literature related to the week's topic.

Intern year is also a good time to build the habit of regularly reading through the primary literature. Aim to read one article a day and jot down the most salient points. Doing so will make you more informed and enhance your ability to critically appraise research. It may also provide ideas for your own research. Pay particular attention to the introductory sections, as these often provide an excellent background that will fortify your foundational knowledge base. Textbooks can enhance your clinical and operative learning. A comprehensive list of helpful resources for the intern can be found in Table 2.

Time management is crucial. Unlike in medical school where dedicated, uninterrupted time blocks were available for studying, such opportunities are rare during residency. Studying must be completed in brief windows between other tasks, such as in between cases, or be efficiently integrated into routines, such as rounding. To keep track of lessons, it can be helpful to use organizational software like Evernote or Trello, which can create lists and folders for different pathology and operations, as well as store image or text files of textbooks, journal articles, websites, and your own notes.

Staying Close to Your Roots

One of the major advantages of the integrated pathway is that trainees can form longitudinal relationships with CT faculty early on. Some programs formally assign mentors to each trainee. As junior trainees spend a large portion of their time rotating on non-CT rotations, one can make efforts to establish and maintain those relationships with mentors by participating in academic activities such as journal clubs, simulation labs, multidisciplinary conferences, mentored research, writing book chapters, or shadowing cases. These are all tremendously valuable opportunities. In addition to expanding your own knowledge, this will foster consistent, open dialogue, and pay dividends when transitioning back to CT rotations after long stretches on other services and throughout the remainder of your residency and career.

CONCLUSIONS

The breath of opportunities to learn and perform as an intern may seem daunting; however, with proper organization, efficiency, preparation, and attention to detail, medical students entering CT surgical residency will find the joy and success as their lifelong journey continues during training.

This manuscript required the contribution of multiple residents in order to provide advice that could be applied broadly to incoming residents irrespective of their program.