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Incorporation of Surgical Cadaver Lab Training in a Physician Assistant Fellowship Program

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Incorporation of Surgical Cadaver Lab Training in a Physician Assistant Fellowship Program

Abstract

Physician Assistants (PAs) are licensed medical professionals who provide health care under the supervision of and in collaboration with physicians. PAs can [specialize](#) in any field of medicine or surgery with additional on-the-job training while some PAs participate in a postgraduate training program in order to increase their knowledge in a certain subspecialty area. This paper describes the incorporation of a cadaver lab curriculum into a postgraduate PA surgical training program. The description of the development, implementation, and evaluation of the cadaver lab experience can assist other programs to implement this hands-on educational experience for a variety of medical providers, including PAs, NPs, medical residents, and fellows.

Keywords

physician assistant, physician assistant training, cadaver lab, surgical training, PA fellowship, PA residency, PA post-graduate education

Introduction

Physician Assistants (PAs) are licensed medical professionals who provide health care under the supervision of and in collaboration with physicians. The PA school curriculum is a master's degree, modeled on the medical school curriculum which involves both didactic education and clinical training. On average, PA programs span 30 months (three academic years), which includes classroom instruction and more than 3,000 hours of clinical rotations. During the clinical rotations, trainees gain first-hand experience in patient care under the supervision of licensed physicians and advanced practice providers (APPs)—medical professionals, including PAs or Nurse Practitioners (NPs) who have advanced training to assess, diagnose and treat different patient populations.

Although trained in primary care, PAs can specialize in any field of medicine or surgery with additional on-the-job training. Some PAs choose to participate in an additional postgraduate training program in order to increase their knowledge in a certain subspecialty area. As the number of PAs are increasing, post-graduate programs are expanding in order to facilitate specialty training.

This paper describes the incorporation of a cadaver lab curriculum into a postgraduate PA surgical training program. The description of the development, implementation, and evaluation of the cadaver lab experience can assist other programs to implement this hands-on educational experience for a variety of medical providers, including PAs, NPs, medical residents, and fellows.

Texas Children's Hospital Surgical PA Fellowship Program

The PA Surgical Fellowship at Texas Children's Hospital (TCH) is the first of its kind in the country to offer a 12-month didactic and clinical pediatric surgical training program. The fellowship ensures a unique opportunity to gain hands-on supervised clinical training along with continued didactic teaching on advanced topics in a full spectrum of pediatric surgical subspecialties, including congenital heart surgery, general pediatric surgery, hand/ microsurgery, neurosurgery, ophthalmology, orthopedic surgery, otolaryngology, plastic and reconstructive surgery, transplant, trauma, and urology (Krasnosky et al., 2017).

The clinical curriculum features a combination of outpatient, inpatient, and operative experiences. The PA fellow learns to perform daily rounds, present patients accurately and articulately, implement the plan of care, perform therapeutic procedures, and become proficient in first-assisting during the intra-operative care of the surgical patient. The ultimate goal is to foster and instruct the PA fellow to develop proficient clinical skills in the spectrum of perioperative care of the surgical patient and to integrate a knowledge base necessary to educate patients and their families.

The didactic sessions are structured to provide the PA fellow with a solid foundation of fundamental knowledge on which to develop and hone clinical acumen for the care of the surgical patient. These sessions include lectures by clinical specialists complemented with assigned readings, oral presentations, suture workshops and simulation experiences. The content is vast, encompassing topics in pathophysiology, care management, and the advanced surgical techniques associated with the treatment of surgical disease processes.

Problem that Supported Instituting a Cadaver Lab

The development of the PA Surgical Fellowship Program at TCH was an iterative process with each successive fellowship class providing feedback to leadership to create an evolving program to best meet the demands of the surgical PA fellow. While most of our PA fellows had exposure to gross anatomy in PA School, many of them reported the lack of a formal structure for hands-on anatomy review. Specific feedback received was a desire for a safe space to review anatomy pertinent to surgical procedures.

Cadaver Education is Important to PA Training in Surgery

Cadaver dissection has remained a cornerstone of the medical education process (Hussein et al., 2015). All professional anatomical associations and societies clearly state that dissecting cadavers significantly contributes to trainees' understanding of gross anatomy (Tjalma et al., 2013). This experience lays the foundation for successful acquisition of clinical skills required as well as provides the ritual transformation of trainees from lay

people to medical practitioners (Tjalma et al., 2013). The utility of the cadaver lab is also reflected in the perception of trainees, who are of the opinion that dissection provides them with a foundation critical to development of clinical skills (Ghosh, 2017).

There is an ongoing debate regarding the volume, duration and methodologies for teaching gross anatomy to trainees. Historically, the vast majority of medical schools devote more than half of their anatomy curriculum time to the dissection laboratory (Hussein et al., 2015); however, a number of medical training programs, including PA schools, have either removed the practical hands-on aspect of dissection or are seriously considering such a measure.

Clinicians should have intricate knowledge of anatomy before performing any surgical procedure on a patient. Improving knowledge and increasing skills is the fundamental goal of any surgical postgraduate program. The principles of safe surgery include the recognition of landmarks, and it is only by training that one develops the necessary skills required to avoid complications (Tjalma et al., 2013). Sufficient knowledge and experience to recognize regional anatomical relationships is one of the most important areas that surgeons and surgical assistants need to focus on to improve knowledge gaps they bring to the operating room; however, live surgery does not always allow for adequate anatomical visualization and teaching time. Learning the key anatomical elements for surgical procedures by utilizing human cadavers allows for a deeper understanding without the stress and risk of operating on a living patient.

Insufficient understanding of human anatomy has been cited as a major contributor to diminished competence and confidence of surgical trainees (Sharma et al., 2016). New PA graduates often express some concern about whether their training has been sufficient to allow them to rise to the challenge of being a competent first assistant during operations. Therefore, they welcome additional training initiatives, especially if hands-on training such as cadaver laboratory sessions are incorporated (Milano, 2017). Very few trainees actually prefer replacement of cadaver dissection with other available teaching/learning tools as they consider the dissected cadaver to provide the best possible 3D representation of human anatomy. In their opinions, undertaking dissection activates their senses of sight and touch, which in turn increases their understanding of anatomy (Ghosh, 2017). This specialized training helps trainees understand how to get from point A to point B of a dissection while giving the trainees a sense of psychological safety to perform the learned techniques during operations early in their career. Trainees have also indicated that learning through dissection provides them with a foundation which would be useful as future clinicians (Ghosh, 2017). Our PA fellows' requests reiterated the same concerns and brought to light the importance of incorporating cadaver dissection into their fellowship training.

Context of the Fellowship

The TCH Surgery PA Fellowship is a one-year postgraduate training program, established in 2014, designed to provide a dynamic pediatric surgical training experience for up to six (6) PAs per year, enabling them to provide the highest level of care and create a healthier future for pediatric patients. TCH is a nationally ranked, freestanding acute care children's hospital located in Houston, Texas. It is an academic institution affiliated with the Baylor College of Medicine that is located within the Texas Medical Center. The hospital provides comprehensive care with pediatric specialties and surgical subspecialties to infants, children, teens, and young adults aged 0-21 and features an American College of Surgeons verified Level I pediatric trauma center. Its pediatric and neonatal intensive care units serve the southern United States region, and it also has programs to serve children from around the world. With 973 beds, it is the largest children's hospital in the United States. The 2021 U.S. News & World Report ranked Texas Children's Hospital #3 amongst 200 pediatric hospitals in the nation; TCH has been recognized on the U.S. News and World Report Honor Roll for thirteen consecutive years.

With more than 4.3 million patient encounters annually, PA fellows gain foundational knowledge through simulated workshops, skills labs and a lecture series to help increase their pediatric surgical knowledge base while working alongside world-class surgeons and ancillary staff. By rotating through multiple pediatric surgical subspecialties, PA fellows gain remarkable operative technical skills and become accomplished pediatric surgical providers. The PA fellows receive training in the clinics, operating rooms, inpatient floors, and ICUs where they become proficient in pre-operative, intra-operative, and post-operative care. The PA fellows receive vital

exposure, under appropriate supervision, to basic and advanced surgical concepts and techniques that help them gain the confidence and experience necessary to practice in a wide variety of pediatric surgical subspecialties in academic and private settings.

Intervention/Plan

While the first cadaver lab used a single cadaver for dissection by the fellows, faculty recognized that space within TCH and time constraints of faculty and the fellows made this challenging. The utilization of the cadaver lab of the affiliated Baylor College of Medicine (BCM) offered solutions for this dilemma, including providing a teaching facility with existing cadavers, dissection by medical students, and an experienced anatomist to facilitate the educational time in the lab. The proposed structure included a didactic presentation of anatomy with overview of common procedures and case presentations followed by an instructor-led anatomy lab.

Development and Integration of the Cadaver Lab at Texas Children's Hospital

A novel cadaver lab curriculum was introduced to augment the PA fellows' understanding of surgical procedures. Sessions were held 11 times per academic year with each focusing on a specific anatomical domain. The domains covered include brachial plexus, hand, lower extremity, spine, abdomen, thorax, genitourinary, head and neck, brain, and the cardiovascular system. Table 1 shows the alignment of the PA cadaver lab schedule with the BCM Anatomy curriculum for first year medical students, following the same progression for each dissection lab. Each session entails a didactic presentation of anatomy by case presentation administered at TCH, with an instructor-led anatomy laboratory to follow at BCM.

Table 1

Example of the Cadaver Lab Schedule

BCM Medical Student Anatomy Lab Schedule (Exemplar Year):	TCH PA Fellow Cadaver Lab Schedule (Same Exemplar Year):
8/1 Superficial Back and Shoulder	8/3 Spine Review
8/8 Brachial Plexus	8/9 Brachial Plexus Review
8/15 Arm and Forearm	
8/22 Hand	8/24 Hand Review
8/29 Thigh and Hip	
9/5 Knee, Leg, Foot, Ankle	9/7 Lower Extremity Review/Plastics Flap Review
9/12 Heart	9/14 Heart Review
9/19 Lungs	
10/3 Mediastinum and Thoracic Cavity	10/5 Thorax Review
10/10 Abdominal Wall, Inguinal Canal, Kidney	
10/17 Undisturbed Viscera	
10/24 Foregut	
10/31 Midgut and Hindgut	
11/7 Posterior Abdominal Wall	11/9 Abdominal Review
11/14 Urogenital Triangle	
11/21 Male and Female Reproduction	
11/28 Pelvic Wall and Rectum	12/7 GU Review
1/3 Skull and Cranial Cavity	1/5 Neurosurgery Review
1/10 Neck	
1/22 Face, Scalp, Facial Nerve, Parotid Gland and Ear	1/24 Face Review
1/31 Infratemporal and Suprahyoid Regions	
2/7 Pharynx, Nasal Cavity and Sinuses	
2/14 Larynx	2/16 ENT Review

In the lecture portion of the cadaver lab experience, the subspecialized surgeon reviews surgical cases to help the trainee correlate disease processes with its anatomical significance related to the surgical procedures. This facilitates the PA fellow to think through patient scenarios, differential diagnoses, exam findings, pertinent studies, and treatment options.

In the laboratory portion, the anatomist reviews and assists the PA fellows in efficiently identifying the critical structures involved in surgical procedures for that anatomical domain. Because the PA fellows learn on adult cadavers in the anatomy lab, congenital heart defects are reviewed separately in the TCH morgue with presentation of specimens by a cardiac pathologist and a congenital heart surgeon.

Teaching in a small group, one cadaver per 6-8 trainees with one surgeon and one anatomy lab director, is regarded as essential in the training session (Figure 1).

Figure 1

2021 class of PA fellows with anatomy professor



Table 2 describes the checklist for creating a cadaver lab with an affiliated institution.

Table 2

Checklist for creating a cadaver lab

Instructional Steps		
1	Obtain medical student dissection lab schedule.	✓
2	Create curriculum based on completed dissection domains.	✓
3	Reserve lab dates with BCM (need a faculty sponsor).	✓
4	Complete BCM affiliation paperwork for new PA fellows.	✓
5	Identify surgeons for each session.	✓
6	Confirm instructors and participants with BCM.	✓
7	Submit payment for lab usage.	✓
8	Reserve conference room at TCH for didactic sessions.	✓
9	Complete lab sessions.	✓
10	PA fellows complete lab evaluations.	✓

Cadaver Lab Trainee Feedback

A study by Burgess et al. (2016) identified that trainees emphasized the educational benefits of having surgical specialists present to teach and guide them through the clinical application of anatomy and felt that the lab experience enhanced their conceptual understanding of three-dimensional regional relational topographical anatomical knowledge. Annual feedback from the PA fellows at TCH was congruent with these findings. Fellows found the cadaver experience to be stimulating and challenging. The positive effect of the cadaver lab on the

learning outcomes has been significant and highly praised by a majority of the PA fellows. The following quotes describe participant response to the experience:

“It was awesome! It was great having both the anatomy instructor and the surgeon.”

“Pairing clinical correlations with anatomy was extremely helpful. Far exceeded my expectations.”

“I really enjoyed having the surgeon and [the anatomist] going over things with us at the same time. I think having a surgeon there to explain the clinically relevant anatomy while the anatomy professor is there reviewing all aspects of the relevant anatomy was super helpful.”

The following are examples of verbal surgeon feedback that was collected annually:

“The cadaver lab is an enjoyable experience for both fellows and attendings. As always, it is fun to engage with students and learn more about their stories and interests. They seem genuinely interested in learning anatomy relevant to their jobs.”

“I try to make my lecture as case-based and clinically focused as possible since I believe that anatomy for post-graduates is most useful when it is coupled with relevant clinical information.”

Collecting annual feedback from the PA fellows and surgeons provided opportunities for improvement.

One fellow reported that she

“loved the fact that we got to have time in the cadaver lab. That being said, I wish it had been a little more structured. I think just continuing to tweak it will get it there. I would be in favor of each service creating an anatomy handout/overview to provide to the fellows before they go into the lab to get the most out of it.”

Additionally, a surgeon suggested that “it may be worth having the PA fellows review a video or preliminary materials prior to the classroom to better prepare them to get the most out of the limited session.” A result of feedback was to develop handouts, videos, and testing before and after cadaver labs in order to demonstrate mastery of anatomy.

Discussion

Even though PAs can obtain the necessary technical skills to first assist in the operating room without cadaver dissection, the cadaver lab program prepared PAs to better understand surgical techniques, since real-time surgery does not always allow for equivalent anatomical visualization and teaching time. The TCH Surgical PA Fellowship cadaver lab program provides an efficient mechanism to effectively produce skilled PAs with highly advanced knowledge required of a competent first assistant for surgical procedures.

Evolution of the Cadaver Program and Future Directions

Utilizing adult cadavers in teaching pediatric surgery will always have its limitations in replicating exact surgical scenarios. However, the experience allows for PAs to gain a basic understanding of anatomic structures and completes the picture of how and why specific surgical techniques are performed.

A second arm of the cadaver lab project is to conduct a survey of the graduates to assess their feedback regarding the educational curriculum of the fellowship program. Such feedback will further allow for the evolution of course structure and content. Given the early success of the cadaver lab program within the TCH Surgical PA Fellowship, we are interested in advocating for integration of this concept into other postgraduate surgical programs and for other surgical trainees.

Conclusion

The TCH PA fellows indicated that learning through cadaver dissection increased their understanding of anatomy and provided them with a foundation that is useful for understanding the pathophysiology of the surgical patient. The opportunity to visualize and discuss surgical anatomy in the cadaver lab during an intense PA fellowship curriculum augmented trainee comprehension of surgical techniques in a non-threatening situation. The use of

a cadaver lab is an important tool in learning a key principle of safe surgery which is the recognition of anatomic landmarks. It is by training and practice that one develops these necessary skills. Incorporation of a cadaver lab curriculum into a postgraduate surgical training program for PAs is a valuable educational tool that can also be applied to NPs as well as MD residents and fellows.

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