Entrustable Professional Activities in General Surgery: Development and Implementation

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Entrustable Professional Activities are a holistic assessment framework developed in the Netherlands in 2005, which have recently been adopted in undergraduate medical education in the United States. As part of an increased focus on competency-based assessment, the specialty of pediatrics has led the way in incorporating them into graduate medical education. We describe the development and initial pilot process of implementation of EPAs into the assessment of General Surgery trainees. (J Surg Ed 76:1174–1186. © 2019 Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

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COMPETENCIES: Patient Care, Medical Knowledge, Interpersonal and Communication Skills, Practice-Based Learning and Improvement, Professionalism, Systems-Based Practice

EPA BACKGROUND

The concept of an Entrustable Professional Activity (EPA) was introduced in the Netherlands in 2005 as a practical construct to address the perceived gaps and artificial nature of simply describing the work of a physician as a list of competencies.[1] The ACGME 6 core competencies, developed to help define foundational skills necessary for all practicing physicians, are often too granular for meaningful assessment and require specific context for measurement.[2] EPAs are observable and measurable units of work focused on actual health care delivery and thus integrate well into an assessment within the workplace, particularly for Graduate Medical Education (GME). Most simply put, EPAs represent the essential activities of a practicing physician in a given specialty, and these activities incorporate all of the competencies.

Core to the EPA concept is trust. As described by ten Cate, who first conceptualized EPAs, "Trust is a central concept for safe and effective health care. Patients must trust their physicians, and health care providers must trust each other in a highly interdependent health care system. In teaching settings, supervisors decide when and for what tasks they entrust trainees to assume clinical responsibilities. Building on this concept, EPAs are units of professional practice, defined as tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence. EPAs are independently executable, observable, and measurable in their process and outcome, and therefore, suitable for entrustment decisions. Sequencing EPAs of increasing difficulty, risk, or sophistication can serve as a backbone for graduate medical education."[3] The nature of graduate medical education training is such that faculty currently make ad hoc, in the moment entrustment decisions on an ongoing basis in clinical situations where learners are being supervised without any explicit underlying description of the minimum necessary performance. Establishing a more conscious rubric around these entrustment decisions has the potential to ease faculty assessment burden and make assessment more clinically relevant while providing

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learners with a blueprint to understand specific behaviors that will result in entrustment.

In 2014, the Association of American Medical Colleges (AAMC) published 13 EPAs that represent activities which all medical students should be entrusted to perform with indirect supervision upon entering residency, regardless of specialty choice.[4] The 13 activities chosen were selected as they represented core practice requirements of a new physician, and also because they addressed a performance gap in the transition between medical school and residency. The AAMC has organized a pilot of these core EPAs in 10 selected medical schools, which are collaborating to determine best practices in curriculum development, assessment of competency using the EPA framework, the pathway to entrustment, and key features of faculty development.[5,6] This early work in EPAs in US undergraduate medical education has served as a foundation for the work in graduate medical education in this country.

However, the concept of EPAs as a foundation upon which a competency-based medical education system can be developed is not new. Over 2 decades ago, Canadian medical education and training shifted focus to an outcomes-oriented framework termed CanMEDS[7] (Competence by Design [CBD] is the current term used by the Royal College of Physicians and Surgeons of Canada for the nation-wide shift to Competency Based Medical Education in graduate medical education. The outcomes-based orientation has continued to gain momentum with the entire country making the shift to CBD; in July 2017, the specialties of otolaryngology and anesthesiology moved completely to a CBD model for GME. Surgery is set to transition completely by 2020. In this model, as detailed in the resource-rich website maintained by the Royal College, several features are prominent and similar to the framework that EPA-based training includes.[8] First, the focus is on expected learner outcomes; second, there is a requirement of demonstrated competence before progression in training; third, time is viewed as a resource for training and not a criterion for advancement (i.e., it de-emphasizes time-based training); and fourth, it is learner centered by requiring trainees to play a greater role in planning their learning, seeking feedback, and tracking their progress while being accountable for these elements. The work that is being done in Canada can and will inform similar work in the United States.

Within the United States, important work in this area has been done in pediatrics. In 2007, after OBGYN programs in the Netherlands demonstrated that EPAs could be used as a meaningful framework for assessment.[9] The specialty of pediatrics began designing a framework for residency training organized around EPAs and their integration of competencies and milestones. After an iterative process, 17 EPAs were selected, which define the desired outcomes of the pediatrics residency-to-pediatric practice transition. These 17 EPAs define what a practicing pediatrician should be competent to perform in practice.[10] Currently, in year 2 of pilot in that specialty, as led by the American Board of Pediatrics, data are being collected and analyzed regarding this new EPA-based assessment framework for residency training. Additionally, subspecialties of pediatrics have begun the process of defining the EPAs for their training areas, such that an EPA-based framework for training will soon exist across the continuum of training in pediatrics.[10]

Other specialties, including Family Medicine, Internal Medicine, Pathology, Psychiatry, Physical Medicine and Rehabilitation, Geriatrics, Anesthesiology, and Hospice and Palliative Medicine, have described EPAs but to this point have not described widespread, integrated, or uniform implementation in their training programs.[11-15]

Encouraged by the prospect of decreasing faculty assessment burden, establishing a uniform definition of competency and engaging the learners in the assessment process the American Board of Surgery (ABS) embarked on a pilot program of EPA development and implementation.

INITIAL CHARGE

The ABS began seriously investigating the possibility of using EPAs as a way to move toward a true competency-based residency education framework for training beginning in early 2016 with a visit to the Netherlands by past chair Dr. John Hunter, past Executive Director Dr. Frank Lewis, and Association of Program Directors in Surgery (APDS) representative to the ABS Dr. John Mellinger. The aim of this visit was to see what EPAs looked like in practice in a single educational system in which they had been in place for many years. Based on information gained during that visit and the desire of the ABS directors to continue moving toward Competency-Based Resident Education (CBRE), the ABS convened a one-day retreat June 24, 2016. A group of ABS directors along with representatives from the APDS, the Residency Review Committee for Surgery (RRC), the American College of Surgeons Division of Education with leadership from Olle ten Cate, Robert Englander, and Rebecca Minter spent the day trying to define the work of a general surgeon. Following ten Cate's recommendation of 20 to 30 EPAs to cover the entire specialty, the workgroups came up with a list of 27 to 45 possible EPAs to describe the core of General Surgery.[3]

CHOOSING THE EPAS

A smaller group met in January 2017 to distill these comprehensive lists, with the aim of identifying 20 to 30 EPAs for General Surgery. This group included ABS directors from the Executive Committee, the General Surgery Residency Committee, representatives from the APDS, RRC, and the ACS Resident and Associate Society (RAS) and was ultimately named the reactor panel. The group initially struggled with identifying EPAs covering the work of a general surgeon precisely because there is no one definition of General Surgery. Guided by the newly adopted ABS definition of the scope of General Surgery, the group decided to choose 5 EPAs to pilot with the plan to add others later if the EPA assessment framework was embraced in General Surgery training. The 5 were chosen based on the desire to cover the most common conditions seen and managed by general surgeons that are part of the ABS core general surgery definition, informed by case lists reported by residents reported to the ACGME as well as essential activities all practicing General Surgeons must be able to perform.[16]

This highlights the second struggle the group had, common in procedural specialties, which was separating the concept of an EPA from a specific procedure or case. All procedures, all patient care episodes, are made up of many perhaps innumerable integrated steps. While we learn each of these steps in order to be able to execute the operation or encounter successfully, the steps themselves are only part of the whole. Similarly, a preoperative clinic visit, specific procedure, or postoperative clinic visit does not constitute an EPA, but the care of a patient with a specific condition or concern that encompasses preoperative, intraoperative, and postoperative care does. The case lists pointed us to the conditions on which we focused, but we broadened them to include all of the perioperative care surrounding the specific case or condition.

In addition to the 3 EPAs focused more narrowly on disease processes or symptom presentations, the group felt that providing consultation and leading a team during trauma resuscitation were other important activities of a general surgeon not captured by management of a particular disease.

The 5 EPAs ultimately selected for pilot from the longer initial list were:

1. Evaluation and management of a patient with inguinal hernia.
2. Evaluate and manage a patient with right lower quadrant pain
3. Evaluate and manage a patient with gallbladder disease
4. Evaluation and initial management of a patient presenting with blunt or penetrating trauma
5. Provide general surgical consultation to other health care providers

Although these EPAs do not represent the entirety of General Surgery, they are a starting point that reflects commonly cared for disease processes, procedures, and other activities performed by general surgeons that are core to General Surgery practice. Potential feasibility also informed the choice of these 5 EPAs, as one of the important aspects of EPAs is the necessity of frequent direct observation across multiple contexts and conditions in order to provide feedback. In the pilot study, assessing implementation of these first 5 EPAs in General Surgery, it may be determined that any one of these does not represent a feasibly measurable unit of work and will need to be modified in the future.

EPA CREATION

Definition and Essential Functions

With this direction, a writing group was constituted, maintaining representation from the ABS, APDS, RRC, and RAS. There was purposely little overlap with the reactor panel, and members of the writing group were chosen based on prior experience with EPAs or experience as a program or clerkship director. Members of the writing group were paired in dyads to draft the initial EPA including scope and essential functions. Scope included inclusions and exclusions, such as whether pediatric patients would be included, as well as setting, such as whether the EPA included patients seen in both elective and emergent settings. Essential functions are the directly observable actions encompassed by the EPA, and the explicit description of these actions helps to differentiate the EPA from the overall curriculum.

The scope and essential functions were finalized via several conference calls, and were presented to the reactor panel in June 2017. Feedback from the reactor panel was subsequently incorporated into the final versions of each EPA (see Appendix A).

Mapping to Competencies

As previously discussed, EPAs are a more holistic approach that incorporates ACGME milestones, subcompetencies, and competencies (Fig. 1). It was therefore important to determine which subcompetencies were encompassed by each EPA to ascertain whether the 5 EPA pilot would cover a majority of the General Surgery subcompetencies. This was done by the writing group using a Q-sort process in June 2017. The group

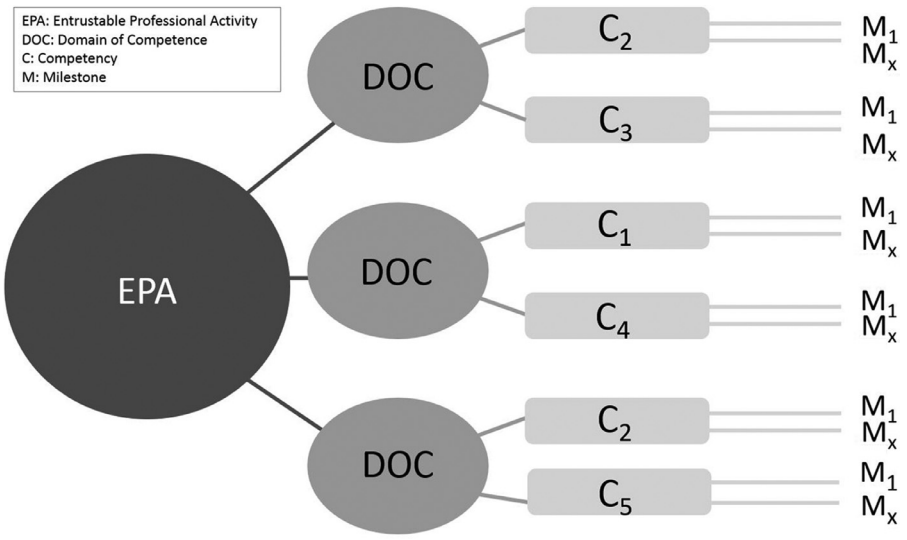

FIGURE 1. Relationship of EPAs to ACGME milestones, competencies, and domains.

determined that the 5 EPAs cover 13 of the 16 subcompetencies within the General Surgery milestones, missing only PBLI-1, PROF-2, and SBP-1 (Table 1).

Behaviors and Vignettes

The definition and expected behaviors are necessary components of the EPA, but they are broad and are not anchored to progressive levels of entrustment. Once key competencies were mapped to the 5 General Surgery EPAs (5-6 subcompetencies per EPA), defined behaviors per level of entrustment were developed. This was done by writing expected behaviors using the language from the milestones from the selected subcompetencies to paint a picture of what a resident would look like for the given EPA at each level of entrustment. This was critical work for creating a shared mental model for both faculty assessors as well as residents for what progression should look like for a given EPA. Once the defined behaviors were developed and iteratively refined by the entire writing group, the dyad developed qualitative vignettes describing what a resident who exhibited these behaviors would like and this aided in resident and faculty development for EPA implementation. These vignettes were then likewise iteratively refined by the larger group. An example of the full EPA, including essential functions, behaviors, and vignettes, is included in Appendix A.

IMPLEMENTATION

The first step in the implementation strategy was to convene an implementation group. This group included the ABS Executive Director, key APDS leadership, representatives from the reactor panel and writing group along with an implementation scientist and additional ACGME representation with expertise in milestone and EPA development and deployment.

An assessment tool is only as good as it is feasible, particularly across multiple General Surgery programs with innumerable surgical faculty. With that in mind, the implementation strategy had 2 primary goals: to determine the relationship of EPA assessments to milestone evaluations, and to identify barriers in implementation of EPAs across a broad spectrum of General Surgery programs.

The first step in the implementation strategy was to determine what characteristics of General Surgery programs were felt to be important to successfully implement EPAs. Given the goal of assessing feasibility, there was only 1 characteristic that was felt to be of such importance that its lack would exclude a program from participating, and that was length of time in role for the Program Director. All other characteristics, including university or community affiliation, size, track record with innovation, research background, were felt important to record. The goal of the pilot was to include as diverse a group as possible in order to effectively address barriers for wider dissemination identified in any particular representative program.

A call for interested programs to participate in the pilot was sent out on the APDS listserv November 1, 2017. Response to the call was overwhelming; the initial goal was to choose 20 to 25 programs to ensure representation as well as scientific validity examining the relationship of EPAs to milestones. Twenty-eight programs were chosen by the implementation group based on diversity in December 2017. Faculty development materials were developed by the implementation team in January 2018. These were shared with the implementation programs via webcasts in Spring

TABLE 1. Subcompetencies of the ACGME Milestones for Surgery Covered by the 5 EPAs

Subcompetency	Inguinal Hernia	RLQ Pain	Gallbladder Disease	Trauma	Consultation
Patient Care-1	×	×	×	×	×
Patient Care-2	×		×		
Patient Care-3	×	×	×		
Medical Knowledge-1		×			×
Medical Knowledge-2	×	×	×		
Interpersonal and Communication Skills-1	×			×	×
Interpersonal and Communication Skills-2				×	×
Interpersonal and Communication Skills-3	×	×	×		
Practice-Based Learning and Improvement-1					×
Practice-Based Learning and Improvement-2					×
Professionalism-1					
Professionalism-2					
Professionalism-3					×
Systems-Based Practice-1					
Systems-Based Practice-2				×	

2018 with an in-person kickoff at Surgical Education week in May 2018. Pilot use of the 5 EPAs began in July 2018, with ongoing support, sharing of best practices and trouble-shooting occurring on monthly conference calls and twice-yearly face to face meetings in October 2018 and April 2019.

POTENTIAL RISKS AND CONSEQUENCES

There are several potential risks with the launching of EPAs. Implementation of the chosen EPAs may not be feasible for a variety of reasons. They may not consist of directly observable work. It may be too difficult for faculty to adjust behavior to provide just-in-time assessment for parts or all of an EPA. Feasibility may depend on program characteristics, including size, number of rotation sites, number of faculty, and available resources. Costs, both in terms of time and financial resources, may be prohibitive. These potential barriers are the primary reason for the pilot phase prior to broad launch or any mandatory aspect of EPA use, and a key reason for the selection of a broad spectrum of programs to participate in the pilot. Interim evaluation by implementation team will be necessary to either modify or drop EPAs that are not feasible as currently constructed, or if deemed critical to the assessment of General Surgery trainees consider residency redesign, which would support the opportunity for assessment.

It may be observed that some aspects of preoperative or postoperative care are not directly observed as frequently as required for making entrustment decisions, and that intraoperative assessment will dominate the EPA assessment. To address this in the pilot, entrustment decisions for a given EPA are divided into the preoperative, intraoperative, and postoperative phases of care where relevant. Issues related to these type of assessment opportunities will become evident by the number and type of assessments that are available to the Clinical Competency Committees as they make entrustment decisions or through more in-depth interviews with faculty at the chosen pilot sites.

Given that one of the goals of the EPA assessment framework is to transition to a learner-driven construct, it is also possible that the residents will focus on the EPAs to the exclusion of other necessary work and education. While a successful switch in terms of assessment drivers, this clearly would be undesirable from an overall educational standpoint. Thus, it will be important that the entire scope of skills required to be a competent practicing surgeon are incorporated into the final training and assessment framework.

The longer-term risk is that the pilot EPAs do not measure something of value or do not improve our current system of evaluation. This could be because they do not add anything to current evaluation systems or because they do

not produce an educational product that is somehow "better" or does not function more effectively within the healthcare system. While it is unlikely that the pilot study will be able to address this risk, it is important to continually consider that the reason for change is to improve the current process or product.

FUTURE PLANS

As we begin the pilot, the only certain thing is that the process will look different at the end than it does now. The current 5 EPAs will likely be modified, and there will be standardized processes identified as to how best to deploy them across residency programs including faculty development, assessment tools, and data management platforms.

Additional EPAs will be developed to more broadly encompass the specialty of General Surgery, recognizing that EPAs will never be the only method of assessment that will be required for graduation and certification. More standardized competency assessments such as FLS, ATLS, and FES are not going away as they represent foundational skills, nor are defined category numbers in some form to ensure breadth of experience. However, it is recognized that these are insufficient in isolation to confirm a competent surgeon at the completion of training and this is the genesis of the current exploration and pilot using EPAs as an overarching assessment framework.

One of the more frequently asked questions regarding the EPA assessment framework is what becomes of a resident that is entrusted—with either indirect supervision or unsupervised—for a particular EPA. Current supervision rules are complex and go far beyond the rules and regulations of educational governing bodies, so even with full entrustment of a trainee faculty are unable to disappear from patient care. There are many potential answers to this question. This framework could be used to increase transparency and confidence with patients, as many of us do not currently have as much transparency with our patients about the role of residents in their care. While there are real logistical issues to moving to a time-variable model of training, a true competency-based assessment framework could also be used to shorten residency training for some while lengthening it for others. In the Toronto orthopedic experience, length of training was not significantly altered but residents used time after entrustment to work on mastery of a particular EPA.

One of the most exciting outcomes of the EPA pilot has already been realized, in that it represents the work of an invested community of educators aimed at improving assessment of our current surgical training. This community includes the organizations that first came together to develop the EPAs (the ABS, ACS, APDS, RAS, RRC, and Young Fellows Association (YFA)), the innumerable individual people who contributed to their development, the Program Directors and faculty in the 28 pilot programs, and the residents in these programs. This group is poised to define best practices for the assessment of surgical training for many years to come.

APPENDIX A

EPA Title: Evaluate and Manage a Patient with an Inguinal Hernia

Description: General surgeons are often called to evaluate patients with a groin mass, pain, or other symptoms of inguinal hernia. They must be able to diagnose inguinal pathology, complete preoperative evaluation for a patient requiring operative intervention including informed consent, perform an indicated procedure, and oversee postoperative care including management of any coincident complications. Surgeons may perform these activities for patients presenting in the outpatient/elective setting as well as patients with urgent or emergent conditions.

Functions

- Synthesize essential information from records, history, physical exam, and initial diagnostic evaluations to develop a differential diagnosis.
- Recognize the severity of a patient's underlying medical comorbidities and their ability to tolerate an operation. This should include whether or not the patient is a candidate for surgery, as well as selection of anesthetic and surgical approach.
- Recognize complications of inguinal hernia requiring emergent operation.
- Describe the indications, risks, benefits, alternatives, and potential complications of the planned operation to the patient using easily understood language to obtain informed consent.
- Synthesize an operative plan, including an understanding of the operative anatomy, physiology, indications, contraindications, risks, benefits, alternatives, and potential complications of:
  - inguinal hernia repair with and without mesh
  - femoral hernia repair

Integrate new information discovered intraoperatively to modify surgical plan/technique as necessary:

- hernia containing nonviable bowel
- need for performance of laparotomy
- indications and contraindications for use of mesh

Initiate and oversee postoperative care, including postoperative disposition.

Communicate with the patient/family and members of the care team (PCP, nursing staff, etc.) to ensure pre- and postprocedure instructions are understood and followed.

Recognize and manage the most common complications following inguinal hernia repair:

- Pain syndrome
- Hematoma
- Urinary retention
- Recurrence

Recognition of limitations:

- General surgeons may possess skill to perform an inguinal hernia repair in the pediatric population; however, should recognize their own limitations and/or limitations of their practice, and refer to a subspecialty pediatric surgeon at their discretion
- General surgeons may possess skill to perform an inguinal hernia repair using minimally invasive techniques; however, should recognize their own limitations and/or limitations of their practice and refer to an advanced laparoscopic surgeon at their discretion.

Behaviors and Vignettes

Expected Behaviors of Residents with Critical Deficiencies (Level 0)

Preoperative Phase of Care: Residents at this level have a rudimentary understanding of the anatomy and pathophysiology of the inguinal canal. This lack of knowledge prevents the conduct of a focused history that includes pertinent positive and negative symptoms as well as a focused physical examination that includes all necessary elements. Additionally, their differential diagnosis for a patient presenting with signs and symptoms of an inguinal hernia includes errors of omission, resulting in an inability to initiate the expected cost-effective workup. They are also unfamiliar with published literature regarding the management of inguinal hernia and does not include all necessary elements (relevant risks, benefits, and alternatives) when performing informed consent for the operation.

Intraoperative Phase of Care: In the operating room, these residents are not able to describe the anatomic boundaries of the inguinal canal or the locations of direct and indirect inguinal and femoral hernias. They are unable to accurately mark or describe the optimal location for an incision or how to identify and isolate the hernia sac. They do not anticipate errors and may not work to preserve the ilioinguinal, iliohypogastric, or genitofemoral nerves and may take deep suture bites for mesh fixation that place the femoral vein at risk for injury. Their movements are uncertain, jerky, and may demonstrate discoordination between their 2 hands.

Postoperative Phase of Care: These residents fail to recognize concerning signs of a postoperative complication such as hematoma, urinary retention, testicular ischemia, or pain syndromes. If a complication is recognized, they do not necessarily communicate the change in patient status to their supervising physician. They also fail to ensure that specific postoperative instructions are communicated to the patient and do not check for understanding of the patient and their caregivers.

Vignette of a Resident with Critical Deficiencies (Level 0)

Dr. Susan Black is working with Dr. Gustavo Rodriguez in general surgery clinic. She is asked to see Daniel Thompson, a 55-year-old man who reports a bulge in his left groin. He states the bulge has been present on and off for 2 months and the area is painful when he tries to lift something. Susan learns that he is otherwise asymptomatic and has no other medical problems and no history of surgery. On physical exam, Susan notes a left inguinal bulge with no associated lymphadenopathy. She tells Mr. Thompson that he appears to have a left inguinal hernia and that it should be repaired surgically. Mr. Thompson inquires about whether the procedure will be performed using a scope. Susan states that she is not sure, but she will discuss with Dr. Rodriguez. Susan gives a presentation about her encounter to Dr. Rodriguez, who asks additional information about Mr. Thompson's history, including whether he has experienced any obstructive symptoms or change in bowel habits and whether he has to manually reduce the hernia. When asked if a hernia is also present on the right side, Susan admits that she did not examine the right groin. Susan suggests ordering a CT scan to determine whether the hernia is direct or indirect. Dr. Rodriguez and Susan return to the exam room and Dr. Rodriguez confirms with Mr. Thompson that he has not had any obstructive symptoms, the hernia reduces spontaneously, and determines that no hernia is present on the right side. Dr. Rodriguez recommends an open left inguinal hernia repair with mesh. When Susan goes over the informed consent with Mr. Thompson, she omits the risks of chronic pain secondary to nerve injury, as well as possible bowel resection and recurrence. Dr. Rodriguez also discusses the alternative of observation. Mr. Thompson is scheduled for an operation in the near future.

Susan is assisting Dr. Rodriguez for Mr. Thompson's procedure, and he asks her to mark the incision she would like to use. She marks a long incision laterally along the inguinal ligament. Dr. Rodriguez relocates the incision more medially and the operation begins. During

the dissection, Susan is unable to name the layers being incised during the operation, and when lifting the external oblique fibers during the dissection, she places a clamp on the ilioinguinal nerve. She often grasps the instruments in awkward ways and her movements are frequently uncontrolled and somewhat jerky. When asked where within the spermatic cord the hernia sac is usually located, she is unable to answer the question. Dr. Rodriguez completes the remainder of the dissection and allows Susan to place sutures in the mesh. Being uncertain of the correct angle for the stitches, she frequently readjusts the needle on the driver and proceeds to take very large bites along the inguinal ligament. When asked what structure she is putting at risk of injury, she is not sure.

Postoperatively, Mr. Thompson is planned to be discharged from the recovery room. Susan is called by the bedside nurse to evaluate him because he has continued to complain of operative site pain despite medication. She performs an exam, but fails to recognize the significance of bruising and fullness beneath the incision. Instead, she orders an ice pack and states that Mr. Thompson is OK for discharge and that he should keep his scheduled follow-up appointment. She does not notify Dr. Rodriguez or document her postoperative evaluation of Mr. Thompson in the medical record.

Expected Behaviors of Residents at Level 1

Preoperative Phase of Care: Residents at this level have a basic understanding of the anatomy and pathophysiology of the inguinal canal. They are able to perform a focused, efficient, and accurate history that includes pertinent positive and negative symptoms and physical examination. Additionally, their differential diagnosis for a patient presenting with signs and symptoms of an inguinal hernia is inclusive of the most common disorders but may also have errors of omission or commission. These residents can begin to initiate the expected cost-effective workup but rely on supervisors for oversight. Level 1 residents may be unfamiliar with published literature regarding the management of inguinal hernia but are able to communicate the basic facts about the condition to the patient and family members and understand the necessary elements that constitute an informed consent discussion.

Intraoperative Phase of Care: In the operating room, these residents are able to describe the anatomic boundaries of the inguinal canal and the locations of direct and indirect inguinal and femoral hernias. They can describe the basic steps of the operation, but require supervision and coaching for most intraoperative decisions, such as ensuring the incision site is optimally located or positively identifying and ligating the hernia sac. Residents at this level are able to describe most potential errors, such as injuring the ilioinguinal, iliohypogastric, or genitofemoral nerves or taking deep suture bites for mesh fixation that place the femoral vein at risk, but may not fully be able to demonstrate how to avoid them. Their movements demonstrate increasing coordination between their 2 hands and facility with the most common surgical instruments; however, they may use dissection techniques that are inefficient or result in tissue trauma.

Postoperative Phase of Care: These residents are able to recognize concerning signs of common postoperative complications, such as hematoma, urinary retention, or wound infection, but may not recognize complications specific to inguinal hernia repair, such as testicular ischemia, pain syndromes or recurrence. These residents immediately communicate changes in patient status to their supervising physician, but are unable to synthesize a coherent management plan without the input of the supervising physician. They communicate basic specific postoperative instructions to the patient and their family members using a variety of methods that ensure understanding.

Vignette of a Resident at Level 1

Dr. Darren Strong is working with Dr. Nisha Agarwal in general surgery clinic. He is asked to see Eli Jakubowski, a 72-year-old man who reports a bulge in his right groin. Darren learns that Mr. Jakubowski endorses intermittent nausea and constipation when the bulge is "sticking out." He does not lift heavy objects routinely but does have COPD and coughs for long periods each day, although he has never had surgery previously. On physical exam, Darren notes a right inguinal bulge while Mr. Jakubowski is standing that he has difficulty reducing until he lies supine. Darren gives a presentation about his encounter to Dr. Agarwal, which is organized and complete, but asks her to verify that the patient has an indirect hernia and does not include femoral hernia as a possibility in his differential diagnosis. Darren recommends proceeding with a laparoscopic right inguinal hernia repair with mesh, but Dr. Agarwal reminds him about the patient's history of COPD and asks how that might affect their operative approach. Darren reconsiders and they discuss preoperative pulmonary function testing and an open right inguinal hernia repair using local vs general anesthesia. For informed consent, Darren discusses the indication, benefits, risks, and alternatives of surgery with Mr. Jakubowski, but omits discussion of possible bowel resection or the need for laparotomy. Mr. Jakubowski is scheduled for his preoperative testing and surgery in the near future.

Darren is assisting Dr. Agarwal for Mr. Jakubowski's procedure, and she asks him to mark the incision he would like to use. He is not entirely sure and suggests a

line stretching from the anterior superior iliac spine along the inguinal ligament. Dr. Agarwal asks him about where the mesh will ultimately be located, and he moves the incision more medial. During the dissection, Darren is able to name the layers being incised and discuss the next steps they should perform. His movements are sometimes uncontrolled and he applies excess tension on the external oblique, which results in some shredding of the tissue. With coaching, he is able to demonstrate proper technique to encircle the spermatic cord, but he appears uncertain about how to proceed in dissecting the cremasteric fibers away from the hernia sac and Dr. Agarwal takes over. Once the sac has been freed and ligated, Darren is able to place the mesh in the best location and discusses the danger of deep mesh fixation bites, but he loads the driver on most of the way back on the needle and takes bigger bites than he intended. He struggles to get every knot down well while tying the monofilament sutures into the mesh. He is able to perform a layered closure and apply a sterile dressing without coaching.

Postoperatively, Mr. Jakubowski is planned to be observed overnight, given his complex medical history. Darren is called by the bedside nurse to evaluate him, because it has been 6 hours since surgery and he has yet to void his bladder. He obtains a full set of vital signs and interval history and performs an exam including a bladder scan. His plan is to perform a straight catheterization, and he calls his supervisor to ensure agreement with that plan. He communicates basic postoperative instructions to Mr. Jakubowski and attempts to assess his understanding. When he sees the patient back in clinic with Dr. Agarwal, he reports he has been doing fine since surgery except for 1 episode of pulling and pain at the site; however, on Dr. Agarwal's exam, she notes that the hernia has recurred.

Expected Behaviors of Residents at Level 2

Preoperative Phase of Care: Residents at this level have an advanced understanding of the anatomy and pathophysiology of the inguinal canal, including differences in types of hernias and the varieties in their presentation. They are able to perform a focused, efficient, and accurate history that includes pertinent positive and negative symptoms and physical examination. They recognize the need for a chaperone when conducting the physical examination of a sensitive body region. Their differential diagnosis for a patient presenting with signs and symptoms of an inguinal hernia is inclusive of the most common disorders and contains few, if any, errors of omission or commission. These residents can initiate the expected cost-effective workup for a straightforward presentation independently, but require oversight for advanced or unusual presentations. They may be unfamiliar with published literature regarding the management of inguinal hernia. These residents are able to customize their communication about the condition to the patient and family members based on their individual characteristics, and are able to clearly conduct an informed consent discussion for a straightforward, elective inguinal hernia repair.

Intraoperative Phase of Care: In the operating room, these residents are able to describe the anatomic boundaries of the inguinal canal and the locations of direct and indirect inguinal and femoral hernias. They can describe the basic steps of the operation and can make straightforward intraoperative decisions, such as ensuring the incision site is optimally located, opening the external oblique aponeurosis, or positively identifying the hernia sac, but they require coaching for steps such as ligating the hernia sac, decisions about use and placement of mesh, and closure to avoid nerve entrapment. They are able to describe most potential errors at the relevant portion of the procedure and takes steps to avoid them, but they may not always be successful. Their movements demonstrate developing skill with instrument handling, coordination between their 2 hands, and have respect for tissue that results in minimal tissue trauma. Their dissection techniques may still be inefficient and result in excess maneuvers.

Postoperative Phase of Care: These residents are able to recognize concerning signs of common general postoperative complications, such as hematoma, urinary retention, or wound infection, as well as those specific to inguinal hernia repair, such as testicular ischemia, pain syndromes, or recurrence. They are able to initiate management of common postoperative problems without their supervising physician physically present, but may require assistance to synthesize a complete management plan for complications specific to inguinal hernia or more severe postoperative complications including large, severe scrotal hematoma, chronic groin pain, mesh infection, or sepsis. These residents can communicate customized postoperative instructions to the patient and their family members using a variety of methods that ensure understanding, and provide updates in a timely manner throughout the duration of the patient's hospital course.

Vignette of a Resident at Level 2

Dr. Fatima Faisal is the general surgery consult resident asked to see Roberto King, a 42-year-old man who came to the Emergency Department with left groin pain, nausea, and vomiting. Fatima learns that Mr. King endorses nausea for the past 8 hours associated with 2 episodes of nonbilious emesis. He is continuing to pass flatus. She learns that he is employed as an operating room (OR) nurse and routinely assists with patient transfers. He has never had surgery previously. On physical exam, Fatima

notes normal vital signs, mild abdominal distention without tympany, and a left inguinal bulge that is not reducible but is not associated with skin changes. Fatima gives a presentation about this encounter to Dr. Jonathan Moore, her supervising physician. The presentation is organized and complete with a differential diagnosis that includes the most pertinent diagnoses. Fatima orders an abdominal x-ray to assess Mr. King's bowel gas pattern and recommends proceeding to the operating room for an open left inguinal hernia repair with mesh. Dr. Moore reminds her about whether the hernia is incarcerated or strangulated and asks how that might affect their operative plan. Fatima then agrees they may or may not be able to use mesh depending on whether or not the bowel is threatened or ischemic. For informed consent, Fatima discusses the indication, benefits, risks, and alternatives of surgery with Mr. King, using a variety of techniques and language to ensure that he understands, not assuming that he does given his healthcare background, although she glosses over discussion of possible bowel resection or the need for laparotomy.

Fatima is assisting Dr. Moore for Mr. King's procedure, and she marks the incision she would like to use accurately without hesitation. She is able to perform the initial dissection and exposure of the hernia with supervision only, but needs coaching about techniques for atraumatically surrounding the spermatic cord. Upon identifying bowel within the hernia sac, Fatima describes that it is important to maintain a gentle but firm grip on the bowel so that it does not slip back into the abdomen before it can be thoroughly inspected, but she loses her grip and the bowel disappears. She and Dr. Moore discuss that the bowel appeared to be viable from what they could see through the hernia sac and they would keep a close eye on the patient postoperatively. Fatima demonstrates skill with familiar instruments in isolation, but her hands sometimes get in each other's way and she frequently forgets to use both hands while operating. She suggests using mesh for the repair and can cogently describe reasons why. She places the mesh in the best location and she not only discusses the danger of deep mesh fixation bites, but also demonstrates how they can be avoided. She is also able to perform a layered closure and apply a sterile dressing without coaching.

Postoperatively, Mr. King is admitted to the floor. Fatima sees him the next morning and he has been tolerating clear liquids and has voided his bladder postoperatively, but complains of some nausea and abdominal pain in addition to pain at the operative site. She states that it seems as though everything is going well, that he can have some regular food and go home later that day. When she discusses the daily plan with Dr. Moore, he reminds her of how the incarcerated bowel slipped back into the abdomen during the procedure and that given the patient's new symptoms he needs to undergo further observation. Fatima goes back to Mr. King's room and discusses the need for observation with him and his family to provide an update and ensure their understanding about his condition.

Expected Behaviors of Residents at Level 3

Preoperative Phase of Care: Residents at this level have an advanced understanding of the anatomy and pathophysiology of the inguinal canal, including differences in types of hernias and the varieties in their presentation. They are able to perform a focused, efficient, and accurate history that includes pertinent positive and negative symptoms and physical examination. They recognize the need for a chaperone when conducting the physical examination of a sensitive body region. Their differential diagnosis for a patient presenting with signs and symptoms of an inguinal hernia is complete, without errors of omission or commission. They can initiate the expected cost-effective workup for all but the most advanced or unusual presentations independently. These residents are familiar with published literature regarding the management of inguinal hernia. They are able to customize their communication about the condition to the patient and family members based on their individual characteristics and anticipate logistical problems in optimizing the patient for surgery. They are additionally able to clearly conduct an informed consent discussion for a complex or emergent inguinal hernia repair, including individualizing risks and benefits for the patient.

Intra-Operative Phase of Care: In the operating room, these residents demonstrate all requisite background knowledge to optimally develop an operative plan for all but the most advanced or unusual presentations. They can describe all steps of the operation and make all straightforward intraoperative decisions independently, requiring assistance only for complex decisions such as incarcerated or strangulated bowel, aberrant anatomy, or a sliding hernia. They are able to describe most potential errors at the relevant portion of the procedure and take steps to avoid them. Their movements demonstrate facility with instrument handling, coordination, and dexterity between their 2 hands, and have respect for tissue that results in minimal tissue trauma. Their dissection techniques mirror those of a practicing surgeon with few extra maneuvers.

Postoperative Phase of Care: These residents are able to recognize and independently manage common general postoperative complications, such as hematoma, urinary retention, or wound infection, as well as those specific to inguinal hernia repair, such as testicular ischemia, pain syndromes, or hernia recurrence. They can also recognize more severe postoperative complications, including large, severe scrotal hematoma, chronic

groin pain, mesh infection, or sepsis. These residents can communicate customized postoperative instructions to the patient and their family members using a variety of methods that ensure understanding, and provide updates in a timely manner throughout the duration of the patient's hospital course. If necessary, they can effectively deliver bad news and discuss unexpected findings or changes to the operative plan to a patient or family member in a sensitive and caring manner.

Vignette of a Resident at Level 3

Dr. Carlos Campos is asked to see Danh Nguyen, a 45-year-old man who presented to the general surgery clinic with a 6-month history of a growing left inguinal bulge. Carlos performs a focused history and physical exam and elicits that the patient is a smoker of ~0.75 packs per day but otherwise has a negative history. Mr. Nguyen denies episodes of obstruction or urinary retention and has had no previous abdominal or inguinal operations. On exam, he has a body mass index of 26, his abdomen is soft and nontender, and there is a reducible inguinal hernia on the left. Carlos discusses the case with his attending, Dr. Sasha Peters, and recommends a laparoscopic inguinal hernia repair after the patient has quit smoking. Carlos informs Mr. Nguyen that he is not a surgical candidate for a hernia repair while he is smoking and gives him a referral to smoking cessation. He is able to discuss the risks and benefits of a laparoscopic inguinal hernia repair, including the risks of conversion to open. Mr. Nguyen questions the need for mesh and Carlos is able to discuss the risks and benefits of a mesh repair vs a tissue-only repair. The patient and the providers create a smoking cessation plan and Mr. Nguyen is scheduled for a laparoscopic inguinal hernia repair.

One month after Mr. Nguyen had quit smoking, he is taken electively to the OR for a laparoscopic totally extraperitoneal (TEP) inguinal hernia repair. Carlos and Dr. Peters are working together. Carlos makes skin incisions in the optimal locations and places the trocars while Dr. Peters runs the camera. Carlos begins the dissection at the pubic tubercle and proceeds laterally. He is able to identify the hernia sac of the left indirect inguinal hernia and dissects it off the cord to reduce it. He then inserts and secures the mesh with tacks to the pubic tubercle, Cooper's ligament, posterior rectus sheath, and the transversalis fascia. Care is taken to place no tacks below the ileopubic tract. He closes the wounds and places the postoperative orders and instructions.

Mr. Nguyen is discharged home the same day and returns to clinic for follow up at 2 weeks. He is complaining of continued pain in the left groin and wants to know if his hernia is back. After taking an interval history, Carlos learns that the pain is consistently present as a dull, burning pain but sharp and worse with movement. On exam, he notes a small seroma but no evidence of a recurrent hernia or other abnormality. He counsels the patient about groin pain due to nerve entrapment or injury and recommends a trial of NSAID therapy. Mr. Nguyen is seen again 6 weeks later and the pain has not resolved, so they discuss options such as mesh removal or other procedures and make a plan for referral to a pain clinic.

Expected Behaviors of Residents at Level 4 (Expert Practice)

Preoperative Phase of Care: Residents at this level have an advanced understanding of the anatomy and pathophysiology of the inguinal canal, including differences in types of hernias and the varieties in their presentation. They are able to perform a focused, efficient, and accurate history that includes pertinent positive and negative symptoms and physical examination. They recognize the need for a chaperone when conducting the physical examination of a sensitive body region. Their differential diagnosis for a patient presenting with signs and symptoms of an inguinal hernia is complete, without errors of omission or commission. These residents can independently initiate the expected cost-effective workup for all inguinal hernia presentations, including those that are advanced or unusual. They can delegate appropriate tasks to other healthcare team members, and are able to exhibit effective leadership if conflict arises between team members or with the patient and/or family. These residents are familiar with the most current published literature regarding the management of inguinal hernia. They are able to customize their communication about the condition to the patient and family members based on their individual characteristics and anticipate logistical problems in optimizing the patient for surgery. They are additionally able to clearly conduct an informed consent discussion for a complex or emergent inguinal hernia repair, including individualizing risks and benefits for the patient.

Intraoperative Phase of Care: In the operating room, these residents demonstrate all requisite background knowledge to optimally develop an operative plan for even advanced or unusual presentations. They can describe all steps of the operation and make intraoperative decisions independently, even in the presence of unexpected findings, such as incarcerated or strangulated bowel, aberrant anatomy, or a sliding hernia. These residents are able to effectively guide another resident through the operation, including avoidance of common potential errors. Their movements demonstrate facility with instrument handling, coordination and dexterity between their 2 hands, and have respect for tissue that results in minimal tissue trauma. Their dissection techniques mirror those of a practicing surgeon.

Postoperative Phase of Care: These residents are able to lead a team and supervise management of common general postoperative complications, such as hematoma, urinary retention, or wound infection, as well as those specific to inguinal hernia repair, such as testicular ischemia, pain syndromes, or hernia recurrence. They can also supervise management of more severe postoperative complications including sepsis, systemic inflammatory response syndrome, and multiorgan dysfunction. These residents can ensure that team members communicate customized postoperative instructions to the patient and their family members using a variety of methods that ensure understanding, and provide updates in a timely manner throughout the duration of the patient's hospital course. If necessary, they can customize emotionally difficult news (e.g., changes to operative plan, adverse outcome, or end-of-life discussion) to a patient or family member in a sensitive and caring manner.

Vignette of a Resident at Level 4 (Expert Practice)

(Evaluating Dr. Bogdana Bot). Dr. Bogdana Bot is on call when Sameera Naidoo, a 72-year-old woman, presents to the Emergency Department with a 2-day history of abdominal pain and progressive bloating. Her last bowel movement was 3 days ago. The Emergency Department physicians diagnose a bowel obstruction by CT scan. Bogdana asks Dr. Amy Kim, the junior resident, to see the patient first. Amy notes that Ms. Naidoo's abdomen is distended and tender, and she also notes a right inguinal hernia with a bulge below the groin crease that is firm and tender to palpation. She attempts to reduce it and is unsuccessful. She calls Bogdana and presents this patient as someone with small bowel obstruction secondary to an incarcerated inguinal hernia. Bogdana examines Ms. Naidoo and confirms the pertinent positive and negative findings, reviews the CT scan, and notes that the femoral hernia is visible on CT and appears to be the transition point of the small bowel. She does not attempt to reduce the hernia. She recommends an open inguinal hernia repair for this patient with an incarcerated and possibly strangulated femoral hernia. She obtains consent and later discusses the surgical options with the Ms. Naidoo's daughter who has arrived as the patient is too sleepy from the pain medications. She discusses the planned procedure as well as the possibilities of nonviable bowel and the need for laparotomy, bowel resection, and ostomy creation and calls her attending, Dr. Cynthia Rogers, to notify her of the plan.

In the operating room, Dr. Rogers allows Bogdana and Amy to do the procedure together. Bogdana discusses Ms. Naidoo's condition with the anesthesia provider and they plan a postoperative transabdominal preperitoneal (TAP) block for pain control. After the patient is positioned and under anesthesia, it is clear that the bulge is below the inguinal ligament. Bogdana guides Amy through the inguinal incision and dissection to internal oblique. They open the transversalis fascia over Hesselbach's Triangle and note the incarcerated bowel going through the femoral defect. Through the hernia sac, Bogdana notes the bowel is purplish black in color. She engages Amy in a discussion about next steps, and together they alter the intraoperative plan and convert to a laparotomy. After opening the abdomen, she identifies the bowel in the hernia and reduces it. The involved segment of small bowel appears a dusky color. When Amy moves on to thinking about how to repair the hernia defect, Bogdana guides Amy through a discussion about resecting the bowel and together they resect a 5-cm segment and perform a linear stapled reconstruction. The laparotomy is closed and they return to the groin where a McVay repair is performed. Additional discussion with anesthesia team reveals that the patient is now hypotensive and they have initiated her on vasopressors during the case. She has made no urine. Bogdana arranges for Ms. Naidoo to be admitted to the Surgical Intensive Care Unit.

Ms. Naidoo is taken to the Surgical Intensive Care Unit, intubated, and put on vasopressors. Her postoperative labs indicate a WBC of 18 and creatinine of 2.1 mg/dL. Bogdana reviews the postoperative orders Amy placed and completes the operative note for Dr. Rogers' review. She then goes and discusses the operative findings with Ms. Naidoo's family in the waiting room. She discusses the operations that were performed and explains that the change in Ms. Naidoo's condition now mandates admission to the ICU for sepsis and acute kidney injury. Over the next 24 hours, the vasopressors are weaned off after judicious fluid resuscitation, and she begins to make urine. Ms. Naidoo's sedation is weaned off and she is able to be extubated. After 2 days, she is transferred to the floor, where after 5 more days she is ready for discharge to a skilled nursing facility.

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