Challenges to Medical Education on Surgical Services During the COVID-19 Pandemic

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Published online: 28 August 2020

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Introduction

The arrival of the COVID-19 pandemic to the USA in March of 2020 had a profound and unforeseen effect on education of American medical students. Students and faculty in the middle of academic programs were given little advance notice that learning would be disrupted. As the epidemic spread, concerns grew for medical systems becoming overwhelmed with new cases and needing to conserve personal protective equipment (PPE). Medical schools moved to cancel classes and restrict students from participating in clinical activities or even setting foot in their affiliated medical centers. With recommendations for social distancing and state-ordered mandates to stay at home, students were additionally forbidden from getting together in groups and had to remain physically separated from anyone other than immediate family.

Previous disruptions in medical education have been described in the literature, generally in the forms of natural disasters such as floods and earthquakes [1–3]. Unlike these events, several factors made the COVID-19 pandemic unprecedented. The disruption was on a global scale—not just affecting one medical school or one community, but institutions across the country and around the world. Solutions that helped to circumvent the effects of financial failures and natural disasters, such as the distribution of students to other institutions or programs would not apply in this case [1–4]. The length of the disruption is likely to be greater than that for other examples as well. Floods recede and earthquakes cease, with recovery linked to the time it takes to rebuild and redevelop

infrastructure. In the case of the current pandemic, effects on student participation will likely last until the threat of infection abates, which may not occur until a reliable and effective vaccination program is in place, an intervention predicted to require a year or more. For other disasters, there was little or no risk to students beyond the initial insult; students suffered from emotional and financial trauma following natural disasters but did not remain at risk of physical harm. In those cases, students were often enlisted to help with recovery efforts and participate in clinical care, giving them a sense of purpose and a useful hands-on education. In the pandemic scenario, students are isolated and restricted from participation due to health concerns and the need to preserve resources for more extensively trained providers.

Nevertheless, some lessons learned from responses to natural disasters have been applicable to the pandemic situation. Following Hurricane Katrina, the interruption in medical education necessitated some acceleration of the educational process, with a reevaluation of what requirements were necessary to graduate with an MD degree [5]. The pandemic situation is forcing educators to take a hard look at what the minimum requirements should be to complete a field of medical study. Medical educators and administrators are asked to make a difficult ethical decision, where the education and safety of trainees are being weighed against the increasing demands of medical personnel needed in high-risk environments. These situations also demonstrate the potential psychological trauma on students and emphasize the need for adequate student counseling and mental health resources [6]. Regarding educational content, all of these situations have prompted educators to look for alternative means of instruction outside of the classroom. Introduction of remote learning with televised lectures, online learning modules, and interactive online discussions have become important solutions to the lack of available time spent within institutional walls.

Televised and electronic learning is most appropriate when replacing didactic content, whether related to basic sciences or clinical teaching. However, for rotations that involve large

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numbers of procedures and hands-on learning, such solutions may prove inadequate. Clinical clerkships in surgery, obstetrics and gynecology, and anesthesiology require students to participate in surgeries and procedures to learn technical skills, and then demonstrate such skills to assess competence. In addition to learning the skills required for competence as a physician, students also learn vital lessons about communication and function in a surgical team within these arenas. Exposure to the surgical or obstetrical atmosphere is often what guides a student into or away from choosing these specialties as a medical career [7]. Unfortunately, these experiences are not as easily replaced by electronic learning as are other clinical arenas in medical education. The remainder of this paper focuses on the potential solutions and barriers to providing adequate undergraduate medical education in procedure-oriented fields in the setting of the COVID-19 pandemic.

Teaching Methods

Many of the challenges of teaching surgery and obstetrics/gynecology content have been successfully met with online educational platforms. A central learning objective for students in these fields is gaining the clinical judgment to weigh the relative merits of medical and surgical interventions. Working through clinical scenarios of patients with potentially surgical conditions is a tried and true method for mastering this objective [8, 9]. In the absence of having such patients physically present, it is useful to work through constructed cases that describe such scenarios. Several online services are available that offer these cases and give students a chance to interactively work through their management. OnlineMedEd, Geeky Medics, Oxford Medical Simulation, and Aquifer are platforms that walk students through clinical scenarios that require them to decide when surgery is necessary, for example, in the setting of appendicitis or ectopic pregnancy (Table 1). Other available resources include case vignettes prepared by professional organizations like the Association of Professors of Gynecology and Obstetrics (APGO) [10] and the Association for Surgical Education (ASE) [11] (Table 1). These can be utilized via remote faculty-led sessions to guide students through surgical decision-making similar to case conferences that more typically happen on clinical rounds.

A greater educational challenge lies in reproducing the experience of assisting in surgical procedures. Part of the experience lies in witnessing the procedures themselves and learning the relevant techniques and anatomy. There are many excellent examples of online surgeries on internet video platforms such as YouTube and Vimeo that display recordings of surgical cases. They range from demonstrations of classical open approaches to cutting-edge techniques that employ the

newest technologies available. These latter examples are often geared towards practicing physicians seeking to expand their repertoire of surgical skills and are not applicable to students learning basic surgical concepts. Educators looking to provide examples of surgical videos to their learners need to curate these collections with the knowledge base of the learner in mind [12, 13].

Although many videos are narrated to edify their audience, the content and expertise of narration varies greatly. For some, the intent is to point out impressive pathological findings or to highlight potential surgical complications. Others, more relevant to the undergraduate medical experience, concentrate on basic anatomy and rationale for surgical techniques. Even when the perfect video is found that exposes learners to an appropriate procedure with narration at an appropriate learning level, asking a student to watch it alone can still be isolating. Excluding the ability to interact with the surgeon and ask questions diverges substantially from the usual experience of being in the operating room.

A potential solution is to enlist an interactive online platform to create an electronic classroom where the experience can be shared. A surgical faculty member can share his/her screen with a group of students as he/she describes the video being viewed. The video may be one found online or one recorded by the surgeon. Providing real-time narration ensures that the content matches the faculty's objectives and is given at the correct level of complexity. It also provides a point of contact with a faculty member who may be a resource for future questions about the material or about career exploration.

The situation still falls short in the instruction of how to assist at surgery. The importance of providing helpful and knowledgeable assistance is a skill that medical students often fail to appreciate. Providing instruction through surgical videos about what role the assistant plays is a viable option, though it fails to reproduce the experience of retracting and suctioning. Very few resources are available online that are not designated for professional surgical assistants, whose goals may be quite different from the undergraduate learner. Creating educational tools that instruct students in surgical assisting may fill an important need.

Another established technique used in remote surgical education is the use of simulation. In general, simulation is used to demonstrate procedural techniques on a simulated patient (whether physical or virtual) in order to reduce patient risk and increase available opportunities for practice [14, 15]. Telesimulation, which provides the benefits of simulation instruction to learners at an off-site location, has been described in settings where a single faculty may teach students in several disparate locations [16]. This technology may be useful in settings such as developing nations where local faculty lack the expertise to train their learners, and the challenge is in finding a reliable electronic infrastructure to communicate

Table 1 Suggested resources for remote teaching

Educational objective	Suggested resource	Example
Clinical management of surgical issues	Interactive online cases	Aquifer Geeky Medics OnlineMedEd Oxford Medical Simulation ASE Educational Resources APGO Teaching Cases
Exposure to surgical technique	Educational vignettes by professional societies Online surgery videos	SurgeryU.com AcademyofPelvicSurgery.com Various YouTube and Vimeo offerings
Opportunity to develop surgical skills	Simulation models Virtual reality Self-constructed kits	Plastic models in central location Immersive simulations on screen Homemade models of pelvic anatomy or surgical pathology
Modeling professionalism and communication	Video examples of appropriate communication	Online videos from appropriate agencies (e.g., Institute for Healthcare Communication; Innovating Education in Reproductive Health)
Assessment of technical skills	Remote direct observation of skills	Recorded video of skills demonstrated on prefabricated kit

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the simulations being explained [17]. In the setting of medical students being physically isolated from their institution, the challenge is not with the equipment used in communication but rather with the equipment used for the simulation itself. Without being able to gather centrally at a simulation center, students lack the opportunity to use resources such as manikins and surgical instruments.

A newer technology that has been proposed to authentically reproduce live experiences remote from the operating room is virtual reality. Devices that incorporate virtual reality vary from partially immersive (where a surgical environment that can be manipulated by user controls appears on a screen) to totally immersive (with the use of a headpiece that places the user within a 360-degree environment). Such devices have been used in surgical training, particularly in training for minimally invasive surgery and robotics [18, 19]. Virtual reality has been proven to be an effective educational tool even for learners at the early stage of medical training [20]. While virtual reality devices may someday be affordable and available outside of the institutional setting, they are currently too expensive to put in the hands of every student learning from home.

Other less expensive resources are more realistic. Providing each student with a prefabricated kit of surgical tools may be cost-effective, depending on the nature of the materials and the size of the class. At minimum, a hemostat, a suture removal kit, and a pack of suture could be provided to train students in suturing and knot-tying on the surface of his or her choice. Alternatively, a student could create simulation models using implements at home. Several do-it-yourself simulation kits have been proposed to educate students on topics ranging from cervical exams in labor [21] to performing

hemorrhoidectomy [22] using household items. Students choosing to pursue such instructional methods would be remarkable for high levels of motivation.

Objectives for surgical education that are more abstract are difficult to teach remotely. A key element of training in surgery is teaching trainees the importance of professionalism and communication. Much of the education provided in the clinical arena is by modeling appropriate behaviors and encouraging students to reproduce positive examples of communication that they witness. Being physically separated from their instructors, students at home may lack opportunities to observe professional behaviors. Sharing web-based video examples of appropriate communication techniques has been shown to be effective in teaching surgical trainees [23]. Use of an immersive virtual reality device to teach communication skills has also been proposed [24].

Choosing what routes of instruction to pursue may be influenced by students' perceptions of each teaching method's value. Students at our institution who were asked which remote teaching methods they considered the most helpful gave similar ratings to interactive online cases, remote lectures, and faculty-guided surgical videos. Several students commented that the latter were superior to teaching they received live in the operating room, since the faculty spent more time teaching and the views of the surgical field were clearer.

Assessments

Another challenge in having students forced to stay at home during the pandemic is finding optimal means to assess their clinical performance. Assessment of student performance is

crucial to ensure that students graduate with adequate knowledge to address clinical conditions they will encounter and adequate skills to safely and effectively treat them. Assessment is also important to identify struggling students who may require remediation and exemplary students worthy of commendations or honor programs. Assessment usually includes written, detailed performance feedback from supervising residents or faculty, and objective evaluation of knowledge and critical thinking based on oral and/or written examination. This tiered system has been used for decades, but recent evidence suggests it may be subject to implicit bias [25].

Assessment of medical knowledge is carried out with standardized testing that requires little change in either preparation or execution. Students may study using a variety of online and textual resources, and the test can be administered remotely, although significant trust is needed for ensuring adherence to an honor code to prevent cheating. Modern medical education has embraced the addition of structured patient encounters and note writing assessments into many course grades [26, 27]. These encounters can be accomplished in an online format where patient, student, and grader may be physically remote from one another. It is more difficult to assess clinical performance in a rotation where a student has never set foot in the hospital. The ability to distinguish one student from another and provide the individual assessments so important to the progression on to residency is further challenged.

Grading performance on surgical rotations also includes proficiency at specific procedural and examination skills. Direct observation when students are not present is limited by both the lack of resources to perform such procedures and the time requirement for faculty to set aside time for observation. It is unreasonable to expect assessment of complex procedures done remotely, but a video assessment of basic skills such as suturing and knot-tying is feasible if students are provided with a basic, prefabricated kit as previously mentioned. Video assessment of surgical skills has been previously described using monitors as handy as a smartphone or GoPro [28].

Because the limited interaction with students has made it difficult for faculty to objectively discriminate degrees of mastery, many institutions elected to transition affected courses to a pass-fail format. With students confined at home, it is difficult to judge when they have either motivation or skills that exceed those of peers. Professional behaviors such as attention to required attendance and appropriate interactions with standardized patients may be evaluated remotely, but in this setting, it is fairer to define a single standard of competency than to establish gradations of excellence. The use of pass-fail in medical education and its effect on ability of students to make a successful residency match without the distinctions that tiered grading provides was an additional stressor for students and will continue to be debated [29].

Looking Beyond the Pandemic

While everyone would like to see a return to the usual format of patient care and student education, it has become increasingly apparent that things may never return to what has previously been considered normal. As educators plan for a gradual reentry of students into the clinical workplace, they must carefully balance the need for education with the safety of patients and the students themselves. Students participating in surgical and obstetrical procedures require access to personal protective equipment (PPE) to safeguard against COVID-19 as well as blood-borne infections. With rationing of PPE to ensure an adequate supply for health care workers, institutional administrators need to judge the importance of student education against the needs of the community. Depending on limitations in supply, students may be forced to assume an increasingly distant role from the surgical bedside.

The COVID-19 crisis has forced training programs, patient care, and workplaces to incorporate tools for simulation and remote engagement in ways that have been unprecedented. Many of these tools will prove to be useful, even desirable, for our learning environments once the crisis has passed. Remote learning will play an expanded role in our training programs for the foreseeable future. But which experiential activities and assessments are essential to retain, and which could be effectively replaced or supplemented by simulation or by remote activities? We now have an opportunity as educators to test our existing tools, develop new strategies, and collect a body of evidence surrounding remote learning interventions for clinical education. It is incumbent on us as a profession to develop evidence-based best practices to guide curricular development as we move forward in this rapidly changing environment.

Availability of Data Not applicable

Authors' Contributions All authors contributed substantively to the writing of this manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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