



Remote training in flexible gastrointestinal endoscopy

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Formal training in GI endoscopy has always been a 1-to-1 apprentice type of education. The teacher is in the same room as the student, watching each movement, each touch of the controls, every twist and torque, giving verbal suggestions and support during each procedure. The best instructors do a lot of talking, especially during the early phases of learning, describing each turn, remarking on the mucosal appearance, painting a verbal picture of the endoscope configuration as the tip advances in the lumen. Taking over control of the instrument during a training session is to be avoided, and the endoscopic trainer's motto is "keep your hands in your pockets." In fact, in one study, successful colonoscopy by the trainee was defined as cecal intubation without any physical assistance by the supervisor.¹ If the supervising endoscopist had to take over for any reason, the procedure was considered a failure for the trainee.

Dedicated 1-to-1 training is an integral part of learning endoscopy. Over the years, there have been many courses in which live demonstrations are broadcast, showing experts performing standard cases or advanced techniques using new devices. These are educational courses intended to impart knowledge to those already trained in basic procedures² or to introduce equipment for special procedures. These live demonstrations are teaching courses, whereas the actual training in endoscopy, intended to develop

abilities, requires mentoring and close attention. This has been formalized by the government in that attending physicians must state in writing that they were present for the entire endoscopic procedure during which a trainee was performing the endoscopy.

Remote training in procedural techniques has become a reality because of the vast reach of the Internet in transmitting instantaneous sound and motion over great distances using Wi-Fi, satellite, or fiberoptic cables. One-to-one online training has been developed by surgeons over the past several years, especially in the field of laparoscopy, where basic courses are given online by instructors or students are videotaped and their individual case performance is reviewed by a trainer.^{3,4} Skills being taught remotely include port site choice, intracorporeal sewing, identification of tissue planes, and even entire laparoscopic procedures.

There is a large difference between general educational teaching in endoscopy and individual training, which requires a mentor who evaluates each step of the procedure. Mentoring takes time and commitment on the part of trainers, who set aside all other commitments to provide a true learning environment for the student. Surgeons have shown that remote training by Internet instruction in laparoscopy provides outcomes as good as those with live side-by-side training.⁵



Figure 1. Obstructing esophageal squamous cell carcinoma with split screen demonstrating a biopsy. Taken from a monitor with an iPhone.

GLOBAL SURGICAL INITIATIVE, KYABIRWA LIVE ENDOSCOPY SETUP

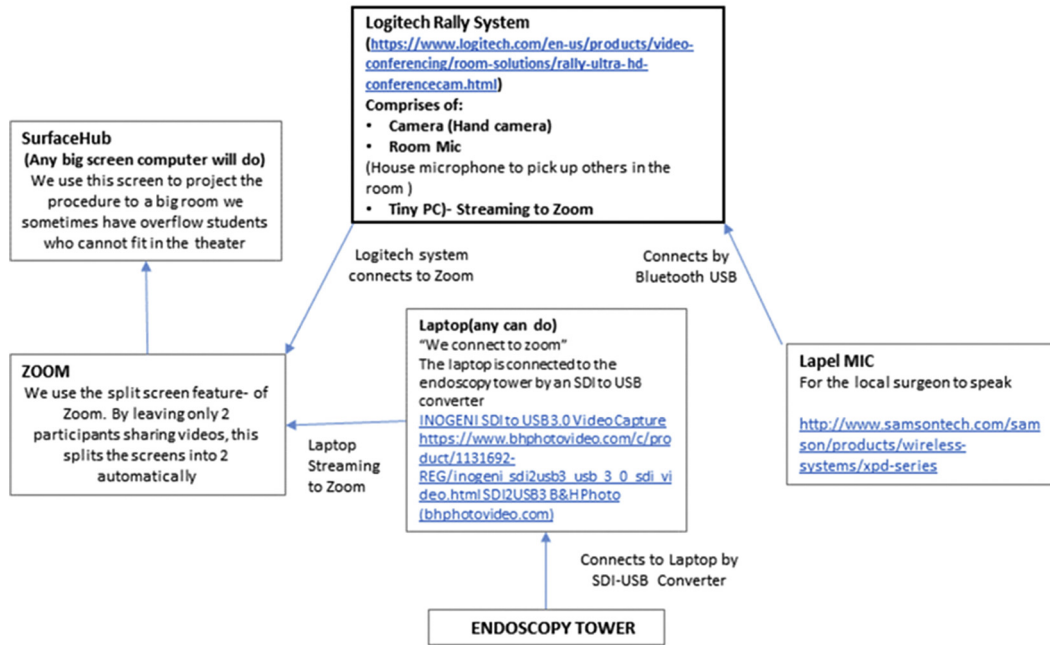


Figure 2. A schematic showing the connections for remote training.

Cost Estimates: Equipment for Remote Training	
ITEM	COST (USD)
Logitech Rally System	3,040
Inogeni Converter	425
Samson Lapel Microphone	165
TOTAL	3,630

Figure 3. Cost of equipment to connect to the Internet.

There is no literature on remote training in GI endoscopy, and the commitment to train a physician thousands of miles away in the performance of endoscopy was undertaken by one of the authors (J.D.W.) without knowledge of the surgical literature. However, the invitation to participate in remote endoscopic training was extended by a surgeon (M.L.M.) who was cognizant of the ability to train elements of laparoscopy by Internet access.

In February 2020, 6 Ugandan surgeons were trained in the performance of upper and lower endoscopy at a surgical facility in Kyabirwa (near Jinja), Uganda, 4 hours from the capital, Kampala. This 1-week in-person “endoscopy camp” (taught by J.D.W.) followed a week of the World Endoscopy Organization’s thrust to establish an endoscopy training facility at St Paul’s Hospital and Medical School in Addis Ababa, Ethiopia. Olympus Corporation (Tokyo,

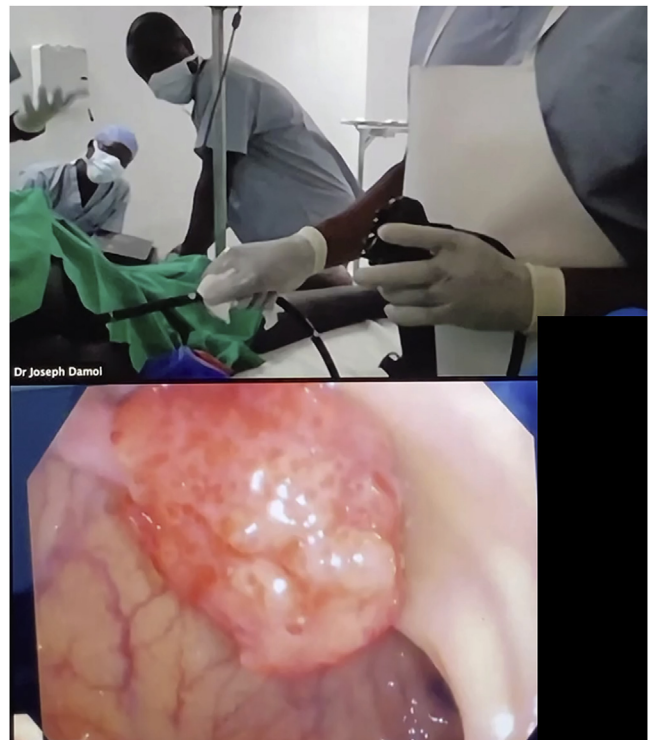


Figure 4. A pedunculated colon adenoma. Both polyp and operator’s hands are seen. Taken from a monitor with an iPhone.



Figure 5. A split screen view of colonoscopy during remote training.



Figure 6. A GI fellow instructs a Ugandan surgeon on setting up the bander and then banding esophageal varices.

Japan) lent a tower with an upper and a lower endoscope, along with a very knowledgeable technician who meticulously taught the care, treatment, and disinfection of endoscopes. After the week of basic introduction to endoscopy, one surgeon's (J.O.D.) training at the Kyabirwa Surgical Centre (KSC) continued (J.D.W.) via a fiberoptic high-speed Internet cable (installed by M.L.M., who built the facility). The video feed was sent directly from the image processor, along with a split-screen camera view of the operator's hands, accessed from a remote home computer (Fig. 1). There was no perceptible lag in the 2-way transmission of either voice or movement, allowing discussion of the findings, the mucosal detail, and the endoscope handling while also directing the course of the procedure (Video 1, available online at www.giejournal.org). It was possible for the trainer to instruct the trainee during a biopsy that the open forceps should be pushed further ("a little bit more... no, that is too

much, pull back a little"), and the response was instantaneous, just as if both were in the same room doing endoscopy standing side by side with one of the GI fellows at Mount Sinai.

For the technical aspects (Fig. 2), the ideal Internet bandwidth should be 40 Mbps, but the key is that a part of the bandwidth (perhaps 10 MBps) is dedicated and reserved for remote teaching purposes. Our system is a fiberoptic feed (although a dedicated cellular line could be used) wherein the transmitting computers are connected directly to a local area network, not through Wi-Fi. Such a connection to the Internet is not expensive (Fig. 3), and any laptop computer with a video graphics array card may be used.

One hundred four upper GI cases have been completed by the team, about half via the Zoom platform, as well as 33 colonoscopies (Fig. 4). In the cases performed by remote training, it is not possible for the instructor to take over

the instrument; overcoming a problem during intubation becomes a team effort, with the instructor talking the student through the process of working through any difficulty. At this time, every colonoscopy (Fig. 5) performed with remote assistance has reached the cecum. It is possible for several mentors to teach at the same session. During one broadcast, a GI fellow at Mount Sinai showed the surgeon in Uganda how to set up a variceal banding kit by having the same apparatus in both places and then closely monitoring the actual first remote banding of esophageal varices (Fig. 6). The step-by-step process was discussed and monitored on Zoom, from opening the kit to the actual placement of several bands on varices. New procedures can be introduced and monitored via the Zoom connection.

Beyond technical skills, there are important cognitive components of endoscopy, which include preprocedure planning, interpretation of endoscopic findings, and incorporation of findings into overall patient care.⁶ These skills can be taught just as effectively in the virtual setting. Collaborative research is also possible, and quality assurance can be tightly monitored by direct video transmission.

In these days of COVID-19 travel restrictions, it is possible to continue to train professionals in aspects of GI endoscopy in a remote setting via the Internet, once very basic talents have been acquired. Travel across the city, across the country, or across the world is no longer available to endoscopists who have the desire and inspiration to teach skills to others, but remote Internet training is an option to consider while remaining at home base yet spreading knowledge around the globe.

DISCLOSURE

All authors disclosed no financial relationships.

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