Telemedicine and Surgical Education Across Borders: A Case Report

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This case report presents the use of a low-tech telemedicine videoconferencing solution as a tool in medical education. The goal was to test videoconferencing as a tool to expose medical students to international health and surgical volunteer work. The clinical case chosen for this test involved the microvascular reconstruction of the mandible of a 7-year-old male pediatric patient using a fibular osseocutaneous flap for the craniofacial management of hemifacial microsomia. The surgery, which was performed by a multidisciplinary volunteer team of specialists from Mexico and the United States at the Hospital Angeles in Tijuana, Mexico, was a technically innovative and rarely performed surgical procedure. During a portion of the procedure, a group of medical students, residents, and plastic surgery specialists at the University of California—San Diego connected to the operating room in Mexico via videoconferencing equipment, which allowed them to interact remotely with the operating surgeons and to watch the surgery live. The videoconferencing connection successfully enabled medical students to pose questions to the surgeons in the operating room, cover major teaching points of the procedure, and actively experience international surgical medicine without the logistical challenges associated with traveling to the international site.

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INTRODUCTION

The exposure of medical students to international health during medical school has been shown to promote their personal and professional development. The issue of how to integrate international medical trips and electives into the medical school curriculum presents significant challenges and risks associated with international travel. Our group looked for an alternative method of exposing students to international health. In this case, low-tech videoconferencing was proposed as a possible solution and was tested for its ability to provide an interactive educational environment to introduce medical students to international health.

CASE REPORT

Surgical Team and Procedure

On February 14, 2008, a multinational team of surgeons performed a rare and technically innovative reconstruction of the mandible of a 7-year-old male pediatric patient for the management of hemifacial microsomia in the Hospital Angeles, Tijuana, Mexico. Hemifacial microsomia, which is characterized by unilateral hypoplasia of the craniofacial skeleton and overlying soft tissue, presents as a broad spectrum of clinical manifestations.[1] The surgery was an 8-hour craniofacial operation that involved the microvascular reconstruction of the mandible using a fibular osseocutaneous flap. The uniqueness of this operation provided a significant learning opportunity for the medical students and residents who observed a 2-hour portion of the surgery via videoconferencing. The surgical team was a multidisciplinary collaboration among different specialists, academics, universities, and countries, which included surgeons from the Division of Plastic Surgery at the University of California—San Diego (UCSD), and Dr. Fernando Ortiz Monasterio from the General Hospital, Dr. Manuel Gea González in Mexico City, Mexico.

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General Setup

The telemedicine videoconferencing session consisted of 2 sites—a hub site and a spoke site. The hub site was the operating room in the Hospital Angeles, whereas the spoke site was a conference room in the University of California, San Diego Medical Center, Thornton Hospital. At the hub site, a setup that consisted of a MacBook Pro (Apple, Inc., Cupertino, California) laptop computer with internal speakers and microphone was connected to a Sony portable camcorder (Sony Electronics, Inc., San Diego, California) and mounted on a boom over the operating room table. The camcorder captured the surgical field and transmitted a portion of the live surgery to the spoke site using a commercial DSL line. At the spoke site, the video image was projected onto a large screen projector so that all participants (medical students, residents, and plastic surgery specialists) could clearly see details of the surgery. Video quality was to the point where participants could easily discriminate and point out distinct anatomical landmarks of the image projected onto the screen. Occasionally, the camera was redirected from the surgical field to focus on individual surgeons. The video image of the participants at the UCSD site was simultaneously captured by a camcorder, transmitted, and displayed on the computer screen at the hub site so the operating surgeons could see the entire conference room and UCSD participants.

Low-Tech Videoconferencing Solution

Videoconferencing was conducted using the free, universally available, and low-tech videoconferencing solution Skype (Skype Technologies, SA, Luxembourg) with chat capabilities. Skype is encrypted and compliant with Health Insurance Portability and Accountability Act regulations. This allowed for transmittance of video, audio, and text between the 2 sites. Prior to the operation, several videoconferencing applications and setups were tested before the team ultimately decided to use the Skype application. The decision to use Skype was based on several technology criteria the team considered important for international surgical telemedicine (Table 1).

Skype met all the above criteria. However, other low-tech solutions were also available and could potentially have been used for the operation. With regard to the 2-way transmittance of audio and video, both quality and clarity were excellent throughout the session. Uneventful transmission of the operation and live 2-way interaction between the 2 sites supported the notion that low-tech solutions such as Skype are effective telemedicine tools. Medical students, residents, and plastic surgery specialists communicated via voice and text with intraoperative surgeons to discuss the case and ask questions. Text communication via Skype provided the added advantage of quickly transmitting written or technical information.

TABLE 1. Technology Criteria Considered Important

Portable Solution
Low-cost solution
Able to work with low or limited Internet bandwidth
Able to provide live 2-way audio-video communication
Able to support an external video camera with optical zoom and adjustable aperture for bright lights used during surgery
Encryption of videoconference
Ease of use

DISCUSSION

Importance of International Health Education

Studies have demonstrated that when students participate in international medical trips, they improve their clinical diagnostic skills, gain an increased appreciation of the importance of public health and health service delivery, enhance their problem-solving skills and laboratory expertise, and learn techniques in cross-cultural communication.[1,2] Within an increasingly multicultural patient population in the United States, these skills are as much applicable to the practice of clinical medicine domestically as they are internationally. Moreover, studies have found that international medical opportunities help shape students' choices in eventual medical specialties and career interests.[2,3] Considering the significant impact these international experiences have on medical students, medical schools may seek ways to integrate international medical trips and electives into the medical school curriculum.

Challenges to International Health Education

Challenges facing medical schools seeking to implement international medical trips and electives include curricular time constraints, financial costs, possible health risks associated with international travel, and the need for vaccinations, accommodations, travel documents, and transportation.[2,4] Although some students are fortunate enough to accompany organizations on international medical trips during school breaks, these organizations lack the logistical capabilities and capacities to expose large numbers of students to international health in short periods. These issues contribute to the relatively few international medical opportunities available to medical students and residents compared with the large interest and demand for such opportunities.[3,5,6] It should be noted that at the residency training level, many medical programs have overcome the obstacles of international medicine and integrated international health electives into their training programs.[3] However, integrating an international travel elective into the undergraduate medical level remains a significant challenge.

Telemedicine as a Possible Solution

Telemedicine, which is the use of telecommunication technologies such as videoconferencing for the delivery of health care, was proposed as a possible solution to these challenges. Telemedicine was specifically chosen as the tool for engaging stu-