

Teleconferencing in endoscopic surgery

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The traditional methods of information dissemination by publication in journals and the classical model of instruction by apprenticeship have not been able to keep pace with the rapid advances in the fields of therapeutic endoscopy and laparoscopic surgery. The advances in communications technology have made it possible to transmit images of operative procedures over long distances. In recent years, teaching workshops where procedures are demonstrated in a real-time fashion have become very popular. This article discusses the logistics, limitations, and problems that may be encountered in conducting such workshops.

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Introduction

Endoscopic techniques have completely revolutionised the practice of gastroenterology and gastrointestinal surgery in recent decades. Fibre-optic endoscopy enables lesions in the gastrointestinal tract to be directly visualised and a biopsy to be performed. As instrument manufacturers come up with improved endoscopes and accessories and endoscopists gain confidence and skill in the handling of endoscopes, it has become possible to offer endoscopic therapy. Diseases that required laparotomy in the past can now be managed effectively without an open operation. Notable examples include ulcer haemostasis, variceal injection and banding, intubation for inoperable oesophageal cancer, endoscopic sphincterotomy for gall stones, stenting for malignant jaundice, colonic polypectomy, and many others.

The advent of laparoscopic surgery marked a new milestone. The success of laparoscopic cholecystectomy is unprecedented. Within a few years laparoscopic cholecystectomy has replaced the open operation as the treatment of choice for gallstones. Laparoscopic techniques have also been used in various other operations in the abdomen, thorax, and other

parts of the body. New techniques are described almost every month and even a proliferation of journals in the subject cannot cope with rapid developments in the field.

Such rapid developments in endoscopic surgery pose special challenges for practising endoscopists and those in training. The traditional method of knowledge dissemination by publication in journals cannot keep pace with rapid developments in the field; by the time a paper appears in print the technique may well be out-dated. Presentations at scientific meetings can be more contemporary but are limited by the relative lack of peer review. In any case, it is not possible to learn a new surgical procedure by reading a manuscript or listening to a presentation. The time-honoured method of surgical training by apprenticeship has also failed to satisfy the needs created by the rapid progress of endoscopic surgery. Many of the techniques have been introduced recently and surgical mentors have not had the opportunity to acquire the necessary skills during their own training.

The procedures for both therapeutic endoscopy and laparoscopic surgery lend themselves to transmission to a large audience. With modern video-endoscopes and laparoscopes, it is easy to take the video output from the endoscope and project it onto a large screen. Workshops organised along these lines provide the means for introducing the practical aspects of new operations, techniques, and accessories in a timely fashion. The past two decades have seen a proliferation of workshops in endoscopic surgery, where procedures are performed live by the expert faculty and transmitted

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to an audience. Means are now available to transmit the image to either a lecture hall on-site at a hospital, to a conference venue in the same city, or even to another continent. In this article, we would like to share with readers the trials and tribulations we have encountered in organising such workshops over the past 15 years.

The logistics

The task of organising a live demonstration workshop is a logistical nightmare. Not only does the course director have to take care of the usual problems associated with an international conference such as sponsorship, travel, accommodation, venue, audio-visual requirements, transport, social programme and many other details, but also the director has to organise the visiting faculty who will perform the technically demanding invasive procedures. In addition, they must orchestrate the equivalent of a television show in front of a live audience.

Patients

The first principle to bear in mind in choosing patients for workshops is that the purpose of the workshop is educational. Any temptation to include difficult cases to test the outer limit of ability of internationally renowned experts or to have the faculty solve a difficult clinical problem must be rigorously resisted. In our experience, patients are invariably magnanimous about participating in workshops. Many are grateful for the opportunity to benefit from the expertise of the visiting specialists. Obtaining a broad enough spectrum of patients on which to demonstrate all of the new techniques within the short time span of the workshop can be a difficult task. For this, we have to rely on the goodwill of other institutions to refer suitable patients.

Faculty

If the visiting speaker gives a poor presentation at a scientific meeting the audience may have to, at worst, endure 45 minutes of boredom. If the visiting endoscopist or surgeon is inept, the consequences can be disastrous. World-renowned authorities are not necessarily technically polished, and technical wizards may not be able to give an instructive running commentary while operating. Only a very few have the rare ability to maintain a lively discussion while performing the most intricate and difficult procedures. Such individuals usually have a very busy calendar and have to be booked a long time in advance.

Facilities

Manufacturers of endoscopes and accessories are usually more than willing to provide the latest models for use in demonstrations and the visiting faculty may have special preferences that must be catered for. Equipment has to be delivered to the hospital well in advance and must pass any safety regulations and examinations that the hospital may have in place. It is advisable to use any new machines a few times before the workshop so that the staff can become familiar with their use in a less stressful situation and also to ensure that machines are compatible with existing equipment. It is the responsibility of the course director to keep overzealous marketing in check to maintain the scientific credibility of the meeting. The director also must take active steps to protect the visiting faculty from badgering by enthusiastic sales persons before, and particularly during, the demonstrations.

The crew

The medical staff, nurses, audiovisual team, and secretarial staff must work as a close-knit team. Each group has a specific role to play but must coordinate closely with the other personnel. Frequent briefings and brainstorming sessions are necessary for a centre conducting a live workshop for the first time. Even for experienced teams, careful planning and multiple rehearsals are recommended when holding a major event.

Modes of transmission

Coaxial cables

Coaxial cables are the most convenient method of transmitting the signal if the audience is within a short distance of the operating theatre or the endoscopy room. Over longer distances, there would be considerable signal loss and amplification is necessary if the distance to be covered exceeds 30 metres. Some endoscopy rooms and operating theatres have coaxial cables hard-wired; in other cases, cables have to be laid especially for the occasion (Fig 1). If possible, such cables should run above the ceiling; cables on the floor are dangerous, untidy, and may be damaged by patient trolleys rolling over them. Such problems may cause poor transmission or interruption of the signal that may be impossible to diagnose within a short time—a disaster during any live demonstration.

Microwave transmission

Microwaves can be used to transmit signals between

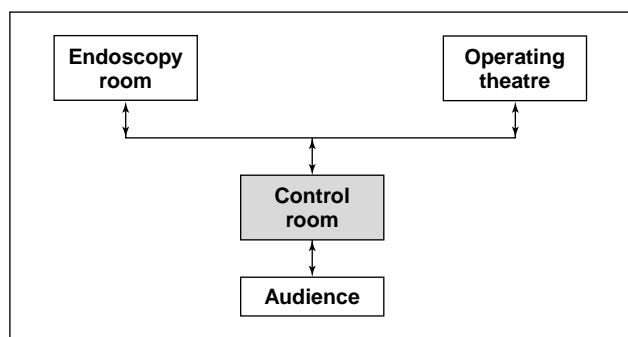


Fig 1. Operating theatres and endoscopy rooms linked by coaxial cables

This is the basic design used in the annual therapeutic workshops held every December

points that can be seen by direct visual contact. If transmission is to be between two points outside the line of direct sight, relay stations are necessary. The quality of images transmitted by microwave are perfectly adequate for the purpose of endosurgery demonstrations. This medium was successfully used to transmit laparoscopic surgical procedures from the Prince of Wales Hospital in Shatin to the Hong Kong Convention and Exhibition Centre in Wanchai during the Endolaparoscopic Society of Asia Conference in 1995 (Fig 2). A relay station at Lion Rock was used. As microwave transmission depends on outdoor dishes, such transmission is at the mercy of the weather, a factor which must be considered if the function is scheduled to occur during the typhoon season. Another factor that must be borne in mind in planning the transmission path of the microwave signal is the emergence of new buildings in a rapidly growing city. At one meeting overseas, there was poor signal transmission at regular intervals that lasted for less than 1 minute.

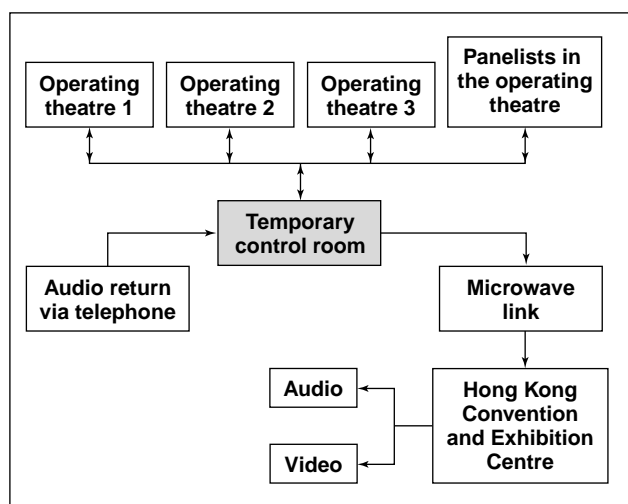


Fig 2. Use of a microwave link in teleconferencing

A microwave link between the Prince of Wales Hospital and the Hong Kong Convention and Exhibition Centre was used for the Endolaparoscopic Society of Asia Meeting in 1995

The engineers and technicians were baffled, as extensive testing several weeks prior to the workshop was without problem. It transpired that the beam of a crane at a building site between the hospital and the conference centre was swinging in the path of the microwave!

Fibre-optic video-link

An optical fibre is the most reliable method of transmitting the signal over long distances. Excellent picture quality can be achieved as there is minimal signal loss. This method was used in 1997 for the Postgraduate Course of the American Society of Gastrointestinal Endoscopy, Washington DC, United States. Therapeutic endoscopy was transmitted from the Prince of Wales Hospital to the International Television Centre, Hong Kong, prior to uplink by satellite. The disadvantage of optical video-link is the high cost of installation and maintenance.

Satellite

High quality video images can be sent anywhere in the world via satellite transmission. Satellite time is expensive, which precludes the use of this method except for very special occasions, but at the moment the quality of the picture is better than that obtained using telephone lines (see below). For the Postgraduate Course of the American Society for Gastrointestinal Endoscopy in 1997, where a high-quality video signal was necessary for viewing by 2000 participants, a satellite link was used for transmission, with integrated services digital network (ISDN) lines as a backup measure (Fig 3). Satellites are not foolproof, however; transmission of a laparoscopic hernia conference from Australia was interrupted, albeit momentarily, by a Japanese home movie!

Integrated services digital network lines

With advances in computer technology, it is now possible to convert analog signals to digital format and to transmit such images, after suitable compression, via telephone lines. Endoscopic surgery requires full-colour motion pictures of at least 15 frames per second, so wide bandwidth is necessary. In our experience, bandwidth of 384 kilobytes using three designated telephone lines is the minimum acceptable hardware. We have used this method to transmit images of therapeutic endoscopy to centres in North Carolina, California, Washington DC, Tokyo, London, Beijing, and Glasgow. This method is relatively inexpensive as, apart from the expense of the hardware (which can be either purchased or rented), one only has to pay for the long distance telephone calls. Unless the cost of satellite transmission is

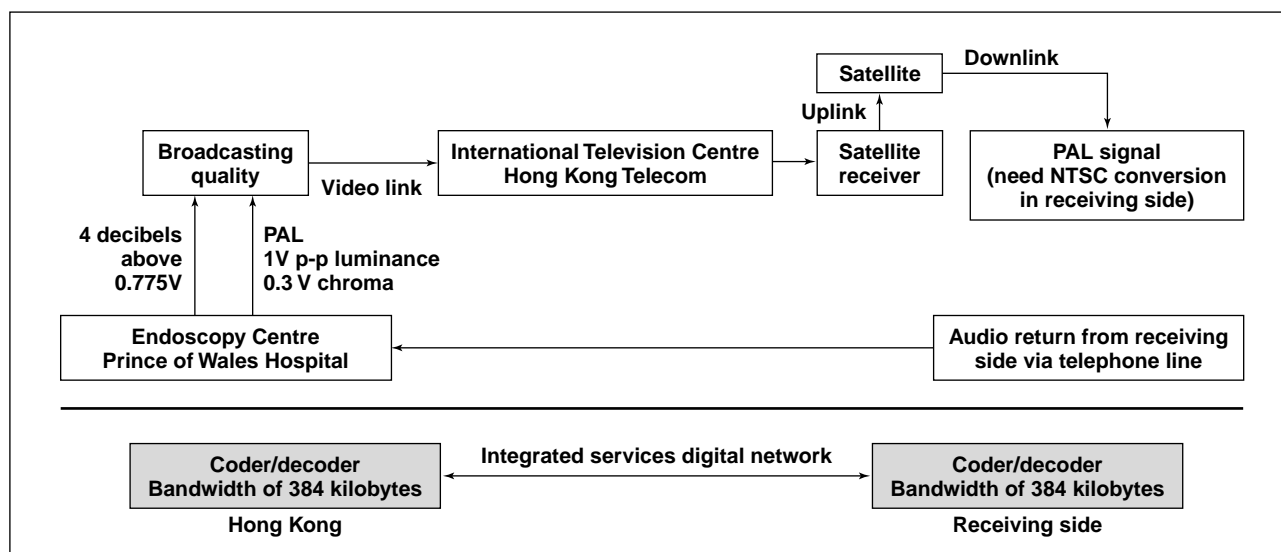


Fig 3. The design for transmission between the Prince of Wales Hospital and Washington DC for the 1997 Postgraduate Course of the American Society for Gastrointestinal Endoscopy

dramatically reduced, ISDN lines are likely to become the standard in medical videoconferencing.

Problems

Cultural differences

Although English may be the common language, people from different cultural backgrounds have different frames of reference, and e-mails, faxes, and telephone conversations are liable to be misunderstood. For major events, it is worth taking the time and expense of visiting the site and meeting the other team in person to finalise any practical matters.

Time differences

One of the major hurdles to transcontinental medical teleconferencing is the time difference. The 8-hour time difference between the United Kingdom and Hong Kong means that a morning session in the United Kingdom has to be linked to a late afternoon session in Hong Kong. We have had to do procedures late in the evening from 7 PM to 11 PM for the morning session of the Postgraduate Course of the American Society of Gastrointestinal Endoscopy in Washington DC. To avoid any misunderstanding, all references to timing in correspondence should be to Greenwich Mean Time (GMT). Even so, one satellite transmission to the East Coast of the United States had to be totally rescheduled at the last minute because the date difference between GMT and United States Eastern time had been overlooked.

Time delay

Because of the long distances involved and the need for

data compression and decoding, there is a time delay of up to 1 second. This may lead to echoes when receiving the audio (which can be avoided by muting the incoming sound track from the audio return). The panelist who is several thousand miles away and giving a commentary may also find this delay disconcerting, as the operating endoscopist cannot respond instantaneously.

With such a complex undertaking, "If anything can go wrong, it will." A successful teleconference depends on one thousand and one items working at the same time. If one piece in the link fails, the whole demonstration will fail. The electrosurgery machine may interfere with the video image; the light bulb in the video projector may blow at the critical moment and the spot light that was brought in at the last moment to improve the lighting may cause an overload and blow a fuse. There is no absolute guarantee for success, but it is essential to have substitutes available for every piece of equipment and to have several rehearsals before the final day.

Conclusion

Televised conferences in endoscopy and endoscopic surgery have played a significant role in the rapid introduction of new techniques into medical practice. With the explosive development of information technology, these conferences may soon be broadcast via an intranet or even the Internet. While it may be some time before endoscopy or endoscopic surgery can be performed over long distances by remote control robots, endoscopic consultations with live-video images, perhaps on the screen of a personal computer at home, will be possible in the immediate future.