

VIDEOCONFERENCING IN A CLINICAL SETTING

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Introduction

Today the exchange of medical information between physicians is literally of vital importance. This is not only because patients are treated by a number of a medical specialists who need to communicate their clinical findings with each other, but also because it facilitates clinical research. To this end doctors use a variety of information, communication devices and media, such as the telephone, hospital information systems (HIS), e-mail, written reports and X-ray films.

Although a lot of information can be exchanged without people actually meeting, there is always the need to discuss the clinical information "face to face". Of course, there is the proven method of physically gathering people and medical information

within a single room so that the information can be discussed. Given the sheer number of intra- and interdepartmental meetings in a hospital, this still seems to be the preferred method.

Setting up a meeting for doctors from different hospitals, however, is a more difficult task because of the lengthy travel times involved. Therefore, interhospital meetings are not scheduled very frequently. Furthermore, quick consulting with (international) medical experts in case of medical emergencies is very difficult because relevant patient data (*i.e.*, image data) cannot be transmitted. Consequently, the information is not exchanged and discussed as quickly as possible.

But now, with the advent of modern communication networks this situation might change. With these networks (multinational) business corporations are already using a technique called videoconferencing to virtually "meet" each other. The advantages are

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that business meetings can be scheduled more frequently and that travel times and travel costs are significantly reduced.

Videoconferencing Systems in a Hospital Setting

For videoconferencing to work with an acceptable image and sound quality, large amounts of data need to be transported over a network. This means that the network should have a large data transfer rate (dtr >300 kbit/s). A conventional analog telephone line (dtr: 64 kbit/s) is therefore not suitable. At the other extreme, the most modern communication networks have very large bandwidths (dtr >500 Mbit/s) but are not yet generally available.

For videoconferencing to be successful in a hospital it is necessary to fulfil the following conditions: the communication network must be a generally available investment; running costs of the videoconferencing system and communication network must be affordable; there must be standard communication protocol; and the quality of the transmitted clinical data must be the same as the original quality. From the first two conditions it follows that it is not possible to use the most modern communication networks. These networks are just emerging and are therefore scarcely available and very expensive to run. The Internet, which is cheap and generally available, is not suitable because of the low and varying data transfer rate. Furthermore, the Internet does not provide a high level of data-security and patient data might, therefore, be retrieved from the Internet by unauthorized persons. The third condition is important because different types of videoconferencing systems need to communicate with each other and therefore need to speak the same language (protocol). The fourth condition is important because much of the clinical data consists of image data (X-ray film, photos, etc) and both parties need to see the clinical images with the same image quality.

At the moment the only communication network which fulfills all the conditions is the

digital telephone network (ISDN: Integrated Digital Services Network). Several types of ISDN videoconferencing systems have been developed but generally they can be divided into two classes, as follows: systems that primarily are designed for the transmission of real time video signals (the professional videoconferencing systems); and systems that are primarily designed for the transmission of digital data (the desktop videoconferencing systems).

The characteristics of both systems will be discussed here and we will investigate how they can be used in a hospital setting.

Professional Videoconferencing Systems

These systems are mostly used in business corporations. They usually consist of a high quality color camera mounted on top of a large monitor to register the participants at the meeting and one or several high quality microphone(s). They may use up to four ISDN lines simultaneously (dtr: 512 kbit/s) to transmit the video signals. They are primarily designed to mimic a business meeting, which means that the accent lies on a high quality video and sound reproduction. The camera positions can be controlled from either side to focus the attention on one or several speakers. If (clinical) data are to be transmitted, it is usually done by placing a report, overhead sheet, film or other object on a visualizer (a light box with a camera mounted above it) which converts the data into the required video signal to be transmitted.

There are major advantages and disadvantages for its use in hospital. Advantages include its utility in a group meeting; the high quality video and sound; clinical data not having to be in digital format; clinical data being easily converted into video format with the help of a visualizer; transfer of real time image data (*i.e.*, videotapes); and quick setting up of meetings. Disadvantages include reduced image quality of still pictures with their conversion to the video format; usual lack of provisions to manipulate the clinical

data, *e.g.*, electronically pointing at certain features in the image, electronically drawing on the image so that the other side sees it; high running costs with the expense of using four ISDN being about eight times more than a conventional telephone line; and high investment costs (US \$25,000-60,000).

Desktop Video System

Basically this system is designed for a person to person communication and consists of a standard personal computer with a small camera mounted on top of the PC monitor. Only one ISDN line (dtr: 128 kbit/s) is used for the transmission of all the information (*i.e.*, audio, video and clinical data). Because of the limited bandwidth, priority is given to the full transmission of the (clinical) data. Audio and video quality are degraded, which results in reasonable audio quality but in a poor video quality, making it insufficient for a group meeting. Advantages of this system include the full transmission of (clinical) data resulting in a high image resolution of still pictures; low investment costs (US \$5,000); and relatively low running costs (one ISDN line). Disadvantages include its unsuitability in a group meeting; its reasonable audio quality but poor video quality; the clinical data having to be in digital format to be transmitted; needing a more complex user interface; and the time required to set up a meeting due to the fact that all clinical data have to be available in digital format, meaning that X-ray films, reports etc. need to be scanned on a flatbed scanner if they are not available in digital format (*e.g.*, via a HIS).

Looking at the above we can conclude that each system has its strengths and weaknesses. If we want to have the fully functioning system (*i.e.*, high quality audio, video and clinical data), a combination of the two systems is (at the moment) required.

Future Developments

The use of a desktop video system is now required to transmit clinical image data without any loss in image quality over an

ISDN network. However, in the possibly near future this may no longer be necessary. New large bandwidth networks will become available or already existing networks will be adapted for digital use. For example, like ISDN, the cable television network is generally available and has a large enough bandwidth to transmit digital data. Television companies are already offering high speed internet access via their television cable networks. So it is only a question of time before analog television sets will be replaced by digital monitors (like the PC monitors) and our television and computer systems will be integrated.

Demonstration

In order to show the current status of the videoconferencing technique both types of videoconferencing systems were demonstrated at the inflammatory bowel disease (IBD) clinical symposium at the Winterthur Auditorium in Barcelona. During this session a meeting was arranged between doctors at the "Vrije Universiteit" Hospital in Amsterdam and the panel at the auditorium. The intention was to discuss two patients from Amsterdam. Both locations used the same equipment which consisted of a professional video system (Viewstation from the company Polyspan, 3 ISDN lines) and a desktop videoconferencing system (Pentium PC from Dell, 1 ISDN line). The professional videoconferencing systems were used exclusively for the transmission of the audio and video signals, while the PC systems were used exclusively to transmit the clinical image data. The videoconferencing software used on the PC was Microsoft Netmeeting (freeware) and Databeam's management tools (\$50), which added some extra functions to the Netmeeting.

During the session it was demonstrated that with the desktop videoconferencing system it was possible to manipulate with the transmitted image data. Pointers, markers and text were added real time to the transmitted pictures from both sides. The discussion generated in this presentation of the case reports is highlighted in the article on page 149.