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Current status and history of teleradiology in India

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Abstract

Teleradiology is yet to take off in India. This is unfortunate since this technology is ideal for a country like India, where expertise in remote areas for advanced investigations such as CT and MR, is lacking. We were the first center in India to use teleradiology on a regular basis. Our initial methodology in 1996 was using video-capture cards and Windows 95 dial-up protocols. Now we use DICOM transfers and remote-access software. Even today, 4 years later, we are the only center in India using teleradiology on a regular basis. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

Teleradiology is an ideal technology for a country like India, where expertise for specialized investigations such as CT and MRI, is lacking, especially in remote areas. This would allow radiologists in the larger towns and cities to provide services to CT and MRI scanners in village and district level places, where radiologists are just not available.

The growth of teleradiology, however, has been retarded due to a number of reasons:

1. Lack of proper telecommunication facilities.
2. Failure of radiologists and physicians to understand teleradiology methods and computer technology.
3. Unrealistic pricing by vendors of teleradiology packages.

Though there has been considerable improvement in telecommunication facilities in the major cities, the same level of progress is lacking in the villages and districts. Good cables, digital exchanges and reliable telephone lines are just not available in the rural areas of the country. So though it is feasible to connect computers within and between the major cities, the ability to transfer data and images from a mofussil rural area to the bigger cities, is limited. The poor communication facilities are a result of the stranglehold and monopoly that the government has had on telecommunications. With the privatization of this sector and the entry of other companies including the growth of mobile

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telephones, a vast improvement in the telecommunications network is expected in the next 5 years or so.

Even if reasonable and reliable connections are available, the cost of transfer of images has been a stumbling block. Since access to the Internet until 6 months ago was not available in smaller towns, inter-town connections have to be regular dial-ups. The cost of long distance calls affects the cost-effectiveness of image transfer. For example, a CT scan of the brain costs Rs 2000 or $45. If the long distance charge for a 10-min transfer comes to Rs 200 or $4.5, the image transfer may not be worth it. ISDN and leased line connections are also prohibitively expensive.

Radiologists and other physicians traditionally are computer aliterate. Though radiologists work on sophisticated computers, a good understanding of PC technology is often lacking. In a country where vendor prices for teleradiology packages are unrealistic, a thorough understanding of computer technology goes a long way in facilitating development of teleradiology and similar computer packages. Our example will illustrate this.

Vendors have also set unrealistic prices for teleradiology packages, based on models for the developed world, where reimbursements or charges for CT scans are usually 5–10 times that in our country. The cheapest system quoted in 1996 to us was $10 000, which we did not find cost-effective. Even today, the prices typically are upwards of $20 000 and this deters radiologists and hospitals from going in for sophisticated teleradiology projects.

2. Our experience

In 1996, we became the first center in India, to use teleradiology. We set up a simple system for transferring images from our center to our individual homes, so as to be able to report emergency CT scans, typically head injuries and strokes. To date, we are still the only center transferring images back and forth on a regular basis, though there are other projects now being developed.

Our first attempt was with the Siemens AR.C CT scanner, an incremental CT scanner. This is a non-DICOM compliant scanner with proprietary image formats. We bypassed this problem by using a video-out port that the CT computer had, for the use of analog cameras. To this port, we connected a video-capture card, the Videoblaster SE 100 card (Creative Labs, Singapore) and images were captured with a 640×480 resolution in a jpg format. Each CT image had to be individually captured and for a CT of the brain with soft tissue and bone windows (24–30 images), this process took 8–10 min. The average file size was 25–30 K per image. It was not possible to window these images.

Once these images were captured on a PC, we used standard Windows 95 based dial-up connection protocols for image transfer. We dialed up from our homes using Windows 95 Dial-Up Networking 95 and connected with the computer that had the images. We went into the directory that contained the images and using Windows Explorer did a copy/paste from that directory to one on our local computer. This set up an image transfer. Initially, using 14.4 kb per second modems at both ends image transfers took approximately 10–15 min for a set of 24 images. The images were viewed using a shareware program called Lviewpro.

The total cost of this teleradiology project including the two computers, modems and the video capture card was approximately Rs 125 000 (approx. $3000).

Over the next 3 years, the following upgrades were made:

1. A shift to 28.8 kb per second modems and then 33.6 kb per second modems, which reduced transfer speeds time by half.
2. Shift to another video capture card, the Snappy (Play Inc, USA) which allowed us to capture at 800×600 and even 1024×1024. Even though we were routinely using 800×600 resolutions for capture, the file size was approximately 10–12 KB, due to superior JPEG compression.

The image quality with this method of transfer was approximately 70% of the original. Windowing was also not possible. Skull fractures and very subtle contusions and infarcts were occasionally missed with this technique. On no occasion, however, was a lesion that would alter the management of the patient, not picked up. We restricted our utility of this technique to brain CTs in patients with acute stroke, headache, head injuries and seizures.

In April 1999, the CT scanner was upgraded to a Siemens AR.Star, which is a fully DICOM-compliant, spiral CT scanner. We now had to change our method of image transfer, both from the CT scanner to the PC-based workstation and from the workstation to our homes.

Transfer of images from the CT to a Windows-NT based PC-workstation is now done by using a DICOM-receive software, Digital Jacket (Desacc, Chicago, USA), downloaded from their website for a cost of $1500. The images are stored in directories named after the patient ID No, as dcm images and the file size is 512 KB.

Since transfer of such images using even 56.6 kb per second modems is difficult and very slow, we decided to use another technique. Using PC-Anywhere (Symantec, USA), a remote access software, we dial into the workstation and transfer the desktop screen of the workstation. The technologist has earlier set up the CT images in a 9 on 1 or 16 on 1 format, using OSIRIS which is a DICOM viewer developed by the University of Geneva. If the window levels and width have to be changed, a telephone call to the technologist achieves this in less than 1 min. The transfer of the desktop also takes less than 1 min. Alternatively with a little more time, the entire process of opening OSIRIS and viewing the images can also be done from the home computer, since the remote access software essentially allows the home computer to control the remote computer; what is transferred are mouse clicks and desktop refreshes.

In the last few months, we have also started using a notebook (Toshiba, USA) for the same purpose, thus allowing us to log in to the CT workstation from anywhere, not just from home.

We have also used teleradiology to report images from a CT scanner in a remote suburban area of Mumbai. The CT scanner is a Sytec 1800 CT scanner (GE, India). Since the scanner does not possess an analog output and is also not DICOM-compliant, the films are scanned on a commercial scanner, the UMAX Powerlook II at 200 dpi resolution. The file size is 400 KB. Once the image is available on the hard disk, we use Windows 95 or 98 dial-up networking protocols for connecting our computers and to transfer the images.

We are in the process of developing an Internet-based application for image transfer and viewing.

Low-cost solutions for teleradiology, such as these have also been used in other parts of the world [1].

3. Other experiences

The first public practical demonstration of teleradiology was given by Siemens, when

they transferred images from a Siemens AR.C scanner to their site at the conference, during the Annual Congress of the Indian Radiology & Imaging Association (IRIA) that was held in Guwahati in January 1997.

Subsequently, using Crystal, an image management software, Wipro-GE has also demonstrated teleradiology capabilities for their entire ranges of scanners.

4. Future trends

The availability of Internet access throughout the country has been improving with each passing month. Telecommunication facilities, better cables and other similar facilities are also improving. The use of DICOM protocols is making image transfers between CT and MRI machines and PC-based computers very easy. With the convergence of all these technologies, the use of teleradiology in India is poised to take-off in a big manner, since the need for this technology already exists.

References

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