

EPID: Managing Cancer Treatment Remotely

A West Virginia cancer center is finding that Electronic Portal Imaging Device (EPID) software can be an invaluable tool in oncology | BY DAN ODERO, PHD

Electronic Portal Imaging Device (EPID) software is a very useful technology in radiation therapy facilities. It is used to acquire, review, process, text and line annotate, print and transmit electronic portal images to department networks or PACS.

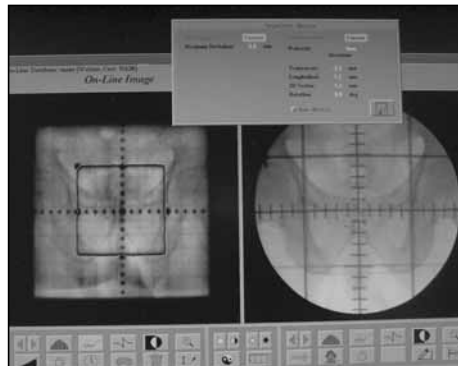
The ideal EPID software shows cancer patient treatment set-up accuracy by comparing the electronically acquired treatment field shapes with the treatment planning digitally reconstructed radiographs (DRRs) and/or digitally converted simulation film images. It also reports localization of the cancer treatment volume through the use of implanted fiducial markers or bony anatomy landmarks for image-guided radiation therapy (IGRT).

The images and the reports stored in the EPID computer or portal image server are then reviewed, manipulated and approved or disapproved instantly. Remote access to EPID would make it possible for users like physicians, physicists, institutions' service technicians and EPID service engineers to instantly access these treatment images while at remote locations with wired or wireless Internet services during the treatment verifications. This would greatly improve the efficiency of radiation therapy cancer management.

Bringing a lot to the table

Access to electronic portal imaging devices in radiation therapy centers, however, has traditionally been limited to on-site users physically accessing computers that have these devices installed. This limits the initial treatment set-up verifications to days when physicians are physically present in the clinic. Remote access to the devices is useful for several reasons:

- With regard to the radiation oncologist who practices at several locations, the doctor's physical presence in the facility would not



Close-up of the TheraView EPID showing a comparison between electronically acquired image with double exposure technique (left) and digitally converted simulation images (right). The inset screen is the result of the treatment field and treatment target comparisons. *courtesy Dan Odero*

be dictated by the days or hours of the initial acquisition of portal images. As such, there would be no need to set specific days for initial treatment set-up verifications because of limited attending physician availability.

- The attending physician can access the images and control the set-up verification process at his desk or in consultation rooms without having to go to the treatment area. This flexibility provides extra time for the physician to concentrate on other patient matters.

- Should the physician be out of the facility for any reason—on vacation or in meetings, seminars or the like—but still able to log onto the Internet, treatment can proceed after his remote approval of the set-up verification images. This reduces the treatment waiting period.

- The quality of the images and maintenance service of the portal imaging system can be reviewed, and software related issues resolved, remotely.

- There is often no cost involved with the usage of Internet-based software modules (if initially equipped with the EPID), but it would cost money to get additional licenses and to install the image processing software on individual physicians' computers. Moreover, there would be no image downloads required at the remote computer. Consequently, large computer memory space would not be necessary.

With recent advances in computer and wireless data transmission technologies providing high-speed connectivity, powerful processors and larger memory spaces, instantly accessing portal imaging devices and manipulating portal images at remote locations is now possible. This can be done either through wireless, cable, or satellite data communication systems, and tasks which have long been limited to on-site users can now be performed off-site. To qualify for this, the EPID computer must be accessible remotely through any one of the above methods. Also, images, once accessible, should be manipulated to the user's satisfaction.

One way to achieve this is to install identical EPID image manipulation software on the remote computer. The images can then be downloaded via the Internet and then manipulated. But this method has several challenges. The remote computer must have adequate data storage capability, the image annotations may need to be synchronized with the main EPID computer at a later time, both the EPID and remote computers must have identical operating systems and, lastly, such remote installations may require additional licensing by vendors, resulting in exorbitant costs.

A better alternative is for the EPID computer or image server to have Internet-based EPID software that can be accessed remotely.

In this method, the only requirement is that the EPID computer be able to connect to the remote computer via the Internet. The software must be stable and capable of being operated at remote locations with minimal image distortion. This method is widely used in radiology departments where radiologists read CT and PET images at remote locations. The advantage of this method is that the images remain at the EPID computers, or image servers, with no downloading, at the remote computers. The only major challenge to this method is the lower data transmission speed, which depends on bandwidth.

In any one of the above methods, the local EPID and the remote computers must be configured in such a way that the firewall can be bypassed at both ends without compromising patient information. While accessing the EPID computers may seem plausible, remote access has been limited to very few EPID systems and has mostly been limited to intranet wired/wireless computers.

TheraView EPID is one system that can be accessed remotely. It comes equipped with the Internet version of the software with limited image manipulation tools. The complete version can be purchased at an additional cost.

A success story

At Raleigh Regional Cancer Center, Beckley, W. VA., we have explored Internet wireless access to the TheraView EPID system, which has an Internet software module for online portal image review and manipulation.

One possible option of achieving this was to use one of several available Internet teleconferencing tools, such as Gotomeeting or Webex. But these tools are not free. They require registration and subscriptions with monthly payments. They require a dialogue between the local and remote computers. The user at the remote location would then take control over the local EPID computer and navigate it as if she he or she were actually on site. To allow this to happen, users would first initiate the process from a local computer that has access to the Internet and is connected to the TheraView EPID through the intranet. The local user would then alert the remote user (e.g. physician) of the established connection either by pager, telephone, email, text messaging or any other communication device. Note that the local computer will access the images through the intranet con-



A close-up view of TheraView EPID internet software module showing a comparison between electronically acquired image (left) and CT Digitally Reconstructed Radiograph (right).



Remote laptop PC with no wireless card at a remote location showing the comparison of TheraView EPID portal images through its Internet software module.

nection, while the remote computer would access this local computer's intranet through the Internet network. In this option, the local and remote computers do not need to have static IP address configurations.

Another option is to configure the remote computer to connect to the local EPID computer and bypass the local firewall. The challenge here is that the local and remote computers must have static IP addresses. There is no additional cost associated with this option. It allows the attending physician at a remote location to guide and control the initial portal image acquisitions and instruct the therapists on the patient set-up procedures.

Remote live access to the EPID and its functionalities is made possible via a combination of a hand-held mobile phone and a mobile computer within its vicinity. This computer is also equipped with voice over Internet protocol (VOIP) software with free Internet-to-Internet long distance calls offered by Skype

Limited. The mobile phone, which has wireless Internet access, acts as a modem for this remotely located computer. If the remote computer has wireless Internet access, then there is no need to use the hand-held mobile system, since it only allows the remote computer to go online by connecting to the mobile phone through the HotSync USB cable or via Bluetooth technologies. The other purpose is to be able to take advantage of the wider computer screen to visualize the images. This application is currently limited to smart phone hand-held devices.

We have been able to configure a PalmOne Treo 650 smart phone hand-held mobile system with broadband Internet service to connect to TheraView EPID. After the Internet connection's established, we can manipulate the portal images remotely using the smart phone's blazer browser. We have also been able to use this wireless smart phone as a modem to wirelessly connect the remote laptop PC to the Internet via Bluetooth and also USB cable. Using this method to take advantage of the computer with a wider viewing area and higher screen resolution, we have successfully been able to manipulate the images. The data transmission rate has been somewhat slow and frustrating, since this is basically a dial-up Internet connection. As expected, the success of this wireless connectivity depends on the hot spot location of the smart phone.

The promising future developments in the data transmission speed of broadband wireless Internet service, together with the GSM smart phone or mobile computer technology, would present a viable approach to the use of EPIDs in radiation therapy facilities. With the GSM capability, the user would not necessarily need to access the Internet based on their home Internet service provider, so long as a local GSM wireless Internet service provider is available wherever the user is remotely located. ■

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