

Imaging for spinal surgery

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Spine surgery has evolved into a specialty heavily dependent on high-quality diagnostic imaging. In Canada, patients and spinal surgeons alike continue to enjoy generally high standards of imaging quality. Whereas printed photographic film has been the traditional medium of image reproduction, current technology allows us to directly view digital images on standard computer displays, albeit often without the image quality required for diagnostic purposes. This approach, called the Picture Archive Communication System (or PACS), is the system that will eventually be used throughout North America. It offers the potential for large cost savings over printed films as well as increased versatility in image viewing.¹ Given the noxious nature of photographic chemicals, the positive environmental impact is also important. Recognizing these advantages, it is not surprising that many medical imaging departments actively promote a conversion to the digital format. It is the consensus of the members of the Canadian Spine Society that the end users of this technology, the Canadian spine surgeons who rely on the technology to make final diagnostic and treatment decisions, have not been properly consulted before its implementation.

As long as the quality of the computer image is adequate, viewing computed tomography, magnetic

resonance imaging, angiography, fluoroscopy and plain x-ray films are effective and efficient for diagnostic purposes. Viewing from remote PACS review stations throughout a region allows immediate consultation with other specialists. As technology improves, the reliability of this system is approaching and even surpassing that of the traditional system of film filing, which becomes increasingly expensive and unreliable as patient volumes increase.²

From a treatment perspective, the potential advantages of digital image viewing in spinal surgery are encouraging. In general, spinal surgeons have embraced new technologies in spinal surgery with cautious but welcoming attitudes. Computerized image handling is no exception.

Currently, the process of change is slow and initially expensive. Problems exist. Examining digital images requires computer hardware and compatible software. Viewing conventional photographic films of imaging studies requires only a view box or a window. It is not uncommon for spine surgeons to treat patients whose diagnostic studies have come from various different formats from other facilities or regions. As a result, lacking the simplicity of the photographic pictures, difficulties have been encountered in accessing critically important digital images. As compact discs replace film, the inability to open

digital images in the office or, more crucially, in the operating room substantially impedes patient care. A failure to obtain the necessary pictures may require repeat studies: an unwarranted cost to the health care system and an unnecessary burden and possible risk to patients. Further, the quality of the available images is now dependent on the amount of data stored and on the resolution of the monitor, adding further potential sources of error. Most of the software programs for viewing these images (eFilm Lite, imageviewer) are specifically labelled as “not for diagnostic purposes.” The quality of the image reproduction is inadequate to make diagnostic and therapeutic decisions.³ This raises both quality of care and medical-legal issues. The spine surgeon viewing these pictures in the office, emergency department or operating room must make a clinical decision at that time. This decision can only be made with confidence if appropriate hardware and software are readily available.

Direct access to the PACS system can be sporadic and unacceptably time-consuming. Some modern facilities provide PACS stations in the examining rooms for rapid image access, but many others do not. When the consultation takes place in an off-site location, the acquisition time may far exceed the time needed to view plain films. A basic concern is

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the available line speed. The delay can be even further prolonged when the request includes archived studies that must be located and reloaded on the active server. In some cases, the firewall at the transmission site may prevent access altogether.⁴ Where the required equipment is unavailable or cannot function properly, having conventional films or a compatible compact disc remains essential. The same inconsistent availability of the PACS system is found in operating rooms across Canada, with potentially catastrophic consequences. PACS systems are designed to log off after a period of inactivity. Images may disappear during lengthy surgeries, requiring the surgeon to move to the computer terminal (delegation of this task is extremely difficult) to re-establish the link and relocate the pictures. When various images from multiple modalities are required simultaneously during surgery, the present systems are uniformly inadequate. For procedures requiring precise visualization, such as needle localization, the pictures in the operating room may be significantly and relevantly degraded from the images available to the radiologist, creating an additional threat to patient safety.

Spinal surgeons unanimously believe that the standard of care requires that appropriate images of a patient undergoing spinal surgery be displayed in the operating theatre. Although computerized image viewing through the PACS system is likely to become universally accepted in health care in Canada, this will take several years. While radiology departments enjoy the cost savings of conversion to digital film processing and storage, they should be cognizant of the unacceptable cost of medical errors that may result from inadequate access to imaging studies. The intermediate phase poses significant risks.

Recommendations

The Canadian Spine Society has developed and endorsed the following

guidelines to ensure appropriate patient care during this transition period.

1. Institutions where spine surgery is carried out should ensure that good quality and reliable PACS stations are available in the operating suite and in all clinic facilities, so the surgeons can easily retrieve and view diagnostic quality images. In the clinic setting, these viewers must be situated in every examining room where the surgeon conducts patient consultations. The appropriate technology is required to enable the doctor to explain and illustrate the surgical options and, when required, obtain a genuinely informed consent.
2. High-speed or broadband Internet access with appropriate security measures should be available for physicians working in offices within and outside of a particular health region so that the necessary reference information is easily available. Rapid distant access requires appropriate identifiers. Hospital systems must be integrated.
3. Institutions that provide spinal imaging must make the images available in a standardized format, such as a compact disc, at the request of a patient or physician outside the region. Recognizing that many institutions carrying out patient care will not be converted to electronic image viewing for some time, imaging studies need to be available on conventional x-ray films on request from the treating physician without delay, special authorization or added cost. This must be performed even in situations where the radiologist has determined the study to be negative. It is the treating surgeon, not the radiologist, who must make the surgical decisions.
4. The inclusion of "scout" films and reconstructed series in MRI and CT studies is essential for both the electronic and, if necessary, print copies. For thoracolumbar pathology, the scout

film should include the sacrum and the level of interest on the same sagittal image. When comparing intraoperative plain radiographs or fluoroscopy to the preoperative studies during surgery on the thoracic spine, it is more reliable for the operating surgeon to "count up" from the sacrum than to "count down" from the head, because the upper thoracic region is often obscured.

5. Because health care policy makers and health care providers plan and implement electronic imaging, it is essential that they communicate with both the end users and as many other jurisdictions as possible. Coordination will ensure compatible software; eliminate unnecessary duplication and waste; and remove unforeseen disruptions, such as needless logging off, to guarantee seamless tertiary and quaternary care.

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