Film-less Radiology - A Future Perspective

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Radiology has traditionally been considered inseparable from 'films', classically in the form of X-ray plates but gradually also including films incorporating images from ultrasonography (US), computed tomography (CT) and magnetic resonance imaging (MRI) examinations. Talk of 'film-less radiology' may therefore appear anachronistic. But the future beckons a world in which the practice of radiology may completely do away with the traditional use of films.

The seeds of film-less radiology were laid with the advent of modalities such as MRI and CT, which were inherently computer-intensive for both acquiring and presenting clinically relevant images. Since images from the newer modalities such as CT and MRI were basically in a digital format, they could be treated in the same manner as any other digital data. They could be viewed on computer monitors with the added advantage of a variety of post-processing tools to alter those images or to analyze them. They could be stored in digital format either on the hard disk of the computer or on removable media such as floppies, CDs etc., for efficient transport. They could also be transported electronically on a network of computers. However, the traditional habit of viewing all images on films, required that these images be also printed on films whether for reporting by the Radiologist, for review by the clinician or for long term archival. With the ever-increasing inclusion of computer usage in the medical field and specifically in radiology, this traditional concept was beginning to be questioned. Thus was born the concept of Picture Archival and Communication System (PACS).

PACS comprises a network of computers, which include the modality computers, additional computers such as readily available personal computers (PCs) or advanced servers, remote viewing stations and peripherals such as printers and storage devices which can seamlessly communicate with each other and exchange data just as in any other computer network. By establishing such a network, images from a multitude of modalities can be brought together on a single platform, transferred on a local area network, a wide area network or even on the internet, viewed independently at multiple nodes in the radiology

department and at select viewing stations in OPDs and wards, be archived in electronic form and retrieved with minimum effort. If the patient's entire medical records are also simultaneously available on such a network, then the system lends itself to a level of efficiency which cannot be achieved with conventional methods of recording data and images viz, manual record keeping and film-based imaging.

The biggest stumbling block in switching from a film-based radiology department to a film-less one, is the fact that conventional radiography still comprises more than three-fourths the workload of any full-fledged department. With such a large proportion of a department's output outside the ambit of computers, it would be impractical to run a department where both filmed and film-less images are concurrently used. The true benefit of PACS can be realized only when all images coming out of a radiology department are available on such a system. Initial efforts to have conventional X-ray images in digital format were directed towards capturing them using digital cameras or film-scanners and storing them as an image file. This however, only resulted in duplication of work and, more importantly, deterioration in the quality of images thus converted. The advent of computerized radiography (CR) and digital radiography (DR) which can directly acquire radiographs in the digital format, gave the final push for the introduction of film-less radiology as a viable proposition. CR and DR offer the added advantage that they afford a wider latitude in the exposure factors required to get a diagnostic quality image which translates into fewer repeat exposures and lesser radiation dose.

A pertinent question is whether film-less radiology is a practical idea for hospitals in the Armed Forces. Hospitals worldwide which have already implemented a comprehensive PACS, which includes CR or DR as part of the network report the following advantages of the system :

1. Direct savings on the recurring cost of films, processing chemicals and on the logistics of storage and transport of both unexposed and archival films.
2. Faster turnaround time in OPDs and wards since

clinical diagnosis is reached earlier with the ready availability of images on remote viewing stations and the added advantage of immediate comparison of a chronological series of archived images during follow up of a patient.

3. Reduction in the number of repeat exposures due to technical faults and in the number of lost or damaged films from as high as 20% to less than 1%.
4. Ease of storage and subsequent retrieval of diagnostic images whether for future follow-up or for teaching and research purposes.
5. When combined with a Radiology Information System (RIS) or Hospital Information System (HIS) which are computerized systems for patient registration whether at a departmental or hospital level, PACS precludes duplication of registration formalities when a patient undergoes multiple diagnostic examinations during one visit.

This can be extended to other services such as OPDs, laboratory examinations and to medical inventory management.

Hospitals in the Armed Forces offer certain organizational advantages for the implementation of film-less radiology. These include :

1. Every patient (serving, ex-serviceman or dependant) can be identified uniquely by the service number.
2. An existing manual system of archival of medical records including diagnostic images for purposes of future review/re-categorization which is amenable to computerization.
3. The ongoing implementation of integrated vertical hospital projects with all services under one roof which is ideal for networking.
4. A pool of fairly educated para-medical personnel who can be trained to work in a 'film-less' environment.
5. The ready availability of connectivity within the Armed Forces by virtue of captive tele-

communication systems on which data and even images can be seamlessly transferred precluding the need for physical transfer of bulky patient-related documents.

6. A general environment which is presently supportive of computerization of all facets of the functioning of the Forces with the availability of a support structure for technical inputs and maintenance.

There are however, certain issues that need to be considered before implementation of a film-less environment. These are :

1. The cost of hardware which includes
 - a) Conversion of existing conventional radiography systems to CR or DR
 - b) Cost of computers/servers/remote viewing stations
 - c) Cost of networking within a hospital
2. Medical images are now viewed in an internationally accepted format called Digital Communication in Medicine (DICOM). Specialized software is required to integrate these with existing computers on a network. These are, however, easily available.
3. Training of personnel in the use of such a system.
4. The requirement and cost of employing or consulting specialist personnel such as computer engineers.
5. The cost of maintenance of equipment. The system needs to be functional year-round since there will be no conventional back-up system once a full fledged film-less environment is embraced.

Technology is providing us with newer ways of performing conventional jobs in a more efficient manner and it is for our organization to decide whether we would like to be a part of this change that is sweeping the world of Medicine gradually. It is time the debate on the introduction of film-less radiology is discussed in various fora in the Armed Forces. In the ultimate analysis, if you can manage your 'Images' on a computerized network, then all other data can be easily managed.

MEDICAL PHILATELY

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