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The Digital Age in Medical Imaging:

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Digital technology has revolutionised our lives. We are collecting, storing, analysing, and using more and more information at a faster and faster pace. X-ray imaging is no exception. Digital radiology, in which x-ray film is replaced with computer-generated images, is not an entirely new technique; recent technologies, such as computed tomography (CT), have always been digital. However, in recent years, advances have come about that allow all diagnostic studies to exist as electronic files, requiring no film at all.

How Does it Improve Services?

Digital imaging provides rapid and improved flow of diagnostic information. Electronic images can potentially be viewed immediately after acquisition on a screen, rather than waiting for a film to be processed. In practice, images can be available for viewing less than a minute after they are taken. Rather than being limited to diagnostic information existing on a single piece of film, digital images can be viewed simultaneously at different locations. This enhances clinical care by permitting multiple care providers to view information that previously existed in only one location on a single film. In addition, consultation and discussion from multiple locations may occur, either from within the hospital or at satellite locations.

Accessing Quality Services

Digital technology allows for remote access to radiographic images. The advent of high-speed networks and the internet has expanded the range of remote viewing to be essentially any place with network and/or internet access. Remote access to images relieves radiologists of the requirement of being physically in the hospital at all times. The limitations of teleradiology are generally related to technology such as remote access, network speed and file size. These limitations are generally minimal with the use of newer technologies. Through the use of teleradiology, even small hospitals can have access to high-quality radiology interpretation on a consistent basis.

The ability to manipulate a digital image offers an enormous diagnostic advantage over film. Software on viewing workstations permits the radiologist to utilise zoom for a close-up of specific areas, digital subtraction for improving image definition, stacking of images for serial viewing, contrast enhancement and other benefits. Precise measurement of objects such as aortic aneurysms is possible. In addition, clinically important findings can be annotated for clinical and educational purposes.

Digital Software Allows Faster Processes

Digital radiology software allows for simplified comparison of studies; for instance, side-by-side viewing of radiographs taken days, weeks, or longer apart allows the radiologist to quickly note fine differences in appearance. The number of images that can be stored is limited only by the storage capacity of the archival system. Images stored digitally with proper backup mechanisms, are much less likely to be misplaced, misfiled, or potentially destroyed; they are easily available regardless of time of day or location to anyone who has proper access to them.

With the increasingly widespread use of computers in the display of radiologic images, it is not surprising that this technology is utilised in their interpretation as well. Computer Aided Diagnosis (CAD) of radiology studies has shown promise in pulmonary and breast nodule detection and in evaluating chest radiographs for abnormal asymmetry. A computer cannot replace the perception, intuition, and correlative abilities of a physician, but this technology does have the potential to further increase the diagnostic accuracy of radiograph interpretation, leading to better clinical decision-making.

Enhancing Education

Digital radiology offers several enhancements to institutions involved in education. The ability to manipulate images allows educators to highlight important findings easily; comparisons between normal and abnormal studies, and the illustration of progressive changes in pathology over time, aid in the development of diagnostic competency. Digital images can also be easily transferred into presentations for educational conferences.

The initial implementation of an extensive digital radiology system (including workstations, software, networks, and digital archives), requires financial resources and institutional commitment. The major financial benefit of digital systems is due to reduction of film costs and staff. Film costs include processing, handling, storage space, and, of course, the film itself. Information technology and digital radiology system administrators need to be hired, but overall staffing needs are reduced because of the elimination of film library functions and the increased productivity of technologists and radiologists.

Another financial justification for digital radiology has been the recovery of charges that were previously unbillable due to misplaced or lost films. Revenue that is otherwise lost from films without a final interpretation can be a significant source of reimbursement. There is also a financial benefit due to improvements in risk management and the corresponding reduction in liability costs as well as operational advantages resulting in improved productivity and reduced turnaround times, but these issues are dependent on numerous specific organisational changes.

Conclusion

Standing where we are in digital imaging, it is not hard to see that the future is digital. However, there are still unanswered challenges to its implementation, with the need to establish quality electronic viewing, reduction of errors, and protection of patient information. Multiple operational questions need to be evaluated and answered. As we embrace the filmless radiology departments, it is important to uphold evidence-based medicine and at the same time to provide a personalised medicine tailored to the history of an individual patient.

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