

DICOM: WHAT RADIOLOGISTS NEED TO KNOW?

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Introduction

In past few years, Pakistani radiologists have seen a gradual transition from non-digital imaging equipment to digital imaging equipment. This transition, beside quality improvements, has also introduced a dictionary of technical terms in radiologist's daily practice. One of those terms - 'DICOM', is the most important that radiologist would need to get an overview.

DICOM (Digital Imaging and Communications in Medicine) is a standard for transferring medical images and their related information between computers. It enables imaging devices such as CT and MRI, to digitally communicate with computer systems like PACS (Picture Archiving and Communication System) or any other imaging device. DICOM based standardization, which had only started a decade ago, has now become a built-in feature in imaging devices from all well reputed vendors.

Now based on DICOM standards, any imaging device can talk-to (communicate) any other imaging device. For example CT scan machine from vendor-A can now print images from vendor-B printer, as long as both are complying with DICOM standards. Similarly, it is now possible to electronically transfer radiological images from near location to a far location without losing diagnostic quality. DICOM standard ensures the same diagnostic image quality at both the locations. DICOM standardization has also been proven as a cost-effectiveness manner by introducing functional compatibility among different brands of imaging devices.

Beside technical advantages, DICOM has introduced many features that can increase Radiologist productivity in less time.

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Reporting Workstation

In film-less reporting environment, image viewing requires DICOM based connectivity with PACS or imaging devices like (CT and MR). DICOM ensures that recent as well as all historical images along with clinical information have been sent to reporting workstation (Fig. 1).

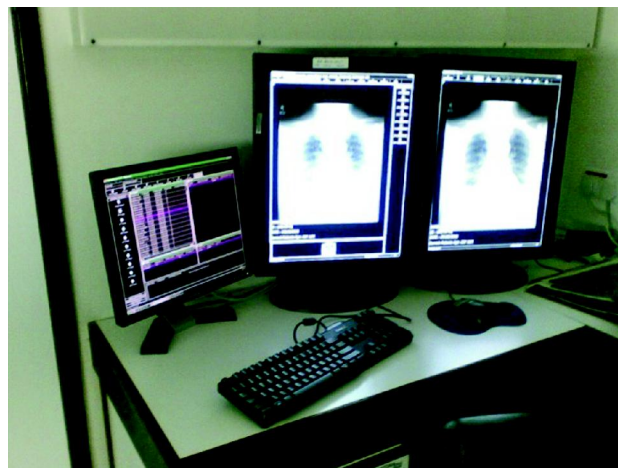


Figure 1: A typical DICOM-based diagnostic workstation for radiologist in film-less environment. A comparison examination of recent chest x-ray with historical x-ray is loaded on 2 high resolutions LCD monitors integrated with a small screen, showing DICOM based patient demographics. The examination is loaded on workstation in less than 3 seconds.

Similarly, DICOM based image viewing has many added functionalities, like dynamic image processing, window level and width, magnification and measurement options, image export for educational presentations using PowerPoint software, simultaneous image sharing in radiology department and clinics (Fig. 2).

Quality Imaging

Image viewing over computers depends on monitor's brightness and contrast. If monitor brightness is set to subnormal, same image can lead to different interpretation. To address this very important scenario, DICOM based monitor calibration can be used to make

image quality consistent on every monitor. Similarly, DICOM-based image archiving has a built-in function of lossless image archiving which further ensures clinical significance of medical images.



Figure 2: A Screenshot of a DICOM Image viewer showing various image enhancements options. (Courtesy: View Pro X , Rogan Delft Company).

Image transfer for telemedicine

In telemedicine, DICOM-based communication facilitates the transfer of images without losing clinical value; which in contrast is not possible in other methods like JPEG.

Productivity and Efficiency

In a radiology department of high patient volume, DICOM based workflows help to improve the report turn around time. Hence, increasing the productivity and efficiency by saving time wasted in films arrangements and related activities.

Educational and Research value

Beside the benefits associated with clinical services, DICOM also plays an important role in educational and research. By standard, DICOM ensures capturing of textual patient demographics as an “image meta-data”. This textual information proves very useful in speedy retrieving of teaching cases for educational and research needs. Similarly, a research applications for CADx (computer aided detection and diagnosis) heavily depends on DICOM images.

DICOM and Ethics

The easy available patient's data and its ease of transfer raise another issue of ethics which is generally less understood in our community. The retrieval of DICOM images and use in different settings such as teaching, presentations and transfer into different systems can potentially bring about unwanted spread of patient information. To ensure patient privacy, Anonymization software for DICOM images is recommended.

Discussion

All the DICOM associated benefits mentioned above requires DICOM-complaint imaging equipment. Therefore understanding DICOM-compliance becomes very important, particularly at the time procurement of imaging equipment. In developing countries like Pakistan, DICOM understanding is improving but not still up to satisfactory level and same is the case with availability of full DICOM-complaint equipment. Due to lower awareness, sometime buyers do not consider it important. To help customer understand that whether the equipment is DICOM-complaint, all major imaging vendors certify their product by releasing ‘DICOM compliance statements’ of individual models. The DICOM statement clearly identifies the available DICOM features in equipment. To further facilitate buyers to understand DICOM compliance statement, IHE (Integrating the healthcare enterprise) also releases

help documents. Having the ability to store and transfer images without decreasing the quality of images is a major advantage of this system. With increasing competition between vendors and faster systems the usability and tools are being update and improved continuously.

In coming years, no doubt the era of film-less imaging will increase and the need to incorporate DICOM lifestyle into our workspace will become an important aspect of a Radiologists' life in Pakistan.

What Compromises do I make without DICOM compliance?
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| <ul style="list-style-type: none">- Integration issues with Radiology information system (RIS)- Integration issues with PACS- Quality issues in film-less environment- Inter-connectivity issue between digital imaging machines- No standardized CD/DVD options- Vendor dependency for future expansions |
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Table1: Compromises that are mostly related to film-less imaging environment