



Medical Imaging: Enhancing Quality Through Access

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As a result of rapid advances in imaging modalities, including ultrasound, computer tomography (CT), magnetic resonance imaging (MRI), nuclear medicine and plain radiographs, clinicians receive an ever-increasing amount of information about patients during both the diagnostic and treatment phases of patient care. Like all aspects of medicine, this increasing volume of patient information puts great strains upon physicians as they try to access and adequately apply such data. Recent advances in information technology now offer attending physicians and radiologists tools to efficiently store, access and transfer these valuable sources of patient information to all members of the care team.

Images as Film

Historically, all images were captured by a scanning device called a modality (e.g., CT, MRI, X-ray machine), with the image recorded on film. These films were then stored in coded patient folders and placed in a film repository where they were kept as part of a patient's medical record for several years. The recent deployment of increasingly sophisticated imaging modalities has greatly increased the number of images associated with each completed study. For example, CT images regularly generate 500 to 1,000 images per case compared with 50 to 100 images just a few years ago. This greater number of images presents severe logistical problems for hospitals, often limiting the size of imaging studies. Often the cost of film production and the capacity to view such large sets of film-based images is not practical.

Not only do hospitals require physical space to store these images, the demand by increasing numbers of clinicians to rapidly access these images, sometimes at the same time, makes satisfactory management of the images impossible. It has become too difficult and expensive to store, transport and monitor the location of each image. As the process of accessing images breaks down, questions of quality of care begin to emerge. Both clinicians and administrators are concerned that patient care may suffer if access to images

degrades because of the increasing number and demand for images. In addition, hospital chief financial officers fear the increasing costs of image storage and retrieval.

Digital Images

For more than a decade, modality equipment manufacturers offered picture archiving and communication systems (PACS) to assist radiology departments in the management of images within those departments. PACS eliminate the need for film images by storing the image in a digital form that can be saved to electronic media such as CD-ROMs or other types of archives. The electronic images are then transmitted via local area networks or encrypted over the Internet to be displayed upon viewing workstations. Access to images is available instantly across an enterprise and from remote locations.

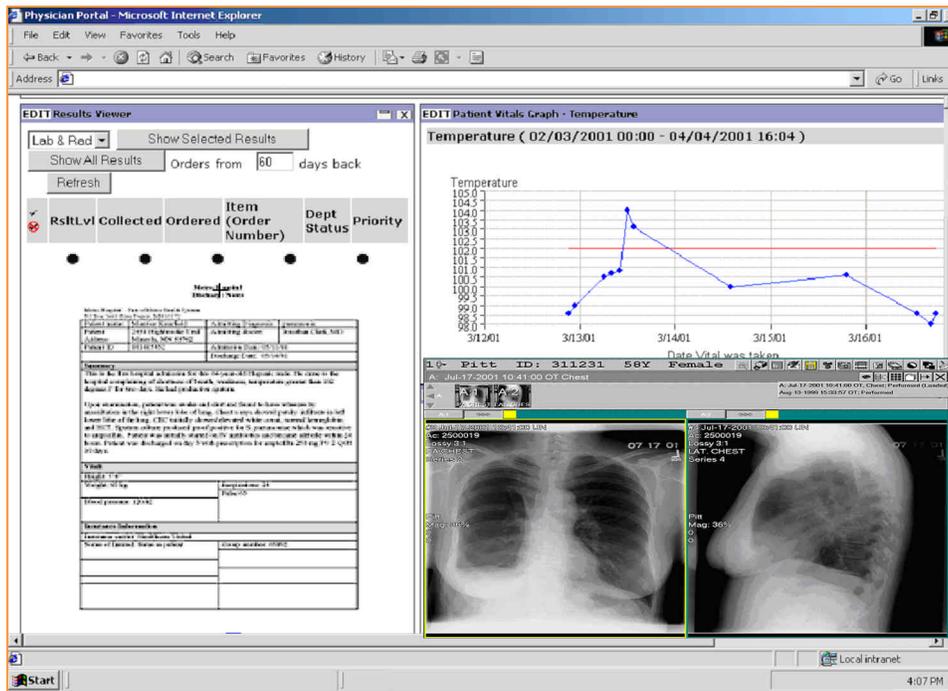


Figure 1. Web technology-based physician portal with multiple source clinical information

As the variety and value of the modalities have increased, an increasing number of clinicians - in addition to radiologists themselves - have demanded access to these systems. Once considered to be systems serving the imaging needs of radiologists, PACS now must serve a wide variety of information-hungry physicians. As a result, chief information officers and vendors now view PACS as one more essential module within their clinical information technology applications.

Quality Benefits of PACS

Clinical benefits of PACS turn upon how they greatly improve the availability of the clinical image. With PACS, images lose the limitations imposed on them by their existence as a physical object (e.g., the film image) and are transformed into a much more efficient and easily transferred digital form represented by electrons. (This shift from moving atoms to moving electrons [PAC digital images] is wonderfully described in Nicholas Negroponte's book *Being Digital*. Currently chairman of the Massachusetts Institute of Technology's Media Lab, Dr. Negroponte also sees the digital age as not only the more efficient movement of information, but also "information about that information.")

In medicine, what is most important is rapid access to information and the information about that information. PACS offer simultaneous, easy access to images at multiple locations. Unlimited numbers of perfect copies of images are available to multiple physicians. This easy availability of clinical information offers physicians more data that they can use to make decisions about their patients. They no longer need to delay treatment waiting for a chart to be found, or rely upon their memory of an image before starting or altering treatments. In addition, easy access to historical images offers comparative information. This much faster, increased access to images can only improve quality of care while enhancing its efficiency.

For radiologists, information about the information includes clinical findings that the attending physician provides and that the radiologist can then use while reading images. This enhances the ability of the radiologist to focus on areas of concern and diagnoses that fit with the clinical condition of the patient. This more informed approach to interpreting images improves quality and enhances the communication among physicians of varying disciplines. It truly facilitates the team approach to care.

Lastly, the ability to easily manage digital images makes it practical for a radiologist to review many more images than could be reviewed on film. The sheer volume of the film and the cost of producing film images essentially ensures that fewer images, and therefore less clinical detail, is generated in film environments compared with digital PACS environments. Also, digital images can be manipulated to construct three-dimensional representations, something that is impossible with film. Enhanced clinical detail provides the physician with more information to both diagnose and treat patients, leading to better decision-making and improved quality of care.

Portal Access Offers Expanded Clinical Information

PACS use becomes even more valuable as hospitals increasingly deploy physician portals, which are single sources of clinical information that utilize Web technology (Figure 1.). Portals are now able to provide physicians with census, laboratory results, consultant reports, medication lists and other data points that come from disparate systems. The integration of PACS into such portals offers single-source access to the entire clinical record of a patient.

This visual integration of clinical data allows physicians to make patient care decisions with faster access as well as more current and accurate clinical information than ever before. In addition, these portals expand the value of PACS

outside the radiology suite by providing reference images that attending physicians can regularly use to monitor their patients.

Summary

PACS offer digital clinical images to both radiologists and other physicians so that they can take advantage of the latest clinical information to care for their patients. By providing more clinical information and making that information faster and easier to access, physicians have better information sources to make proper care decisions. Beyond the financial benefits associated with the implementation of PACS, it will be curious to look for subtle changes in treatment patterns and clinical workflow as these systems expand within the hospital marketplace.

BIOGRAPHICAL SKETCH

Barry P. Chaiken, MD, MPH, Vice President of Medical Affairs, McKesson Information Solutions, has more than 16 years of experience in medical research, epidemiology, continuous quality improvement, utilization management, risk management, healthcare consulting and public health. Dr. Chaiken is currently on the Board of Directors of ABQAURP.

REFERENCES

Negroponte N., Being Digital. © 1995, Alfred A. Knopf, New York.

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