



Integrated

Radiology/Pathology Service for Breast Cancer

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Multidisciplinary Web Conferencing Pilot Project Offers Insight on Current Testing Protocols

Recently the Institute of Medicine (IOM) issued a mandate that the quality of patient care and safety must be improved. The IOM set a five-year time limit and challenged the medical community to evidence improvement. Without improvement, government intervention to address this issue would be implemented at both the state and federal levels. While faced with that ultimatum on one hand, the medical community is confronted with major challenges on the other.

The practice of medicine is changing; it is moving away from the major medical centers into community, small-practice settings. In fact, medical centers are redesigning themselves into clinics, surgi-centers, nursing homes, and physicians' practices. It is expected that within a few years, up to 70% of pathologists' practices will be outpatient, located outside the main campus.

The physical aspect of the practice of medicine has affected and compounded these

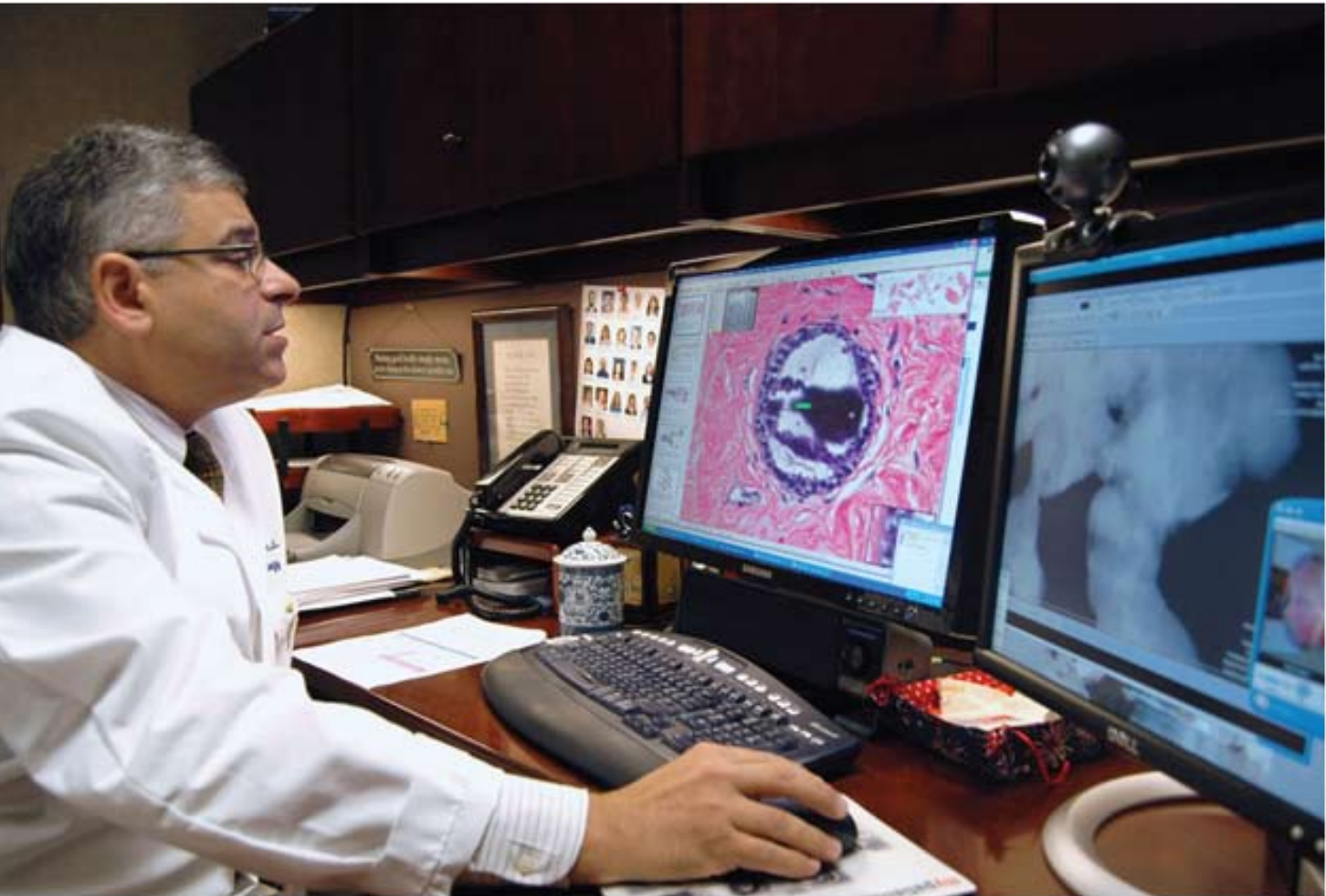
obstacles. The advent of localized medicine separates the entire patient "team," including referring physicians, diagnosticians, and surgeons. Effective face-to-face communication is sacrificed in an effort to meet increasing patient demand for neighborhood facilities, and printed reports circumvent valuable input from the diagnostic team. The end result is a potential breakdown in communication that could affect treatment options and patient outcomes. The traditional use of written pathology and radiology reports will be limited in this new setting.

Pathologists and radiologists must find new ways of communicating for clinical work, research, and education. We have to rethink the way we report our results. How are we going to communicate with our colleagues when they are across town, across the state, or even across the world?

Why Do Radiologists and Pathologists Need to Communicate More Effectively?

During the past three decades the introduction of a variety of breast imaging techniques has brought about a new era of breast cancer diagnosis with greater knowledge and awareness of the characteristics of breast cancer. Numerous studies have documented the benefits of screening mammography. Improvements in breast cancer screening have led to decreased

core specimens range from 2.0 to 3.0 mm in diameter and from 10 to 20 mm in length. Many of the targeted lesions identified on breast imaging studies measure <10 mm. The reduction in detected lesion size is best exemplified by the detection of small clusters of calcifications suspicious for ductal carcinoma in situ. Core biopsy of these small breast lesions results in portions of the lesions being contained in the tissue cores surrounded by tissue that does not represent the targeted lesion. Tissue surrounding the target lesion may be normal or may contain any of the myriad of benign pathologies that often coexist. For



mortality, a significant decrease in the size of suspicious lesions detected on imaging studies, a shift from open surgical to percutaneous image guided biopsy, and a decrease in biopsy specimen size.

Image-guided percutaneous biopsy has resulted in improvement in care of breast cancer patients. It offers patients with definitive malignant diagnoses better subsequent care. It creates opportunities, such as the avoidance of multiple surgical procedures with more accurate excision volumes using bracketed-wire localized excision, and the possibility of performing sentinel node biopsies in the same setting.

In the meantime, image-guided percutaneous biopsies have created challenges in diagnosis. Currently, the majority of

this reason exhaustive evaluation of tissue specimens combined with careful correlation to the imaging studies that prompted biopsy is essential.

The Need for Integrating Radiology and Pathology and Reasons for Collaboration

Radiologists and pathologists have unique training, yet both are dedicated to the detection, diagnosis, and staging of disease. Pathologists are not trained in imaging and cannot independently evaluate mammographic, sonographic, and MRI features of benign and malignant lesions or interpret the various

types of calcifications and their implications. Alternatively, radiologists are not trained to independently recognize histopathologic features of breast disease or to determine when additional pathology studies are indicated.

Collaboration improves patient care by ensuring a more reliable diagnosis and providing for a more thorough consideration of the cases of patients with a high-risk lesion or a malignant diagnosis. By participating in an interdisciplinary conference, each specialty has the opportunity to educate the other, thereby improving the overall skills of the group.

To effectively use core biopsy techniques in diagnosing, staging, and treating breast cancer, radiologists, pathologists, surgeons, and oncologists must interact closely to achieve these common goals. An integrated approach on the part of radiologists and pathologists is required. Failure to follow this integrated multidisciplinary approach to breast biopsy specimen review can lead to a *misdiagnosis*.

Ideally, the pathologist should review the pertinent preoperative imaging and specimen radiographs to correlate the morphology of the radiographic target with the histology. Equally important, the radiologist should review the tissue slides to ensure that the targeted lesion has been properly recognized and diagnosed. Regrettably, it is common practice to rely on a written description of the targeted lesion provided by either the pathologist or the radiologist.

Establishing correlation between the histologic diagnosis and the imaging findings that led to the decision to biopsy is *essential*. Failure to perform proper correlation can result in failure to recognize that the lesion was inadequately sampled, a false negative that delayed diagnosis of malignancy, and/or failure to recognize nonmalignant high-risk lesions, which may prompt additional testing, repeat biopsy, surgical excision, or more aggressive clinical surveillance.

What Needs Fixing?

Currently, the radiologist usually performs the biopsy of suspicious breast lesions. The specimen is sent to the pathology laboratory, where the pathologist reviews written radiology reports and processed tissue specimens. Then the pathologist generates his or her diagnosis in a written report that goes to the radiologist, who determines the results to be concordant or discordant with imaging findings. The radiologist then recommends appropriate management based on histologic diagnosis and concordance.

What is missing in this critical scenario are communication, correlation, and consensus of concordance of the findings. Unfortunately, physical separation, geographic constraints, time, resources, and labor are well-known hurdles to such collaboration. For example, the University of Kansas Hospital, where

the pathologists are located, is 1.5 miles from the Richard and Annette Block Cancer Center, where the breast radiologists are located.

In addition, to ensure success of this collaboration, a team approach must be established by gaining buy-in from other pathologists and radiologists. Clear expectations for patients, referring physicians, and surgeons are also important. Institutional support is key in providing technical, clerical, and nursing support as well as in creating time for conference without affecting productivity and revenue.



Why Is Going Digital Valuable? Can We Do Better? And Why Do We Have To?

At the University of Kansas Medical Center (KUMC), we took the IOM's mandate into consideration, delineating what is considered to be the two most significant obstacles in the medical workplace: First, medicine's physical practice is changing, and second, traditional communication modalities no longer adequately service these changes.

Keeping all these issues in mind, we realized that the ideal solution was to leverage technology to overcome geographic constraints while simultaneously providing radiology and pathology images in a full-fidelity/high-resolution digital format, in the format of weekly audio and video conferencing. The goals were (1) to employ a real-time multidisciplinary approach, (2) to ensure adequate sampling, (3) to reduce errors by confirming concordant diagnoses, and (4) to determine appropriate treatment plans.

We developed a pilot research project in collaboration with the Aperio Corporation and KUMC Telemedicine to bridge the communications gap in the current system. The study was performed to validate image and slide quality by using digital teleconferencing and to confirm service and efficiency. Several variables were evaluated, including concordance between glass and digital diagnoses, image quality, comfort level, and ease

in using digital slides. The study also looked into pathologist–radiologist satisfaction with the digital conferencing and compared actions taken based on digital consultations versus historical follow-up for the same type of discrepancy.

The conference protocol works as follows. The radiologist informs the pathologist of the cases that need to be discussed in the conference via an e-mail message. The pathologist selects representative slides for scanning by the Aperio ScanScope XT, a digital pathology system that can capture images of entire slides with excellent resolution equal to that of a microscope. During the conference, digital microscopic images are accessed remotely and simultaneously onto the desktops of as many individuals as needed via the Spectrum Plus™ digital pathology information management software.

Corresponding radiology imaging studies are uploaded to the radiologist's desktop via the radiology picture-archiving communications system (PACS). The entire diagnostic team including radiologists, pathologists, surgeons, as well as nurses, residents, and students communicate with each other via the Polycom PVX™ video conferencing system, which, in combination with a Web camera and linked computers, allows video conference sharing of desktop items (*see photos*), including radiological images, while maintaining an opportunity to communicate with and see each other electronically.

The pilot project included the analysis of 122 breast core biopsies with a benign diagnosis from 106 patients. The study focused on patients with benign diagnoses to evaluate whether Web conferencing affected decision-making for treatment plans for those patients, because in most cases it is uncommon for these patients to be critically evaluated by a team of physicians. There were no attempts to discuss cases with a malignant diagnosis because those patients are routinely critically evaluated in a team format by surgeons, oncologists, pathologists, radiologists, and radiation oncologists for further individual treatment decisions.

The primary radiologic diagnoses included abnormal mammograms with and without calcifications (73 cases), mass lesions (24 cases), abnormal sonograms (14 cases), abnormal ultrasounds (10 cases), and 1 normal finding. Primary pathologic diagnoses for these cases included proliferative (24 cases) and non-proliferative fibrocystic changes (65 cases), fibroadenomas (19), intraductal papillomas (7), fat necrosis (4 cases), normal breast (2 cases), and pseudoangiomatous hyperplasia (1 case).

Did Conferencing Affect Results?

Results presented at the Pathology Visions Conference (October 2008) and at the Molecular Summit 2009 (February 2009) are telling. Web conferencing affected decision-making in 42 of the 122 cases (34.4%). Out of these 42 discordant cases, 28 were with a minor impact and 16 were with a major impact on the clinical decision follow-up with these patients. The majority of the minor impact cases (23/28) included further evaluation of tissue blocks by pathologists and radiologists to evaluate microcalcifications. Additional minor differences included mislabeling of samples (2 cases) and misdiagnosis of a microscopic papilloma, benign cyst, and diabetic changes (1 case each). Discordant cases with a major impact included re-excision of the lesion (4 cases), re-biopsy (3 cases), and additional radiologic follow-up (9 cases).

The highest degree of discordance was noted with microcalcifications. Currently, there is no standardized protocol for evaluating microcalcifications. This is in part due to the lack of a clear understanding of either the radiologic or the histologic description of calcification, causing a significant inter- and intra-observer variability in reporting such findings. Many pathologists consider the presence of microcalcifications of any size and anywhere on the slide as sufficient evidence of the positive correlation between mammography and histology. Very few studies have attempted to address the issue of mammographic-histologic correlation of microcalcifications in core needle biopsies of the breast. Correlating mammographic and histologic findings of microcalcifications by Web conferencing resolved almost all cases except one in which no calcification was identified in the blocks even following block X-ray.

Other examples of discordant cases included the diagnosis of atypical ductal hyperplasia associated with microcalcifications in one case and atypical ductal hyperplasia and adenosis in another. Following Web conferencing, it was decided to re-biopsy the patients because radiologists expressed their concern about the nature of both lesions. Follow-up findings included the presence of a ductal carcinoma in situ comedo type in the first patient and an invasive well-differentiated ductal carcinoma in the other.

Conclusions

These findings indicate the need for expanding the current patient care protocol and provide a means of meeting the IOM mandate. Changes already implemented at KUMC include the institution of a weekly Pathology/Radiology Breast Conference that re-addresses cases, a time and cost-effective measure that further enhances patient care.

These projects are considered visionary for the future of patient care. The utilization of modern technology is anticipated to bridge the communication gap in the diagnosis of disease, complement day-to-day office activities, and ultimately provide a permanent, inexpensive digital chart file.

Web conferencing can be a cost-effective solution because it negates the need for an on-site pathologist and radiologist to staff biopsy cases. It provides remote viewing and conferencing of live pathology and radiology images. The combined audio-video conferencing adds the critically relevant personal impact on exchanging ideas and the decision-making processes, without the need to leave the office or make phone calls. Current plans include the expansion of video conferencing via e-learning ventures to universities overseas for education, research, and clinical consultations. Our long-term vision includes establishing a Telepathology Consulting Service through the Kansas Telemedicine Network.

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