Telepathology: revolution or evolution?

By Doug Giszczynski

Many view telepathology as one of the next revolutionary steps in diagnostics workflow, and believe that eventually and inevitably, telepathology will do the same for diagnostics as teleradiology (which electronically transmits radiographic patient images and consultative text from one location to another) did for radiology.

While few doubt that telepathology is desirable, many wonder if the technology has advanced far enough for mainstream use. The ultimate goal of both telepathology and teleradiology is improved workflow to facilitate rapid diagnosis and treatment of a greater number of patients. While the principle philosophy is the same, we can compare the two to find key differences.

**Specimen types and imaging needs**
Higher variability of specimen types and imaging requirements for pathology diagnostics can stress imaging systems designed for standardization under defined conditions of color generation (stain type) and specimen preparation (thickness variation). Radiology diagnostic capabilities, however, are discreet and very well defined. A select group of tissue types are imaged and diagnosed with a standard set of imaging tools (x-rays and film). Skilled technicians can adjust the instruments until the desired image is obtained.

Pathology diagnosis encompasses a wide variety of diseases and disease states from all types of specimens, including tissue, fluids, and cells. By necessity, pathology diagnostics is an iterative process that often requires additional sections, slides, and staining techniques to be performed after review of an initial set of H&E (hematoxylin and eosin) slides. In practice, multiple staining techniques are usually required for suspected disease states such as breast cancer.

**Slide digitizers solve some but not all problems**
Slide digitizers operate under a limited number of defined programs, and the opportunities to improve image capture are limited. There are no commercially available slide-digitization systems that can scan slides as quickly as they are produced in high-volume histology labs.

Current communication networks often struggle with the digital-image file sizes. Radiology diagnosis, by contrast, is usually performed on a relatively small set of black and white images. So, digitizing results in comparatively small data sets that are easier to manage over a LAN network or Internet connections.

Pathologists routinely review a series of color slides with amazing rapidity and accuracy. To achieve this, they must have a lower magnification scanning view, high magnification for regions of interest, and the ability to focus through thicker or unevenly sectioned specimens to find the clues lying beneath the slides’ surface.

To achieve similar capability, slide-digitizers would have to make multiple scans of the same slide and use sophisticated algorithms to render composite images that must be compressed for transmission and would still likely contain terabytes of information. Typical computers and networks would struggle mightily to manage this much data.

**Integration and financial considerations**
Currently, a variety of information systems are employed by U.S. medical facilities. Teleradiology systems often integrate well with existing lab information systems (LIS) facilitating convenient data communication, storage, case tracking, and procedure billing. Most slide digitizers are not yet integrated to LIS and do not provide such benefits. The biggest problem so far is that the digitization is an additional workflow step in the laboratory that does not replace the need for any of the current steps. We still need stained slides; we need to store them after diagnosis. Transportation of slides by courier is relatively inexpensive.

For financial viability, medical-testing costs need to be reimbursted. Any changes in workflow that require additional costs must be offset by billing or efficiency improvements — or both. This is well documented for teleradiology and is clearly the goal for telepathology, but return-on-investment, or ROI, studies with convincing arguments are still lacking.

Slide digitizers cannot process all stained-specimen imaging requirements, so the pathologist’s microscope is still required. Slide digitizers ranging in cost from ~$35,000 to over $100,000, the purchaser must be sure that the system will meet expectations.

**Another solution**
Since most slide digitizers are used for reporting, archival, and education purposes, what healthcare professionals, in speaking about telepathology, describe is an intermediate step between a traditional microscope and the slide digitizer — more of an evolutionary than a revolutionary step. What is really required by these lab personnel is an easy means to consult with colleagues, document results, and communicate diagnosis to others.

They need a network imaging solution, which incorporates microscope, camera, and PC in one compact system to generate high-resolution digital images on an LCD monitor. Used with an integrated Linux-based computer, such a system can facilitate easy, rapid acquisition of digital images that can then be e-mailed to colleagues, stored to a network drive, annotated, and incorporated into a report or presentation.

A device that provides the advantages of a digital format with the flexibility of a traditional microscope could be their alternative to slide digitizing. As the discussion of telepathology continues, so will the search for additional solutions in what will likely develop as a true evolutionary chain of unique and more user-friendly systems.  

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