

Whole slide imaging: it's time to take another look

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In recent years, digital pathology (DP) has changed; static snapshots on camera-equipped microscopes have given way to whole slide (digital) images (WSI). WSI allows histologic evaluation of pathology cases on a computer screen along with management of the accompanying case information.

Although widely accepted in education and research, DP's application in diagnostic surgical pathology practice has been slower. It poses challenges in terms of workflow integration, technological infrastructure, pathologist use, clinical practice standards, and cost.

DP in today's environment

The changing healthcare market has created a number of challenges for modern pathology practices, such as limited capacity for slide storage, reduced access to specialist expertise, increased workload, and budget constraints. In order for healthcare providers to successfully address these issues, workflow efficiency and labor distribution must be improved across the industry. DP is a powerful tool that helps achieve these objectives by offering significant cost savings and improved quality of care.

Anatomic pathology (AP) is undergoing a series of rapid and dramatic changes. As new technologies and capabilities come to market, pathologists are provided opportunities for upgrade comparable to those that their colleagues in radiology and cardiology have experienced in the last decade. Advances in image processing, internet bandwidth capacity, and the declining cost of processing power (as predicted by Moore's law) have all coalesced to make DP a reality for everyday use in the pathology lab.

A DP system can be expected to improve a lab's capacity in some or all of the following areas: remote diagnosis and consultation, quality control and quality assurance, quantified image analysis to assist diagnosis, enhanced reporting capability, adherence to emerging guidelines, archiving and rapid

retrieval of images, research and publications, teaching, and operational cost savings.

Practical considerations

The three major components of a “digital pathology system” include WSI scanning hardware, viewing and image management software, and connectivity to host/remote sites for image viewing.

The WSI hardware, also known as the slide scanner, is required to create a high-quality image that replicates what a pathologist may see through the light microscope. Pathologists are dependent on the quality of the image to make an accurate diagnosis, and it is the single most important factor to ensure an accurate and consistent AP diagnosis.

The DP system and its software must be easy to use. The pathologist and technical staff will spend hours daily within the software environment screening slide images, choosing relevant fields of view, annotating relevant structures to support the diagnosis, and then storing those images away for future reference. The software environment must be flexible enough to facilitate moving among different scanning platforms. It must also be able to communicate with the laboratory or hospital electronic medical record system (LIS/EMR), as well as outside parties such as the oncologist or a consulting pathologist.

The pathologist and lab staff should also engage their LIS team to evaluate the graphic user interface (GUI) for its ease of use and ability to replicate the workflow that the lab staff follows daily in evaluating slides and signing out cases.

Image management is the backbone of any DP software platform because AP is driven by images. An effective system must be comprehensive in its ability to handle a wide range of image types and robust enough to allow the pathologist to move rapidly and reliably from one image type to another. It must also enable the pathologist to retrieve or assemble images from other sources to illustrate the patient report and to support the diagnosis. Images must be archived for the pathologist until they are no longer needed routinely and then can be stored in a less expensive format as necessary.

A practical DP system must be able to sort, store, and retrieve images from any location quickly, accurately, and along multiple parameters. It should provide a comprehensive approach to image

annotation storage and retrieval of specific fields of view, as well as the entire WSI. Retrieval must be easy and reliable despite the fact that the images can often be substantial in size and tagged with metadata or annotation.

Finally, ease of system implementation should be considered. If a system is functional but takes a considerable amount of time to set up, train on, and validate, then it is counterproductive and runs the risk of being sidelined. Ideally, a system should be able to be deployed efficiently with minimal need for optimization. It should also be intuitive in operation so that training is straightforward and brief. In addition, the manufacturer should have the ability to support integration with LIS/EMR systems.

Beyond slide management

A well-designed image management system will go beyond the direct application for slide management and will reap other benefits such as applications for user groups like histotechnologists, lab managers, and pathologists (both external and internal). It can potentially generate billing information and allow case scheduling or the setting of personal reports on a user-by-user basis.

Interested stakeholders within the laboratory and its organization want to see the benefits from a DP solution begin to flow as soon as possible. Ideally, the decision-making process needs to include the obvious consideration of software and hardware utility, as well as the often overlooked, but critical, integration services capability.

It should be noted, however, that relying solely on the proprietary software accompanying a whole slide scanner at purchase prevents users from realizing the full benefits of a DP solution. To harness the full power of whole slide imaging equipment, labs augment the scanner software with a comprehensive software platform—one that interfaces with every make and model of scanner and LIS, and provides the workflows and functions inherent in a pathology practice.

This software suite, in fact, is the catalyst that will transform a whole slide scanner from a novelty into a powerful everyday workhorse—standardizing a lab's workflow for critical functions including quality assurance, tumor board presentations, and consults, as it optimizes both intra- and inter-laboratory collaboration. Through deployment of a comprehensive platform, supporting all image

formats and providing standardized workflows for these critical functions, most labs will quickly see a return on their investment of resources and time required for implementation.

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