

Going fully digital: utopia or reality?

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Digital pathology in the last decade has largely centered around whole slide imaging (WSI). Since virtual microscopy was first introduced around 20 years ago ¹, the field of digital pathology has rapidly evolved as this technology advanced (e.g. faster scan times, z-stacking), novel applications emerged (e.g. teleconsultation, image analysis), users slowly began to adopt these tools, clinical guidelines were accordingly developed (e.g. CAP recommendations for WSI validation) ², and regulatory approval for primary diagnostic use was obtained ³. Leveraging technology to better understand disease is not new to the practice of pathology. Even centuries ago Virchow markedly advanced our field when he enthusiastically used a microscope to study histopathology.

Pathology has benefited from digital imaging technology for many years. This includes clinical practice, education and research uses. Digital data is easier to integrate, retrieve, share, and analyze.

Moreover, it is often easier and cheaper to move an image around than it is to move a patient or a pathologist. Today, the practice of telepathology allows pathology laboratories to easily share cases with experts around the world. Successful telepathology use cases include remote interpretation of frozen sections, telecytology for rapid on-site evaluation, and teleconsultation for second opinions of challenging cases ⁴. Ample peer reviewed articles have demonstrated equivalent diagnostic accuracy between virtual slides and glass slides. Although specific areas (e.g. dysplastic tissue diagnosed as benign or reactive) have been shown to be problematic on whole slide imaging in a minority (4%) of cases ⁵, the vast majority of published data indicate that using WSI for primary diagnosis is no longer inferior to the light microscope ^{6,7}.

Investing in WSI has also been shown to enhance efficiency (e.g. easy and timely retrieval of archival slides, balance workloads) and improve certain aspects of quality care (e.g. multidisciplinary tumor board presentations). Furthermore, digitizing slides can support subspecialization and centralization of services. Perhaps the most exciting emerging opportunity of digital pathology is the potential for pathologists to employ next genera-

tion tools, such as image analysis ⁸. Computer aided diagnosis (CAD) has been one of the major reasons justifying the transformation to digital pathology. For certain high level tasks such as prognostication, deep learning tools may be more accurate than pathologists.

Digital pathology is clearly disruptive technology that is helping to bring the practice of pathology into the modern era. However, despite the aforementioned benefits, the reality today is that most pathologists still practice pathology using a conventional light microscope in a way that was performed more than a century ago. Most pathology practices in fact do not have a WSI system. It is predicted that to date approximately 5,000 WSI scanners have been sold around the world. The majority of these acquisitions have been for research or educational use, including users such as pharma and veterinary practices. The authors of this editorial have both visited pathology departments where an underutilized WSI scanner is unfortunately stowed away in a corner of a room gathering dust.

We recently reported the experience of the Cannizzaro Hospital in Catania, Italy, after going fully digital for formalin fixed paraffin embedded histological tissues ⁸. Successfully transitioning to a digital “Catania workflow” was principally based on a laboratory information system (LIS)-centric approach to workflow. This implementation also created an opportunity to standardize workflow processes in the pathology lab including the adoption of a 2D barcode tracking system. For the first year a hybrid workflow was maintained in which glass slides were provided along with digital slides that allowed pathologists to gradually become more confident and overcome their learning curve with WSI. After validating the WSI according to the CAP guidelines ², we decided to abandon glass slides and to move to only digital. This allowed the lab to immediately benefit from all of the advantages of digitization including a reduction in workload related to no longer delivering glass slides and immediate sharing of eSlides with a web-based tool integrated within the LIS (<https://cannizzaro.telepathox.com>). In Catania, the pathology lab was able to achieve what was previously only imagined ⁹.

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If Cannizaro hospital was able to switch to a fully digital operation, what is holding other laboratories back? The slow uptake of WSI for clinical use can be attributed to several barriers that remain to be addressed. These obstacles include a credible business use case that justifies the expense of purchasing and maintaining a digital pathology platform, achieving a “fully digital” workflow that is suitable to practicing pathologists, lack of interoperability with the laboratory information system, as well as limited standardization and vendor-neutral tools. WSI also does not replace glass slides: digital slides currently only duplicate them. Finally, another major barrier to widespread adoption is the pathologist’s mindset. Some pathologists are just technophobic, others are skeptics who feel that WSI is not yet mature enough or easy enough to use routinely to replace the microscope, or perhaps they are concerned that digital pathology may ultimately replace them.

Nevertheless, this is an exciting time to be in pathology. Digital pathology is a game changer on the verge of becoming a new standard of care. It will help elevate us from the basement of many hospitals and solidify our connection with the rest of healthcare that has already undergone their digital transformation journey. We should accordingly embrace this technology, instead of resisting it. We invite you to be part of the digital revolution instead of just watching from the sidelines. Digital pathology is vital for the future of your profession.

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