Construction of a Virtual Microscope that can Accurately Assess Diagnoses Rendered Over the Web

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Background: A Virtual Microscope was designed to serve as an interactive microscope emulator that presents, via the Internet, a complete digitized pathology tissue section. It mimics the use of a microscope in both the stepwise increase in magnification and in lateral motion in the X and Y Cartesian directions. This permits a pathologist to navigate to any area on a slide, at any magnification, similar to a conventional microscope.

Objective: The aim of this study was to construct a Virtual Microscope and assess the accuracy of diagnoses rendered over the Web.

Methods: 10 hemotoxalin & eosin stained glass slides comprised of cases from the general surgical pathology section of the University of Massachusetts Medical Center were randomly selected and digitized. They were then presented to 5 pathologists at various levels of training over the Internet. Participants were asked to examine each slide online and provide a diagnostic classification, comments, and confidence level using online feedback forms.

Results: The overall concordance rate with the standard diagnosis was 44/50 (88%). This includes participants who submitted the standard diagnosis as part of a differential diagnosis. All participants were able to correctly diagnose the major pathologic process (i.e. benign vs. malignant) for each virtual slide 50/50 (100%). Factors which negatively influenced confidence were cited a total of 52 times. Poor image quality was cited in 20 out of 50 cases (40%), patient history was cited as necessary in 5 of 50 cases (10%), insufficient tissue was cited in 5 of 50 cases (10%), insufficient magnification was cited in 10 of 50 cases (20%), and more workup (i.e. immunohistochemical) was cited as necessary in 12 of 50 cases (24%).

Image quality, image magnification, and a participant’s level of confidence in a specific diagnosis are not correlated with diagnostic accuracy. Level of training was associated with perceived negative factors regarding the virtual slide format, but was not associated with diagnostic accuracy.

Conclusion: Results from this study indicate that Virtual Microscopy can be used to make a correct diagnosis. Drawbacks include the need for high speed Internet connectivity and the availability of only one focal plane. However virtual microscopy may be considered a useful tool in medical school education, distance learning, and remote diagnosis.