Original Article

Interactive case vignettes utilizing simulated pathologist-clinician encounters with whole slide imaging and video tutorials of whole slide scans improves student understanding of disease processes

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Abstract

**Background:** One of the drawbacks of studying pathology in the second year of medical school in a classroom setting is the relatively limited exposure to patient encounters/clinical rotations, making it difficult to understand and fully appreciate the significance of the course material, specifically the molecular and tissue aspects of disease. In this study, we determined if case vignettes incorporating pathologist-clinician encounters with whole slide imaging (WSI) and narrated/annotated videos of whole slide (WS) scans in addition to clinical data improved student understanding of pathologic disease processes. **Materials and Methods:** Case vignettes were created for several genitourinary diseases that utilized clinical data including narratives of pathologist-clinician encounters, WSI, and annotated video tutorials of WS scans (designed to simulate “double-heading”). The students were encouraged to view the virtual slide first, with the video tutorials being provided to offer additional assistance. The case vignettes were created to be interactive with a detailed explanation of each correct and incorrect question choice. The cases were made available to all second year medical students via a website and could be viewed only after completing a 10 question pre-test. A post-test could be completed after viewing all cases followed by a brief satisfaction survey. **Results:** Ninety-six students completed the pre-test with an average score of 7.7/10. Fifty-seven students completed the post-test with an average score of 9.4/10. Thirty-six students completed the satisfaction survey. 94% agreed or strongly agreed that this was a useful exercise and 91% felt that it helped them better understand the topics. **Conclusion:** The development of interactive case vignettes incorporating simulated pathologist-clinician encounters with WSI and video tutorials of WS scans helps to improve student enthusiasm to learn and grasp pathologic aspects of disease processes that lead to clinical therapeutic decision making.

**Key words:** Education, whole slide imaging, medical student

INTRODUCTION

Histopathology has traditionally been a foundation of the basic science education for first and second year medical students. Medical education is continually evolving and with the current emphasis on clinically-integrated curricula has come a reduction in the time allotted for histology. The average teaching time devoted...
to histology by American Allopathic and Osteopathic medical schools has dropped from 134 hours in 1967 to 81 hours in 2001.\[^{1,2}\] Most medical students will not go on to become Pathologists, however, an understanding of disease pathology is still necessary in the practice of clinical medicine. A recent survey of practicing non-Pathologists found that 88% felt that histopathology was an important component of the medical curriculum with 66% reporting using their knowledge of histopathology in their clinical practice on a weekly or daily basis.\[^{3}\] One of the drawbacks of studying pathology in the second year of medical school in a classroom setting is the relatively limited exposure to patient encounters/clinical rotations since many 1\(^{st}\) and 2\(^{nd}\) year curricula include a longitudinal clinical experience/rotation making it difficult to understand and fully realize the significance of the course material, specifically the molecular and tissue aspects of disease. In this study, we determined if case vignettes incorporating real/simulated pathologist-clinician encounters with whole slide (WS) imaging and narrated videos of whole slide scans in addition to clinical data improved student understanding of pathologic disease processes.

Technology in the form of virtual microscopy (VM) has allowed many medical schools to eliminate the traditional microscope and glass-slide with 44% of medical schools recently polled indicating the use of virtual microscopy in 2009, which is increased from 14% in 2002.\[^{4}\] VM is also being used in the teaching of pathology residents.\[^{5-7}\] VM utilizes specialized equipment to scan, digitize, and electronically store copies of glass-slides. Software allows for viewing these virtual slides much like a glass-slide, but with a computer instead of a microscope. VM has many benefits over traditional glass slides, including portability, and reproducibility (a single level from a rare case can be shared amongst many). No significant differences in test scores were found in a study comparing instruction with traditional microscopy to VM when used with medical students.\[^{8}\] However, the method of instruction with VM remains largely the same as with traditional microscopy. The relatively inexperienced student is allowed to explore a voluminous, unfamiliar slide. The digital nature of VM allows for annotations to be added to aid in education.\[^{7,8}\] However, these annotations are often static and offer little explanation as to why a particular field of view was selected over others for annotation. Ideally, histopathology is taught at a microscope with an experienced pathologist using a process called “double-heading”. “Double-heading” at the microscope is a process whereby two individuals can see a slide together at the same time under the microscope making it a useful teaching tool to point out salient features on a given tissue section on the slide. However, most medical students will not choose to do an elective in Pathology during their time in medical school. This interaction can be simulated in a laboratory setting by projecting an example virtual slide while explaining key points. This lab-style teaching of histopathology does not always emphasize the relevance or connections of pathology to clinical medicine, especially during the basic-science years. Additionally, the student is unable to review the guided explanation at a later date. Video tutorials have previously been described for use in pathology education and offer the student an experience similar to “double-heading” but still lack integration of the clinical sciences and the interaction of a virtual slide.\[^{10}\] We sought to create an interactive educational tool that would use clinically relevant scenarios as the structure to present basic histopathology where the student could explore associated virtual slides, with annotated guided videos offering additional guidance and instruction.

**MATERIALS AND METHODS**

A website was created containing ten clinical case vignettes which were written to correspond with the second year medical student’s genitourinary integrated educational core. Clinical data including narratives of pathologist-clinician encounters, WSI, narrated and annotated video tutorials of WS scans (designed to simulate “double-heading” at a microscope) were utilized and incorporated within each case vignette. Video tutorials have previously been described for use in pathology education and offer the student an experience similar to “double-heading” at a microscope. The vignettes had several multiple choice questions that required interpretation of histopathologic findings to arrive at the correct answer. The cases were designed to emphasize the importance of histopathology in clinical decision making. Suitable cases were selected by the authors by reviewing slides from the university’s pathology department archives. The selected glass slides were digitized and de-identified utilizing an iScan whole-slide scanner manufactured by Ventana. De-identified virtual slides were uploaded to a private PathXchange (www.pathxchange.org) group, with membership available only to the medical school class. Hyperlinks to the hosted virtual slides were provided where appropriate within the clinical vignettes, allowing the student off-campus access to the virtual slide. Camtasia Studio (Version 7.0, Windows) was used to record video tutorials of the authors’ computer desktop while viewing the virtual slides. Videos were then added to the videos highlighting important features with the videos ranging in length from 52 seconds to 1 minute, 25 seconds. The students were able to view the movie in conjunction with the corresponding virtual slide, providing a similar experience to ‘double-heading’ at a microscope. The cases were hosted on the University of Nebraska Medical Center’s (UNMC) web server and could be accessed from any location. Students were informed of the availability of the exercise both during didactic lecture as well as via an email invitation. The students were asked to take a pre-test and post-test
consisting of ten true or false style questions covering content from the vignettes and were unaware of the answers until after the post-test. Access to the post-test was not provided until after completion of the vignettes. Performance on the tests was not used in determining the core grades. The students were also asked to complete a short satisfaction survey.

**RESULTS**

Ninety-six second year medical students completed the pre-test with an average score of 7.7/10. Fifty-seven students completed the post-test with an average score of 9.4/10. Thirty-six students completed the survey.

Ninety-four percent of the participants either agreed or strongly agreed that it was a useful exercise and ninety-one percent agreed or strongly agreed that it helped them better understand the topics. Results of the survey are illustrated in Figures 4-6.

**DISCUSSION**

VM is being increasingly used for educational purposes. Virtual slides have the advantage of being easily accessible from a number of different locations and are easier to maintain and display. With the decrease in contact time for pathology education it is important to provide educational materials that can be utilized outside of the
Figures 4: Results of the satisfaction survey taken after completing the vignettes

Figures 5: Results of the satisfaction survey taken after completing the vignettes

Figures 6: Results of the satisfaction survey taken after completing the vignettes

traditional lecture/laboratory setting. However, virtual slides can be overwhelming, especially for the inexperienced. Annotated virtual slides can be helpful in illustrating key histopathologic features, but do little to explain the process by which an area was selected for annotation. Virtual slides can be shown in a lecture-type setting, providing an opportunity for explanation, although this approach negates the advantage of being easily accessible outside of the classroom setting and cannot be re-reviewed. Virtual slides are also often associated with only a minimal amount of ancillary clinical information. When clinical information is present it typically does not highlight the management ramifications of the histopathologic findings which is necessary for the development of patient management skills and successfully completing the United States Medical Licensing Exam (USMLE).

Our website was designed to highlight the importance of histopathology to practical clinical decision making. While most students will not become pathologists, nearly all will be reading and using pathology reports to care for their patients. The use of video tutorials was designed to simulate ‘double-heading’ at a microscope as best as possible. The addition of the virtual slide allowed the student to explore the slide in a self-directed and independent fashion, with the video tutorial being available for re-review if necessary. This is somewhat analogous to taking glass-slides to a personal microscope for further review after having signed-out with a pathologist. Our website had the added benefit of being available off-campus. This helps to reduce the pressure of shrinking student contact hours. Additionally, motivated students can further their interest and understanding at their own pace.

The results of our study and survey indicate that the website was well received with an increase in scores of the post-test over the pre-test. Future directions include expanding the number and variety of cases so as not to be all-encompassing but rather with the goal being to provide high-yield examples which illuminate the importance of gross and microscopic pathology and how this dictates clinical decision making. This technique could also be expanded and made more comprehensive for use in pathology resident education.

To our knowledge, studies of this technique of instruction have not been previously published. It is hoped that more such vignettes would be developed utilizing multiple modalities that have the ease of viewing from anywhere and at anytime. With the recent rapid advances in technology, this method is in line with the increasingly global practice of medicine.

CONCLUSION

The development of interactive case vignettes incorporating simulated pathologist-clinician encounters with WSI and video tutorials of WS scans helps to improve student enthusiasm to learn and grasp pathologic aspects of disease processes that lead to clinical therapeutic decision making.

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REFERENCES

1. Gartner LP. Anatomical sciences in the allopathic medical school curriculum in the united states between 1967-2001. Clin Anat 2003;16:434-9.
2. Bloodgood RA, Ogilvie RW. Trends in histology laboratory teaching in United States medical schools. Anat Rec B New Anat 2006;289:169-75.
3. Pratt RL. Are we throwing histology out with the microscope? A look at histology from the physician’s perspective. Anat Sci Educ 2009;2:205-9.
4. Drake RL, McBride JM, Lachman N, Pawlina W. Medical education in the anatomical sciences: The winds of change continue to blow. Anat Sci Educ 2009;2:253-9.
5. Bruch LA, De Young BR, Kreiter CD, Haugen TH, Leaven TC, Dee FR.
6. Li L, Dangott BJ, Parwani AV. Development and use of a genitourinary pathology digital teaching set for trainee education. J Pathol Inform 2010;1:2.
7. Foster K. Medical education in the digital age: Digital whole slide imaging as an e-learning tool. J Pathol Inform 2010;1:14.
8. Scoville SA, Buskirk TD. Traditional and virtual microscopy compared experimentally in a classroom setting. Clin Anat 2007;20:565-70.
9. Triola MM, Holloway WJ. Enhanced virtual microscopy for collaborative education. BMC Med Educ 2011;11:4.
10. Woosley J. Creating interactive pathology tutorials in QuickTime and flash. Hum Pathol 2006;37:974-7.