

Original Publication

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Interactive Tutorial of Normal Lymph Node Histology for Pathology and Laboratory Medicine Residents and Medical Students

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Abstract

Introduction: Computer-based e-learning modules have been shown to be an effective learning tool in medical education. However, readily available, interactive, computer-based modules specifically educating on the histology of the normal lymph node have not been developed. **Methods:** Using Microsoft PowerPoint, I developed a macro-enabled slide show illustrating and describing the architectural, cytomorphologic, and immunophenotypic features of the normal lymph node. This resource can be made available to medical students and residents prior to their hematopathology service rotation, as well as during their rotation should they want to review the module. The tutorial is interactive, with mixed-media features, links to pre- and postquizzes, and an interactive quiz at the end to solidify understanding and address areas of confusion. **Results:** After 1 year of elective implementation, eight out of 13 students chose to use the tutorial, four of whom gave formal feedback in the form of a survey and three verbal feedback. All feedback was positive, finding the tutorial a useful adjunct. **Discussion:** Although extensive implementation was limited given the small numbers that rotate through the hematopathology service on a yearly basis, an interactive, computer-based module was found helpful by the students in learning normal lymph node histology. This 1-year experience demonstrated that the normal lymph node tutorial can be used as an effective adjunct in educating pathology residents and medical students on normal lymph node cytomorphology and immunoarchitecture in the context of a busy clinical patient care setting. Continued learner feedback will be necessary to further enhance the quality of this platform for education.

Keywords

Lymph Node, Histology, Morphology, Immunoarchitecture

Appendices

- A. Normal Lymph Node Histology Tutorial.pptx
- B. Pretutorial Quiz.pptx
- C. Posttutorial Quiz.pptx
- D. Survey on Effectiveness of Tutorial.pdf

All appendices are peer reviewed as integral parts of the Original Publication.

Educational Objectives

By the end of this tutorial, learners will be able to:

1. Recognize the normal lymph node histologic architecture and structures.
2. Identify the typical location and cytomorphology of B cells, T cells, plasma cells, and histiocytes/dendritic cells.
3. Describe the phenotype of B cells and T cells, relating it to normal lymph node architecture by interpreting immunohistochemistry and recognizing the use of flow cytometry.
4. Interpret histologic and immunophenotypic findings of normal lymph node components in an embedded postmodule quiz.

Introduction

Most medical students are taught the basics of histology and pathology of the major organ systems, including the lymph node. It is expected that physicians entering an anatomic or clinical pathology residency already understand normal histology before they begin to hone their morphologic diagnostic skill of reactive and neoplastic entities. However, the level of morphology training differs amongst medical schools, and some residents will have forgotten the details. Given the busy nature of routine patient care

in hematopathology medical practice, allocating time for uniform and quality didactic teaching on normal histology can be challenging.

The hematopathology division of the University of Washington Department of Laboratory Medicine was interested in developing an alternative, mixed-media teaching method that the residents could review prior to starting their hematopathology rotation. Typically, eight to 15 residents/medical students and two fellows rotate on service. Although there is published literature describing normal lymph nodes, as well as excellent basic videos such as Dr. John R. Minarcik's Shotgun Histology series on YouTube,¹ there are no interactive resources describing the architectural, histologic, and immunophenotypic findings (i.e., immunoarchitecture) of the normal lymph node at the more advanced level of a pathology resident.

Computer-based e-learning modules have been shown to be an effective learning tool in medical education.²⁻⁵ A recent study evaluating training for radiology residents showed a statistically significant improvement through use of an interactive musculoskeletal ultrasound learning module.² Therefore, my intent was for the tutorial to be interactive and include an embedded postmodule quiz to ensure residents gained interpretive knowledge from the experience that they could apply to their patient care practice during their hematopathology service rotation.

Methods

A self-directed, mixed-media, interactive educational approach using an electronic module was desired. Given its ubiquity and familiarity, I opted to use Microsoft PowerPoint in order to create a macro-enabled slide show for the interactive tutorial. Using linked slides, the user can maneuver through the presentation based on what he or she wants to review. The linked slides also allow for real-time feedback on the postmodule quiz performance and the ability to jump to additional educational material if desired.

To allow for variation in learner preferences, a variety of media, including pictures, diagrams, text, and verbal descriptions, were used as part of the education process within the tutorial. Using a Leica DFC295 camera, pictures were taken of normal histologic material, such as hematoxylin and eosin-stained tissue and immunohistochemically stained tissue, as it was reviewed through the University of Washington hematopathology diagnostic service. The flow cytometry dot plots were obtained from previously analyzed data on a normal lymph node using flow cytometric analysis software developed in house. I provided the verbal descriptions within the tutorial. A Macintosh computer was used for all development components. In order to experience the full functionality of the tutorial, including the linked slides, the PowerPoint presentation (Appendix A) must be saved as a macro-enabled slide show in the .ppsm format, as opposed to the traditional PowerPoint .pptx format.

A prequiz (Appendix B) and postquiz (Appendix C) were developed during implementation of the tutorial and are available here. In order to collect results data from users, I have included hyperlinks in the presentation to online versions of the pre- and postquizzes. Note, however, that the online versions of the quizzes have not been MedEdPORTAL peer reviewed.

It is important to understand normal histologic findings in order to appreciate what findings indicate a true abnormality. Therefore, pathology residents and medical students were encouraged to review the tutorial prior to their start on the hematopathology morphology service rotation so they could familiarize themselves with normal lymph node findings prior to evaluating pathologic patient samples. Residents who were early in the implementation process were encouraged to give verbal or emailed feedback for improvement so adjustments could be made. Later in development, the residents were asked to complete a Catalyst survey (Appendix D).

Results

During any given year, there are typically eight to 15 residents/medical students who rotate through the hematopathology service, along with two hematopathology fellows. During the piloting of this session, eight of 13 learners (six residents and two medical students) voluntarily participated in the tutorial, and four participated in the survey. Of those who took the survey, 100% felt the tutorial solidified knowledge they

already had, 100% felt they were taught information they did not know, 100% felt the tutorial was useful and appropriate, and 100% would recommend the tutorial to others. Learners appreciated the simple and concise descriptions, the image quality, and the focus on foundation learning. There were no suggestions for improvement from the limited survey responses.

The normal lymph node tutorial was also presented at the University of Washington Medical School Teaching Scholars program, where suggestions were made to turn this into a web-based opportunity that could benefit a larger audience, such as medical schools, pathology residencies, and other postsecondary programs.

Discussion

Effectively teaching normal lymph node histology in a time-effective, uniform, and high-quality manner for all pathology residents can be a challenge. Although this information is covered in the typical didactic format, it is only done once per year, which does not coincide with the timing of the majority of the residents or medical students starting their hematopathology service rotation. Additionally, while normal teaching sets are available, the amount of time available while on service (for both faculty and resident) varies depending on patient caseload, impacting the ability to review the study-set material. The normal lymph node histology tutorial can be reviewed at a time convenient for the learner and provides an effective, interactive learning experience. Although the tutorial was not a requirement, more than half of the learners participated in the tutorial, and those who participated found it an effective way to learn.

One of the challenges and limitations using a PowerPoint macro-enabled slide show is that the user must click in the directed way as originally instructed in order to follow the intended path of the tutorial. If the user should misclick, he or she can get off the path and may have to restart the tutorial in order follow the intended path. This is a significant limitation of using this format; however, given the resources available, it was the only option available to me. Additionally, the file is too large to email and must be distributed to students via a file-hosting service, such as Dropbox or Google Drive, or accessed from MedEdPORTAL, which, given the file's size, can take as long as 10 to 30 minutes to download. Regardless, even having these limitations, it is the only interactive tutorial available to teach pathology residents normal lymph node histology.

The hematopathology education committee plans to implement this tutorial as mandatory learning for the 2016-2017 year. In addition to continuing with the learner satisfaction surveys, the pre- and posttutorial quizzes will allow the education committee to evaluate the effectiveness of the module. Given that there are no similar resources of this type available, the normal lymph node histology tutorial can be an accessible option for all hematopathology programs, as available in this published format, and continued improvements can be made if learners participate in the survey.

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Disclosures

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Ethical Approval

Reported as not applicable.

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