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Video-Based Teaching of Image-Guided Breast Interventions: Stereotactic Core Biopsy Using a Prone Table

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Abstract

Introduction: The introduction of new technologies and teaching strategies to educate the digital learner creates the potential for a better and more standardized training experience across programs. Thus, we sought to create an instructional video on stereotactic core breast biopsy that simulates best practices and could be readily accessed by training programs to improve and standardize resident education. **Methods:** At our institution, we use the video and questions as part of a flipped classroom educational activity. Residents are requested to complete the questions at home and watch the video. They then take the posttest questions during the lecture period, at which time the answers are reviewed and there is additional discussion of the procedure. The tests contain both video-related questions and control questions. **Results:** After viewing the video, there was a 30% mean improvement in the video-related questions compared to a 0% improvement in the control set of questions. **Discussion:** An instructional video on stereotactic core biopsy was created with associated assessment questions that can be used at any institution for the purposes of improving and standardizing training in breast imaging procedures. This resource can be especially useful for programs where trainees have limited procedure exposure.

Appendices

- A. Stereotactic Guided Breast Biopsy.mp4
- B. Assessment Questions .docx
- C. Assessment Questions PDF Version.pdf
- D. Assessment Questions Answer Key.docx

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

Keywords

Education Videos, Breast Radiology, Breast Procedures, Video Simulation, Stereotactic Core Breast Biopsy

Educational Objectives

By the end of this resource, learners should be able to:

1. Describe the indications for stereotactic core biopsy.
2. Identify and state the purpose of each portion of the equipment involved in a stereotactic core biopsy.
3. List the steps in planning for the procedure.
4. Describe the steps of the stereotactic procedure.
5. Define new terminology, including stage, pass, differential, stroke, and stroke margin.

Introduction

As the new generation of digital learners enters radiology training, educational approaches must evolve to incorporate new technologies and teaching strategies that respond to changing learning styles.¹ Medicine and surgical training programs have already begun introducing and studying these new approaches.²⁻⁵ With the introduction of video-based learning comes the potential to create a better and more standardized experience across training programs. Although discussion on using this technology in radiology education has increased⁶⁻¹⁰ and a recent study showed overall resident improvement after watching instructional videos,¹¹ the majority of programs continue to rely on conventional teaching methods.

In breast imaging, we train residents in a number of invasive procedures. Although exposure to procedures can be quite variable, it is expected that graduates of all programs develop competence in basic, intermediate, and advanced image-guided procedures. Teaching these procedures is challenging; residents need to have a good understanding of how a procedure is done and the challenges involved before they attempt to perform it. In addition, this is an emotionally difficult area for patients, and discussing details during procedures in front of conscious patients may increase patient anxiety. Lastly, as residents typically only rotate through breast imaging once a year, there is a need for refresher training on their return. In reality, teaching procedures is very difficult to do via written materials alone.

These challenges are true for all breast imaging procedures, including stereotactic core biopsy. That being said, teaching stereotactic core biopsy has its own unique challenges as well. Unlike ultrasound-guided breast procedures that employ a technique similar to other forms of ultrasound-guided procedures, stereotactic core biopsies are performed on dedicated equipment that is only used for this specific purpose. To safely and successfully perform the procedure, the resident must learn to perform multiple important steps that require attention to both equipment function and patient comfort. This is difficult to learn with limited time and exposure.

Our primary objective was to create an instructional video on stereotactic core breast biopsy simulating best practice for procedure performance that could be readily accessed by all training programs. This approach has already been shown in one study to enhance resident understanding about stereotactic procedures across all years of training and therefore has the potential to standardize the resident experience within and across programs.¹¹ This video can be used at any stage of resident training, including prior to initial exposure to the procedure and after any significant interval apart from performing these procedures. The video would also be suitable for practicing radiologists who have not performed these procedures previously or for some time.

Overall, we believe this video is an improvement over the primary method of teaching stereotactic core biopsies, which is apprenticeship-style teaching at the workstation and bedside in the presence of the patient.

Methods

Using multimedia applications that allow the simulation of a live-teaching experience, we created an instructional video on stereotactic core biopsy (Appendix A). We first created a storyboard to highlight key aspects of the procedure and ensure that the video would flow smoothly. We next took images and video and placed them in the appropriate position within the storyboard. We then used an interactive whiteboard application called Explain Everything to create the video.

This video simulates the experience that happens at the imaging workstation and at the patient's bedside while including background information and key teaching points, problems, and solutions. The video walks trainees through the indications for each procedure and reviews commonly used equipment, the steps involved in preprocedure planning and patient positioning, and the key steps of the procedure itself. Images in the form of schematics and real-life cases, as well as a variety of simulation models, are used to illustrate key concepts. All residents therefore have access to the same procedural teaching regardless of the circumstances of their specific training program.

Ideally, this video would be viewed both prior to first exposure and after multiple exposures to the procedure. Included in both Microsoft Word and Adobe PDF formats (Appendices B & C) are 10 multiple-choice questions that can be given as a pre- and posttest or as just a posttest to confirm compliance and understanding. The questions are specific to stereotactic guided biopsies. Answer choices and explanations are also provided (Appendix D).

At our institution, we use the questions as part of a flipped classroom educational activity. Residents are requested to complete the questions at home, watch the video, and then take the posttest questions during the lecture period, at which time the answers are reviewed and there is additional discussion of the procedure.

Results

We first tested this educational resource prior to using it in our educational training program. This study was described in Phillips et al.¹¹ and is summarized here. Pre- and posttests conducted before and after residents viewed the video were performed at one institution. As all radiology residents in the program were asked to watch the video, limiting the possibility for using a control group, we opted instead to use a control set of questions that tested material not included in the video. These questions were on similar material and were framed in a similar fashion.

Out of 40 radiology residents, 30 (75%) participated in the study. Nine of the residents were second-year residents, six were third-year, nine were fourth-year, and six were fifth-year residents. Overall, there was a 30% mean improvement in the video content questions compared to a 0% improvement in the control set of questions (Table). Residents in the fourth- and fifth-year groups actually performed worse on the posttest control questions. Fifth-year residents showed the most significant improvement, with a mean increase in the video questions of 39% and a mean decrease in control questions of 3%.

Table. Number of Correct Assessment Questions by Postgraduate Year ($N = 35$)

Year	Control Questions		Video Content Questions	
	Pretest	Posttest	Pretest	Posttest
PGY 2	6.1	6.6	6.8	13.0
PGY 3	6.8	7.8	6.7	11.8
PGY 4	9.0	8.3	8.7	14.2
PGY 5	9.3	8.8	8.7	16.5

Adapted from Phillips et al., "Educational Videos: An Effective Tool to Improve Training in Interventional Breast Procedures," *Journal of the American College of Radiology*, 2016;13(6):719-724.

In addition, we shared this video with residents at three other institutions and then anonymously surveyed residents at all four institutions using SurveyMonkey. We had 45 respondents distributed between the four institutions. The respondents ranged from second-year through sixth-year residents. Eighty-seven percent of respondents felt that the video helped their understanding of procedure planning ($n = 39$), 82% felt it helped their understanding of procedural technique ($n = 37$), 60% felt it helped their understanding of patient safety ($n = 27$), and 69% felt it increased their confidence in the procedure ($n = 31$). However, only 47% of respondents indicated that the procedures helped them understand how to troubleshoot complicated cases ($n = 21$). This will therefore be a priority for future educational videos.

Given these results, we now include this video in the radiology training program at our institution. While residents are asked to watch the video prior to first performing the procedure, we also recommended they watch the video throughout their 4 years in training as a refresher.

Discussion

It is well accepted that radiology residents across the globe do not have the same radiology training experience. This education varies for multiple reasons, ranging from equipment resources to clinical staffing to practice culture. As a result, residents graduate from residency with varied levels of comfort in radiology procedures. Introducing instructional videos that simulate best practice allows standardization across programs while responding to the changing needs of digital learners. Since introduction of this video into breast imaging education, our trainees have demonstrated a greater understanding of and comfort with the procedure. They report enjoying access to this resource, as they can watch on their own time, from anywhere, using their mobile devices. They also report feeling better prepared when on service.

We currently use this resource as part of a flipped classroom exercise. Residents do the pretest questions at home, watch the video, and complete the posttest questions during the lecture period. We then review the questions and answers and further discuss the procedure. We also recommend that residents access the video throughout their 4 years of residency as a refresher and to solidify material learned.

The development of this resource was an iterative process that started with recording short, simulated video segments via an iPad and combining them using iMovie. This developed into combining movie segments, voice-over PowerPoint slides, and annotated diagrams using Explain Everything. Optimizing the sound and images without making files too large was challenging. The faculty involved had to be trained in these applications. Suitable simulation models had to be identified to demonstrate various aspects of the procedures.

There may be challenges to implementing this resource in an educational program as well. Our data show that not all of our residents participated in our evaluation. This was because residents had varying schedules that took them away from the local educational activities such as overnight call, outside rotations, or conferences. That being said, having this digital resource allows those who were absent to still benefit from the material. We are also fortunate at our institution that all residents have iPads from which they can access the video; however, we have also made sure that the resource is available on our section website for viewing. This may be difficult at some other sites.

An important limitation relates to the lack of long-term outcome data to show that this video is successful. However, prior educational studies have shown that students retain more when they are continually challenged. This suggests that the video needs to be a part of a larger effort by the residency program in which residents are actively engaged by being asked questions and made to think critically.¹² Another limitation is that this video discusses only a prone stereotactic core biopsy procedure and one type of biopsy device. Alternative types of equipment and biopsy devices exist, and it is important to adapt this educational discussion to those varying methods. Lastly, a third limitation is that no control group was used for our study. However, by using a control group of questions, we were able to show that residents did not use outside material to improve on the posttest, nor was their improvement in video questions related solely to learning from the exam. This was shown by the fact that residents demonstrated either no change or worse performance on the control questions, with an improved performance on the video questions.

Given the success of this video, we hope to create an additional video series on the breast curriculum that uses a more interactive approach for learners everywhere. These videos would also specifically address troubleshooting techniques and patient safety, based on resident feedback. Future investigation may relate to residents' comfort with different educational resources and the long-term impact of this form of education.

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Ethical Approval

Beth Israel Deaconess Medical Center Institutional Review Board approved this study.

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