ADVANCES IN ENDOSCOPY

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Section Editor: John Baillie, MB ChB, FRCP

Training Model for Endoscopic Ultrasound–Guided Fine-Needle Aspiration of Lymph Nodes

Annette Fritscher-Ravens, MD
Professor of Gastroenterology
Experimental Endoscopy Unit
Internal Medicine I
University Hospital Schleswig-Holstein
Campus Kiel
Kiel, Germany

G&H What training models are currently available for endoscopic ultrasound–guided fine-needle aspiration of lymph nodes?

AF-R Unfortunately, suitable training models to practice endoscopic ultrasound–guided fine-needle aspiration (EUS-FNA) of lymph nodes are scarce. Several bench models using barium-filled bags, agar gel with fruits and vegetables, and excised porcine stomach with grapes have been used to practice the handling of the endoscope and needle; however, sticking a needle through a saline bag or into grapes is too easy and cannot replicate the feeling of resistance that is present in lymph nodes. Therefore, none of the ex-vivo models are suitable to train for manual dexterity, the feeling of needle penetration in a lymph node of a live subject, and the experience of complications, such as bleeding or perforation, which is necessary for sufficient training. A live pig seems to be the best model, as its anatomy is similar to that of a human; however, the number of lymph nodes needed for training is not naturally present in a healthy animal. Studies from a US group led by Dr. Manoop Bhutani and a French group led by Dr. Marc Barthet have reported the use of live animal models with either lymph nodes from the liver hilum or saline that was injected into the tissue to mimic pathology. More recent papers have shown that trainees improve their skills considerably and reduce their psychological barrier of performing EUS-FNA by training with live animal models even though a healthy animal does not naturally have a sufficient number of lymph nodes of varying sizes for use in such training courses.

G&H You recently published study results of an animal lymph node model for hands-on EUS-FNA training. How was this model created?

AF-R The idea for this model came from having worked in the coal miners' district in Germany for some time. I had noticed that all coal miners undergoing EUS for various reasons had a multitude of lymph nodes in the mediastinum due to exposure to coal. With a grant from the American Society for Gastrointestinal Endoscopy, my colleagues and I used these data to create lymph nodes in pigs by injecting sterile graphite into their mediastinum and perigastrically. We initially created lymph nodes in the pigs so that we could develop a new surgical procedure, but it quickly became clear that our young colleagues benefited from practicing how to puncture the lymph nodes. Therefore, we created a teaching and training study, the results of which were published in the February 2013 issue of *Endoscopy*.

G&H What was the design of your study?

AF-R We developed a 2-step model. We first injected graphite into the mediastinum of the animals and allowed lymph nodes to grow naturally around the graphite (Figure). Two weeks later, 2 endoscopy trainees who had very limited experience with EUS-FNA received training for 2 days on the procedure for puncturing lymph nodes. Prior to this, I examined the graphite-induced lymph nodes to ensure that puncturing them felt similar to puncturing normal benign lymph nodes in patients. The trainees completed a questionnaire before and after per-

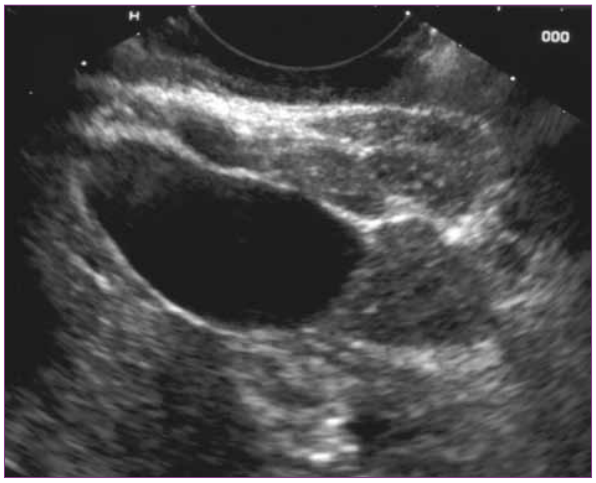

Figure. Lymph nodes created by graphite injection into the celiac axis for training of endoscopic ultrasound–guided fine-needle aspiration.

forming EUS-FNA in 96 lymph nodes in 18 animals, and accuracy, speed, adequacy of sampling, and the trainee's performance were measured before and after training.

G&H What were your study findings and conclusions?

AF-R There was a correlation between puncture time and the number of EUS-FNA procedures performed in all but the subcarinal locations. Although the trainees made major progress in their ability to puncture lymph nodes, the most significant change was noted in regard to the confidence they developed in echoendoscope and needle handling in the puncturing process. After puncturing 96 lymph nodes, the trainees were much more confident of their ability to perform the procedure, which translated into quicker procedure times when seeing patients later.

However, the fact that we were able to create lymph nodes in the first place was the most important and novel achievement. The study results have received some attention, particularly in regard to the lymph node creation process, which was done in a minimally invasive and ethically acceptable manner.

G&H How do the study findings compare with those of other training models in this area?

AF-R Our findings are similar to those of other training models. Trainees benefit in many ways from such an intense training course; afterward, they are more self-sufficient, confident, and quicker. According to the results of a questionnaire by Dr. Manoop Bhutani and colleagues, all doctors surveyed found training with animal models to be very helpful.

The benefits of training with a live model are especially important because of the significant lack of EUS access and training in many countries, including the United States, where EUS is typically offered only in a few specialized centers that can train only so many doctors at one time. A recent study by Dr. Sachin Wani and colleagues investigated patients with esophageal cancer over several years and found that only 10% had undergone EUS. The fact that patients who underwent EUS had much improved survival rates stresses the importance of training more gastroenterologists in this technique to be able to cover at least staging and diagnostic tissue sampling of cancers that are within reach of an echoendoscope.

In addition, many doctors want to learn and use EUS-FNA, but adequate training is limited. It is a very complex and little-reimbursed procedure with a limited number of experts available. As a result, some doctors who perform EUS use it for imaging alone and are hesitant to use it for FNA or more advanced procedures, despite availability of the equipment. These doctors may be afraid to stick a needle through the esophagus into the mediastinum and so on; it can be mentally challenging for some to cross that barrier into a sterile space and puncture a lymph node. We try to overcome this problem with our training model by helping doctors gain more confidence and apply their training experience to the lymph nodes of patients. Hopefully, other centers will also be able to use this model in the future for training courses. This is particularly important in countries where the availability of EUS is mandatory in order for an institution to obtain "cancer center" status. Some US doctors travel to Canada for EUS training, and even our center in Europe has been approached.

G&H What are the disadvantages of this training model?

AF-R The major disadvantage is that only a few echoendoscopes are available for use in animals. Due to regulations, an instrument that has been used in an animal cannot be used in a human. Thus, dedicated EUS echoendoscopes, which are very expensive, are needed for training in animals, which may limit the interest of companies supplying instruments for such courses.

In addition, some doctors may feel that it is ethically questionable to train on animals. However, many laparoscopic surgeons train on live animal models. This experience can be transferred to endoscopy training as well, particularly since there is already a lack of sufficient training with expert EUS knowledge. Training is most effective when performed in a live setting (ie, with a heart beat, breathing, blood vessels, and so on, which makes the FNA procedure more difficult and more closely simulates real-life conditions with human patients).

G&H How does this training model compare with other models in terms of cost?

AF-R Other animal models are less expensive because our model is a natural one, in which the animal body is creating the lymph nodes and, thus, must survive for 2 weeks. Costs are higher because, essentially, there are 2 procedures: One is quick, using anesthesia and EUS-FNA, and then the animal needs to survive for 2 weeks before it can be used for training. Other training models use acute animals, which means that the animals are kept alive only for 1 day and are killed immediately after the training session. This is cheaper, as the main cost of the training procedure alone is considerably lower. However, as noted in my article, the cost of our training model can be reduced by training multiple endoscopists (8–12) throughout the day with the same animals.

G&H What has been the response to this training model?

AF-R Thus far, clinicians have been receptive. In fact, I was surprised at the response: Several institutions have already contacted me because they want to use the model for research or training purposes.

G&H Are there plans to further develop the model?

AF-R We have used this model for approximately 2–3 years to create lymph nodes on which to operate. Additional studies are being conducted on EUS-FNA of lymph nodes as well as radiofrequency ablation of lymph nodes and other methods for lymph node treatment in the mediastinum. However, we have not yet been able to persuade the industry to sponsor these courses due to concerns regarding costs (if endoscopes are damaged). Nevertheless, there is increasing interest in this area, so there may be sufficient demand for these tools in the future.

Suggested Reading

Fritscher-Ravens A, Cuming T, Dhar S, et al. Endoscopic ultrasound-guided fine-needle aspiration training: evaluation of a new porcine lymphadenopathy model for in vivo hands-on teaching and training, and review of the literature. *Endoscopy*. 2013;45:114-120.

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