A simple training tool for CT-guided spinal pain management

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ABSTRACT
The use of models as training tools to learn and practice medical skills has become an important part of medical education. Image-guided spinal interventions for lower back pain are probably one of the most commonly performed procedures in interventional radiology. Thus, a training model for these types of interventions would be helpful. This article presents a simple training tool for computed tomography guided spinal pain interventions. The model is described, and the potential advantages in training are discussed.

Key words: • computed tomography, X-ray • interventional radiology • low back pain • educational model

The use of models for training and learning medical skills has become an important part of medical education, and the classic example is laparoscopy training (1). Because image-guided spinal interventions for back pain are one of the most commonly performed procedures in interventional radiology, a training tool for these procedures would be helpful. The present article presents a simple training tool for computed tomography (CT) guided interventional spinal pain management (i.e., peri-radicular infiltrations and facet and ileosacral joint infiltrations).
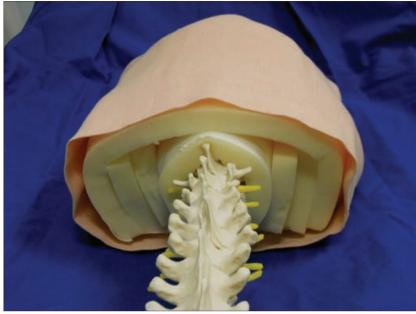
Training tool

The model consists of three components. The basis is a commercially available spine model, which consists of a polyvinyl chloride (PVC) model of the vertebral bodies, the spinal cord, and the spinal nerves. This PVC model was covered in several layers of coarse cellular foam. In addition, a densely woven flax fabric was used to simulate the skin (Fig. 1). The total cost of the model was less than $100. The model can easily be positioned on the CT table, and the whole interventional pain treatment procedure can be simulated; even the needle placement can be controlled with CT scans (Figs. 2 and 3).
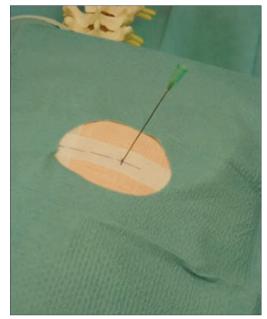
Discussion

Like other medical skills, interventional radiology cannot be learned theoretically out of books; it has to be learned by practicing on patients. To protect the patient, close supervision is needed in the beginning. In addition to learning through patient experiences, training models have been used for medical training. For example, many interventional radiology procedures can be learned on pigs (2). In addition to ethical concerns, training on animals requires a special environment and is expensive; thus, it cannot be incorporated into everyday practice. Recently, virtual simulations have been proposed for training in interventional radiology, and this method has shown a positive effect on the learning curve and radiation dose (3). However, there are a limited number of training tools available, and the high costs and technical complexity limit their widespread usage. Because there are no training tools for CT-guided interventional spinal pain management, I developed a very simple training tool that is cheap, easy to build and can be used in a normal examination room. This "low-tech" approach has also been described for laparoscopy training, which is one of the classic applications for off-patient training (4).
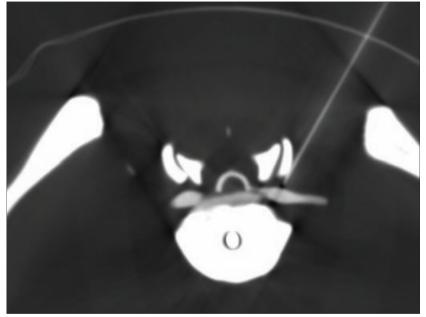
Training on models in interventional radiology has many advantages. First, without the stress of a real intervention, individuals can learn how to handle the material in a safe environment. In addition, the whole sequence of an intervention can be practiced (i.e., preparation,

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Figure 1. Photograph of the model showing the layers of coarse cellular foam and a flax cover around a commercially available spine model.

Figure 2. Photograph of a simulated peri-radicular infiltration with sterile setup and positioned puncture needle.

Figure 3. Axial CT image showing the model with the puncture needle positioned at the spinal nerve for peri-radicular infiltration.

planning the puncture target, aseptic technique and image-guided needle placement). This is not only important for the physician performing the intervention, but also for the whole team, especially the assisting radiographer. A good working team is faster, which may be important in times of high workloads and economic burdens, and can provide a higher level of patient safety and satisfaction. Patient safety and satisfaction is especially important in interventional spinal pain management because patients with chronic pain are often very sensitive to environmental factors. Moreover, radiation is used in these treatments, and excess radiation can be harmful to the patient. This is an important concern in interventional spinal pain management because the patients are often young and have to undergo repeated interventions. In a study by Schmid et al. (5), the estimated dose of a CT-guided peri-radicular infiltration with 10 single slice images using a standard protocol was 3.5 mSv, which can be reduced to about 0.5 mSv using an ultra-low-dose protocol. In reality, even experienced spinal interventionalists need more than these few images for proper needle placement. In addition, some complex anatomical situations require a standard spine scan for planning. Training in needle placement (i.e., learning to estimate the angle and depth of the puncture) may decrease the attempts needed for optimal needle placement, which would result in fewer control scans and less radiation exposure. Indeed, a reduction in radiation exposure has been shown with a simulator for intra-operative fluoroscopy (6).

I am aware that my training tool is very basic and that the materials used cannot provide the real feeling of punctured skin, fasciae and muscle. Moreover, I know that this model is not a substitute for supervised learning on patients, but it may help beginner radiologists and radiographers learn the interventional spinal pain management techniques, especially needle placement. In addition, medical personnel can become familiar with the materials and image-guided therapy procedures. Thus, this model may function as an intermediate step between the book and the patient.

Conflict of interest disclosure

The author declared no conflicts of interest.

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