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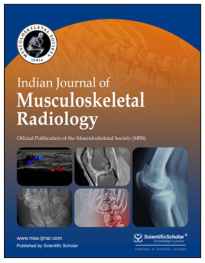

Editorial

Cadaveric training workshops in musculoskeletal radiology: Are we there?

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Human cadavers have been an immense source of knowledge from times immemorial and have aptly been termed as "silent teachers." Sushruta Samhita, an ancient textbook in Ayurvedic medicine, said to be written in 6 BC comprises a systematic description of cadaveric dissection. Cadavers have been utilized in various other specialties such as anatomy, surgery, and anesthesiology for teaching. As the application of ultrasound has increased exponentially over the past few decades, radiologists have also fancied the idea of using cadavers in diagnostic and interventional aspects of radiology training. The use of cadavers in MSK radiology intervention in India is gradually gaining importance and, in turn, is bringing a paradigm shift in the training of budding radiologists.

This is more so as other modes of hands-on training have certain disadvantages. There is insufficient evidence regarding task fidelity, skill transfer, validity, and reliability for most of these alternate tools. Non-meat phantoms have low background echogenicity which enhances the needle visibility. This can lead to false confidence regarding clinical ability. On the other hand, meat phantoms have excellent feasibility, are cheap, can be constructed with minimal preparation, and can be disposed off easily. Computer-based training imparts knowledge but is insufficient to improve procedural skills. Books and atlases provide a detailed description of the anatomy, but retention of knowledge is variable. Synthetic (bench) models are also available but these are expensive and dedicated faculty is required so that they are within easy reach of many trainees.

Performing ultrasound-guided interventions require a strong knowledge base about scanning techniques, recognition of normal anatomy, pathologic conditions, and needle guidance techniques. The use of human cadaveric specimens allows the learner to augment the scanning and interventional skills to immediately begin integrating the skills into clinical practice. With the advent of modern cadaveric laboratories equipped with state-of-the-art equipment and better cadaveric preservation techniques, radiologists can learn and refine their skills using ultrasonography to perform procedures on cadavers.

To achieve the best of result, the cadavers have to provide near real-life experience to the radiologist. Cadavers differ in several aspects such as color, flexibility, quality of preserved tissue, cost, and storage based on the embalming method. It is important to understand the strong and weak points of a cadaver to determine which preservation method is best suited for a procedure.

Fresh frozen cadavers are obtained by keeping the body at −20°C for 3–4 days after death. There is an increased risk of exposure to infection from these specimens even though the

bodies are routinely screened for common pathogens and viruses. Formaldehyde is another agent which has been used for a long time. However, it suffers from the inherent disadvantage of making the body tissues hard with the loss of normal suppleness of the joints. Moreover, it is a known carcinogen that is easily absorbed through the skin and mucous membranes. Cadavers prepared using Thiel's embalming method overcomes many of these shortcomings. Thiel's embalming mixture is a water-based mixture of glycol, chlorocresol, ethanol, salts for fixation, boric acid for disinfecting, morpholine as a color preservative, and a small amount of formaldehyde. Color, suppleness of the skin, joint flexibility, and fascial integrity of the cadavers are retained in Thiel cadavers. Due to fluid in tissues, the echogenicity of muscles increases which enhances the sonographic contrast between muscles and nerves making their sonographic assessment better.

Cadaveric workshops provide near real-life experience to the operator to learn the techniques of MSK intervention. They use landmark-based techniques with needling which further enhances the knowledge and understanding of three-dimensional anatomy. Cadavers can be used for learning sonoanatomy and practice skills such as hand-eye coordination, probe handling on an irregular surface, and probe needle alignment for MSK-related guided injections and interventions. Due to the lack of blood flow and tissue movement, the cadavers provide optimal ultrasound images. At the same time, these features limit near life experience of the true tissue characteristics while performing the MSK interventions. Cadavers also have the advantage of providing high fidelity akin to real-life scenarios and are a great tool to learn the fascial tactile feedback and ergonomics.

Cadavers are procured either from voluntary donations or from unclaimed human bodies. Normally, they are routinely screened for common contagious viruses such as HIV and hepatitis viruses. Yet, the risk of transmission of infections from the cadavers cannot be ruled out. It is, therefore, always advised to handle these cadavers with due precautions. The protocols of optimization make procuring fresh cadavers difficult.

Cadaveric simulation has been used frequently in multiple surgical specialties though it has not gained its foothold in the field of radiology. The obvious advantages of cadaveric simulation include realistic anatomical portrayal with capturing anatomical variants and pathology. However, cadaveric models have been criticized as postmortem tissue is not completely accurate for various tissues of the body.

In today's scenario, the MSK workshops based on cadaveric teaching include revisiting the sonoanatomy of the joints, vessels, and nerves, technical considerations to prepare the injectant, how to carry out the injections, individualized joint-specific intervention, and therapy. Not only do these workshops cover the basics of interventional procedure including pre-procedure preparation and scanning technique (like in-plane and out-of-plane techniques) but also deal with guidelines to manage the complications and post-procedure rehabilitation.

As a front-runner Musculoskeletal Society (MSS), India has been able to hold these workshops regularly and at an affordable fee structure for the radiologists across the country. However, only a very few fully equipped laboratories are available to provide the complete component of equipment, the trainer, and the cadaver at one place in India. Organizing cadavers in India are a herculean task and are governed by the Anatomy Act of 1949. It will need a lot of impetus from professional bodies such as the Indian Radiology and Imaging Association, the Indian College of Radiology and Imaging, and the MSS, India, to make cadaveric workshops a part of the regular postgraduate curriculum in radiology.

Cadaveric workshops are, therefore, an important aspect of radiology training and have brought about a paradigm shift in contemporary teaching of MSK Radiology and related guided interventions. It is a continuous process that will take time to evolve and popularize in the times to come. Even though the attempts at holding these events by MSS, India, on a regular interval are laudable, there is still a long way to go for it to be fruitfully employed in core radiology training.

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