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White Cane Approach to Teaching Spinal Anesthesia

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With aging-associated obesity and osteoarthritis, anesthesiology trainees and their instructors face difficulties in identifying the surface anatomy and landmarks for spinal anesthesia, and successfully advancing the needle into the intrathecal space. Through a series of illustrations and instructions, this teaching tool suggests that using a spinal needle in the same way that a blind person uses a white cane may improve a trainee's ability to successfully perform a lumbar puncture. Reviewing the technique and instructions with the trainee before approaching the patient can minimize verbal instructions in the patient's presence and may lead to improved efficiency and trainee success. (A&A Practice. 2022;16:e01592.)

GLOSSARY

JiTT = Just-in-Time Training

The teaching of spinal anesthesia is not standardized and can be haphazard. Providing simulation training of spinal anesthesia techniques before lumbar puncture or so-called "Just-in-Time Training" (JiTT) can improve performance and success, but JiTT simulation is resource-intensive and difficult to accomplish in the context of a busy operating room schedule.[1,2] Therefore, a JiTT method for teaching spinal anesthesia is suggested here whereby a trainee is given a "low-tech" illustrated handout that can be read in a few minutes and followed up with a short discussion with the instructor, just before the actual procedure.

The intent of this teaching tool is to help anesthesia trainees and their instructors understand that surface landmarks do not necessarily indicate what lies beneath, and that access to the intrathecal space may be enhanced by using the spinal needle as a probe, in the same way that a blind person uses a white cane to find their way.[3]

While navigating from point A to B, a blind person avoids tripping hazards and finds a clear path by sweeping a white cane from side to side and tapping to identify obstacles. In familiar environments, visually impaired people make navigation possible by learning the layout and memorizing where things are. In an analogous manner, the spinal needle can be used like a white cane when navigating from the skin (point A) to the intrathecal space (point B). The purpose of this communication is to help trainees learn and memorize the layout of the obstacles that can prevent access to the intrathecal space.

Written informed consent for the publication of the images was obtained from the individual depicted in the figures.

METHODS

JiTT simulation is believed to improve the teaching and learning of complex medical procedures.[1,2] Unfortunately, simulation is costly, labor-intensive, and logistically challenging for operating room teaching. On the other hand, a "white cane JiTT" for spinal anesthesia is simple and can be implemented on short notice. The method, outlined below, consists of providing trainees with a "low-tech" illustrated handout (essentially what is written here), preferably with a handheld spinal model, which can be read in a few minutes and discussed with the instructor just before performing spinal anesthesia. Although successful lumbar puncture is the goal, the principal aim of the white cane JiTT is suggesting an educational process through which trainees develop knowledge, skill, and confidence.

The white cane JiTT begins with an image of an older woman positioned for lumbar puncture (Figure 1). The spinous processes are readily apparent, and needle insertion caudal to either spinous process (A or B) is appropriate. The spinal needle should then be directed slightly cephalad. Figure 2 shows the expected normal anatomy underlying the surface landmarks. However, osteoarthritis and compression fractures, both of which are common among older patients, particularly in women with osteoporosis, can alter the underlying anatomy, as seen in Figure 3. Notably, the right hip is significantly higher than the left. Although it may not be readily apparent from the surface anatomy, this person has severe scoliosis (Figures 3 and 4).

Figure 5 is a radiograph of a normal spine, Figure 6 is a model of the lumbar spine, and Figure 7 illustrates the spinal ligaments. The bones of Figures 5 and 6 and the ligaments of Figure 7 provide important tactile feedback of obstacles to the hand advancing the spinal needle in the same way that the white cane provides tactile feedback to the blind person navigating from point A to B. The bones and midline ligaments provide important

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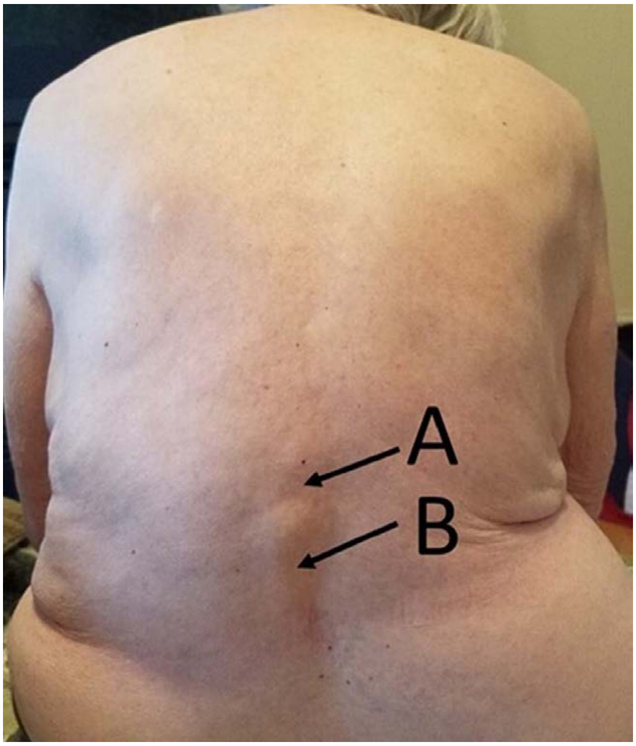

Figure 1. Model positioned for spinal anesthesia. A and B, Two prominent interspaces.

clues as to the location of the tip of the needle as it is methodically advanced to the intrathecal space. There is an increase in resistance when a needle traverses a ligament. When loss of resistance occurs at a shallow depth, it suggests that the needle is no longer in the midline. If one encounters bone or loss of resistance at an improper depth, the spinal needle must be redirected. Redirection requires withdrawing the introducer and needle to the subcutaneous tissue and readjusting the trajectory. The needle cannot be redirected when it is deeply embedded in the back. Withdrawing and slightly redirecting the needle repeatedly, using the spinal needle similar to the use of a white cane, allows one to navigate the course toward the cerebrospinal fluid. One can often "feel" somewhat softer calcified ligaments compared to bone. The needle is "walked" off or around bony obstacles until it penetrates the dura. When the tip of the needle penetrates the ligamentum flavum, a loss of resistance is often felt. If, at this point, cerebrospinal fluid does not appear in the needle hub, advancing the needle a little further so that it pierces the dura should produce cerebrospinal fluid flow. Alternatively, when repeatedly encountering bone or calcified ligaments, a paramedian approach that avoids the midline ligaments, the spinous processes, and the lamina can be advantageous.

Continued unsuccessful attempts to reach the subarachnoid space may be harmful and associated with complications, such as bleeding, nerve injury, and pain. Anesthesia textbooks, journal articles,[4–7] and videos[8] (see Supplemental Digital Content, Video, http://links.lww.com/AACR/A474) provide valuable recommendations and guidelines for various approaches to spinal anesthesia. It is important that trainees and instructors are familiar with these recommendations and know how to troubleshoot spinal anesthesia and alter their approach when the needle repeatedly encounters osseous structures, or they are unable to access the intrathecal space. The alterations include choosing another interspace, avoiding the midline by using a paramedian or Taylor's approach,[9] changing the patient's position, using a larger single stiffer spinal needle without an introducer in older patients who are unlikely to experience postdural puncture headache,[10] using a model (Figure 6) to illustrate to the trainee the possible reasons for failure, and if skilled using ultrasonography.[11] See the Table for a discussion of these alterations.

As the teacher does not know what the trainee perceives when the needle is advanced during lumbar puncture, it is difficult for the instructor to suggest the next steps when there is no success. This is why the guidance provided with the white cane JiTT and using the "blind person's white cane" analogy might prove helpful. Providing trainees with a white cane JiTT handout, as well as reviewing any available radiographs of the patient's lumbar spine, the evening before or just before the planned spinal anesthetic obviates the need to communicate the basic skills in the operating room during the procedure when the patient is listening.

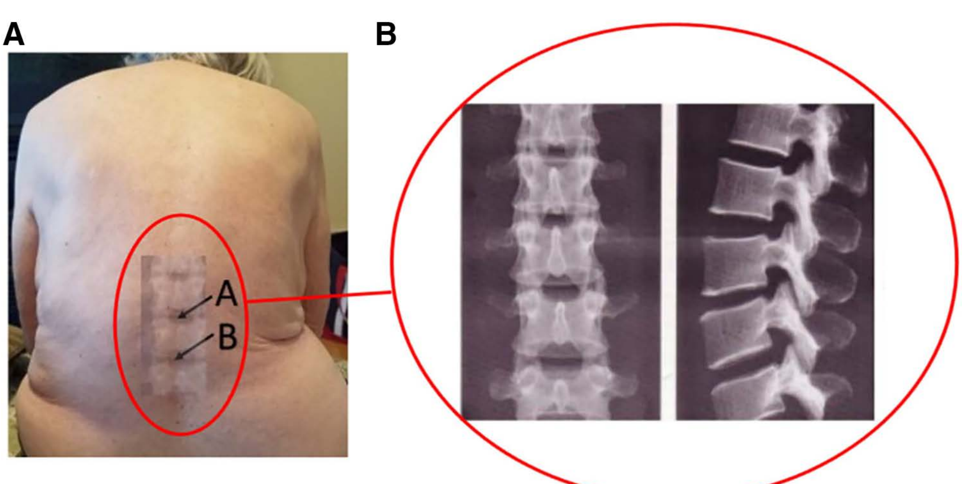

Figure 2. Model seated for spinal anesthesia with overlay of a normal spine. A, Superimposition of a normal spine, without arthritis or scoliosis over the model's surface anatomy. B, Enlargement of the superimposed normal spine. Used with permission from Squire's Fundamentals of Radiology, Fourth Edition by Robert A. Novelline, Cambridge, MA: Harvard University Press (for spine images). All rights reserved.

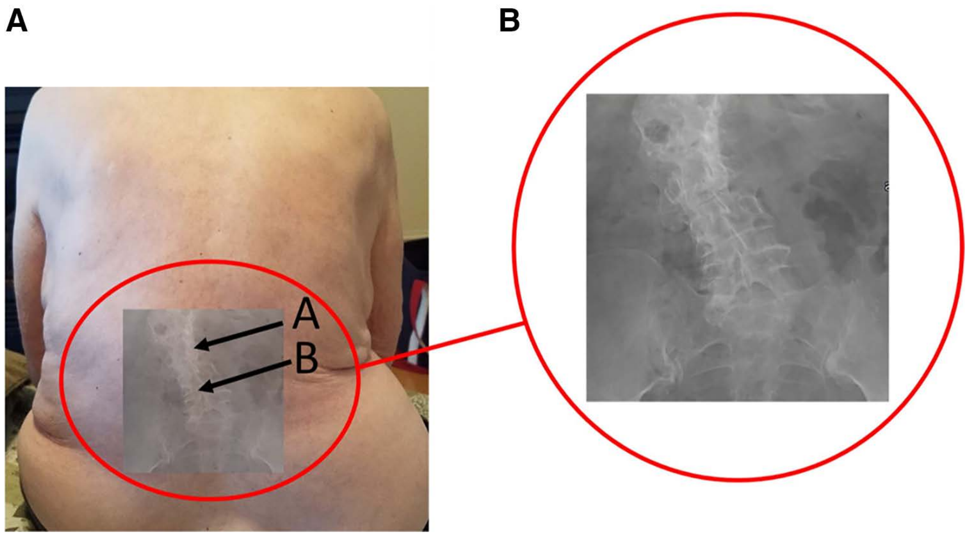

Figure 3. Model seated for spinal anesthesia with overlay of her arthritic spine. A, Superimposition of the model's actual radiological image over her surface anatomy. B, Enlargement of the actual radiological image.

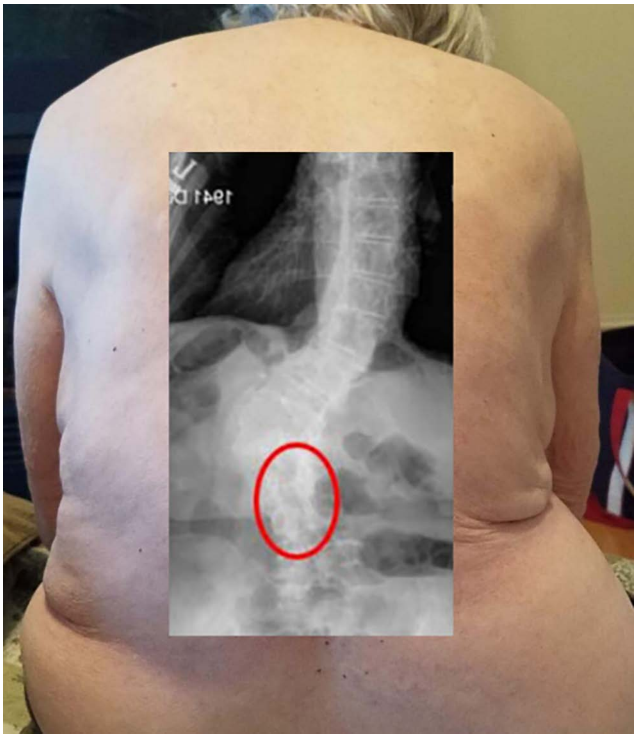

Figure 4. Superimposition of the model's radiological image showing her scoliosis. The red circle is the approximate location of the interspaces (A and B) shown in Figure 1.

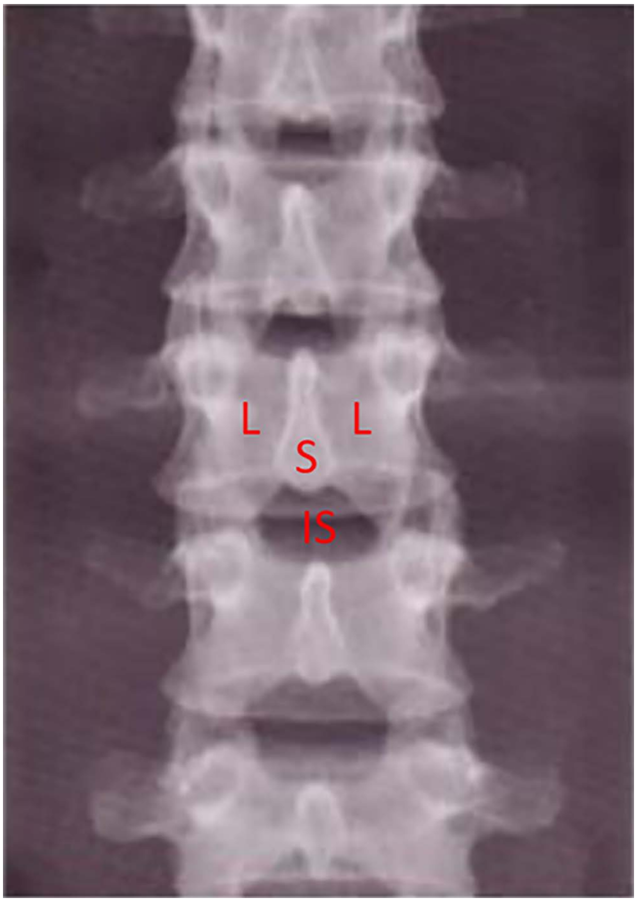

Figure 5. Radiographic image of a normal spine. Spinous process (S), lamina (L), and interspinous space (IS). Used with permission from Squire's Fundamentals of Radiology, Fourth Edition by Robert A. Novelline, Cambridge, MA: Harvard University Press (radiograph). All rights reserved.

It is important to recognize when one should abandon further attempts to perform a spinal anesthetic. A mature and caring provider understands that stopping is better than persisting and causing pain or injury. When trainees are unsuccessful, a debriefing can be effective for learning the next steps to acquire the necessary knowledge and approach to becoming successful. As it is with all complex anesthetic procedures, the skills required to perform spinal anesthesia improve with experience.

In summary, the trainee should carefully probe their way with the needle tip while mentally visualizing (white cane analogy) the anatomy of the osseous structures and the ligaments that are encountered by the needle. They should deduce how to alter their approach until they reach the subarachnoid space or decide to abandon the procedure.

Figure 6. A 3-dimensional model of the lumbar spine.

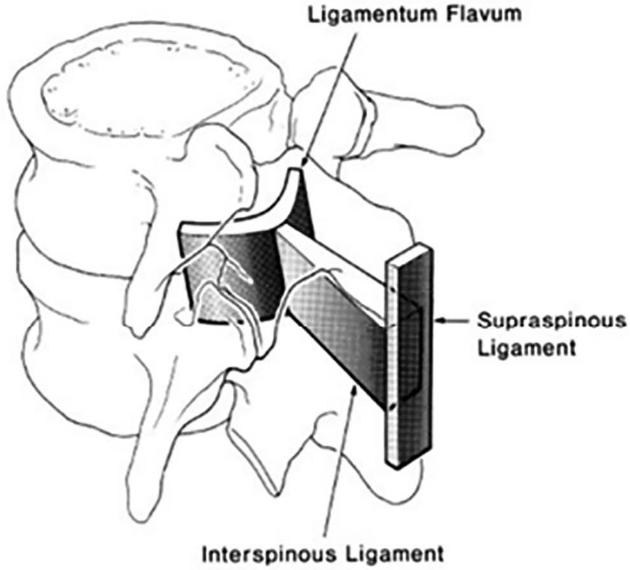

Figure 7. Spinal ligaments. Used with permission from M. J. Cousins and P. O. Bridenbaugh, Neural Blockade In: Clinical Anesthesia & Management of Pain, Figure 8-8, page 186, Copyright, Wolters Kluwer, 1980.

Table. Suggested Adjustments When Spinal Anesthesia Proves Difficult

Adjustment	Discussion
Choose a different interspace	Multiple failed attempts at 1 interspace are less likely to be successful. Moving to a different interspace may result in success.
Consider a paramedian approach	The needle is inserted 1 cm lateral to the superior aspect of the inferior spinous process. The needle is directed slightly medially. If lamina is contacted, the needle is redirected cephalad until it enters the subarachnoid space, and cerebrospinal fluid is obtained.
Consider Taylor's method	Taylor's method is a modification of the paramedian approach. It is performed at the L5-S1 interspace, the largest interlaminar space. The spinal needle is inserted in a cephalo-medial direction, 1 cm medial and 1 cm caudal to the lowermost prominence of the posterior superior iliac spine.[9]
Consider the lateral decubitus position	A well-trained assistant can often improve positioning in a recumbent patient who is heavily sedated, compared to a less-sedated patient in a seated position. The increased sedation that is possible in the lateral decubitus position may also improve patient cooperation.
Consider a larger stiffer spinal needle without an introducer	In patients >60 years of age, consider a 22-gauge, 3.5-inch, Quincke needle. A single stiffer spinal needle is easier to maneuver than a smaller gauge more flexible spinal needle inserted through an introducer. Older patients are less likely to develop a postdural puncture headache.[10]
Utilize a model of the spine	Illustrate to the trainee which osseous structures the needle may be encountering (Figure 6).
Consider ultrasound	In the patients with difficult spinal anatomy, a periprocedural ultrasound of the back can identify the midline and aid with lumbar puncture though this requires ultrasonography skills.[11]

CONCLUSIONS

When performing spinal anesthesia, it is important to consider that the surface anatomy may not represent the position or anatomy of the underlying structures. Teaching spinal anesthesia may be challenging because the trainee and supervisor are both "blind" to the underlying anatomy. Sharing a simplified white cane JiTT approach to the procedure with the trainee and using the "blind person's white cane" analogy may increase the success rate and result in improved patient, trainee, and instructor satisfaction. Unfortunately, there is no evidence that the white cane JiTT improves the transfer of knowledge or skills. Additionally, this teaching method may prove valuable in underdeveloped countries, where simulation equipment and ultrasound may be unavailable.

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DISCLOSURES

Name: Donald H. Lambert, PhD, MD.
Contribution: This author imagined and created the white cane teaching method, and he is responsible for the manuscript's content.
Name: BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA.

Contribution: This author provided extensive collaboration including major rewrites and revisions.

This manuscript was handled by: BobbieJean Sweitzer, MD.

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