Reviewer's report

Title: A novel approach to neuraxial anesthesia: application of an automated ultrasound spinal landmark identification

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Reviewer: Vincent Chan

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This prospective study examined the usefulness of a new automated ultrasound spinal landmark identification for lumbar spinal anesthesia in 100 surgical patients who required spinal anesthesia. This Gabor-based automatic ultrasound spinal level identification system was reported in Conf Proc IEEE Eng Med Biol Soc. 2017:3146-3149. According to the inventors, "spine level identification is initiated by detecting the location of the sacrum using a classifier based on a support vector machine. Image stitching is then conducted to produce a panorama image of the spinal area. During this process, the location of spinal processes are enhanced using a Gabor filter and detected through template matching. The locations of the spinal processes are tracked and used as an overlay on the ultrasound image in real-time. The system then informs the anesthetists when the correct spinal level has been reached."

To me as a lay person, I don't understand how this intelligent image processing system works and how it identifies ultrasound spinal landmarks e.g., spinous processes, interspinous spaces (in particular the L3/4 interspinous space), the sacrum, the transverse processes, the laminae and the anterior and posterior dural complexes. Does this system still require clinician input to designate the spinal levels? Please explain.

Figure 1 is designed as the midline view of the lumbar spine. In fact, the bigger sonogram (upper panel) is most likely showing the laminae and not the spinous processes since they are quite deep. One would expect the spinous processes to be quite superficial (< 2 cm from skin) in most non obese subjects. The sonogram in the lower panel seems to show the L5-S1 interlaminar space. Again I am not convinced the sonograms show spinous processes and interspinous spaces.

Figure 2 is a transverse view showing the interspinous space. The hyper echoic line seems to be the anterior dural complex but it is unusually wide. I cannot tell where the posterior complex and the ligamentum flavum are.

To help the readers better understand, please describe your automated ultrasound spinal landmark identification process step by step using photos, images and sonograms.
The primary hypothesis of the study is that automated spinal landmark identification algorithm using image processing system would achieve a mean 90% first attempt success rate of spinal anesthesia. In my opinion, your study primary hypothesis should be a correlation between spinal landmark identification by the automated machine and identification by an expert anesthesiologist skilled in spine imaging. The key to a successful spinal needle insertion is multifactorial and not just related to proper identification of the interspinous space. Operator error e.g., wrong needle advancement angle can lead to failure too.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

No

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

No

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If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I recommend additional statistical review

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