CORRESPONDENCE

Comparison between a novel 2D–3D ultrasound system (Accuro®) and conventional two-dimensional ultrasound for assessment of the lumbar spine: a prospective cohort study in volunteers

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To the Editor,

Preprocedural ultrasound (US) assessment has been shown to increase efficacy and safety of neuraxial anesthesia.[1] Accuro® (Rivanna, Charlottesville, VA, USA) is a novel portable handheld US device designed to generate an automated three-dimensional image to identify a desired intervertebral space, the optimal insertion point at that interspace, and the distance from skin to the epidural space using a computer-aided detection algorithm. We sought to determine the agreement between Accuro and a conventional two-dimensional (2D) US when used for these tasks—particularly the identification of a given interspace, which is an essential safety component of neuraxial anesthesia.

This prospective cohort study was approved by the Research Ethics Board at Mount Sinai Hospital, Toronto, ON, Canada. Fifty volunteers aged 18–60 yr were recruited after giving their informed consent. Five investigators trained in both conventional 2D US and Accuro participated in the study. For each volunteer, scanning was performed by two randomly chosen investigators; the

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first used Accuro and the second used conventional 2D US (M-Turbo, Fujifilm SonoSite, Inc., Toronto, ON, Canada). We sought to identify the L3-L4 interspace. The Accuro was first moved caudad in a transverse view along the lumbar area until no more interspaces were identified (sacrum); it was then moved cephalad until the third interspace (assumingly L3-L4) was identified. Using an invisible ink pen, this space was marked. The optimal insertion point at that interspace was also marked, and the distance to the epidural space depicted on the Accuro screen was recorded. The conventional 2D US was first assessed in a longitudinal paramedian oblique view starting from the sacrum and moving cephalad to identify the L3-L4 interspace, followed by a transverse view to confirm the interspace and determine the optimal insertion point at that interspace as well as the distance to the epidural space.

The primary outcome was the presence of concordance of the interspace thought to be L3-L4. Secondary outcomes were the differences between the insertion points and between the distances to the epidural space in those cases where the interspace concurred.

We assessed the degree of agreement in the primary outcome with both kappa statistics and the concordance rate (95% confidence interval [CI]). For the distance to the epidural space, we used Bland–Altman analysis and calculated the intraclass correlation coefficient (ICC). Data management and all statistical analyses were performed using SAS 9.3 (SAS institute Inc., Cary, NC, USA).

Of the 50 volunteers, we excluded two because of impossible image acquisition using Accuro. The estimated kappa for the degree of the agreement between the two devices in the primary outcome was -0.37 (95% CI, -0.64 to -0.10) and the concordance rate was 46% (95% CI, 32 to 60), both suggesting poor agreement. In cases where

agreement on the L3-L4 interspace was observed, the median [interquartile range] differences between the insertion points and between the distance to the epidural space were 5 [3–9] mm and 5 [2–12] mm, respectively. Bland–Altman analysis of the distance to the epidural space showed a mean difference of -0.7 cm, with limits of agreement of 0.3 cm (95% CI, 0.9 to -2.2); the ICC between the two devices was 0.1, indicating poor agreement.

Given that Accuro is designed to acquire images only in the transverse view, it is possible that the chance of missing an interspace may be higher when compared with a combination of longitudinal and transverse views used with conventional 2D US. Regarding the poor agreement on the insertion point and distance to the epidural space, the anatomical references used to determine the distance to the epidural space in the two techniques could explain this discrepancy: while Accuro uses the articular process, we used the posterior complex for 2D US. Nevertheless, some error is expected with both techniques.[2,3] We did not use a gold standard imaging technique such as magnetic resonance imaging to confirm the L3-L4 interspace. Similarly, we did not have the gold standard of the actual number of passes or the actual needle depths to determine the accuracy of the insertion point and distance to the epidural space. Therefore, we can only comment on agreement between the two devices, not on accuracy of each device. Further studies are needed to understand the poor agreement between the two devices/techniques and to establish their accuracy compared with gold standards.

References

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