

Introduction

Preprocedural neuraxial ultrasound has been demonstrated to improve neuraxial puncture success rate, by identifying optimal interspace insertion, and decreasing the number of needle redirections. It is also associated with improvement in the first pass rate^(1, 2).

The Accuro (Rivanna Medical, Charlottesville, VA, USA), is a portable ultrasound that has pattern recognition software to identify bony landmarks, the midline, and depth of epidural space. The device has a screen display that presents real-time 3D navigation of the lumbar and thoracic spine⁽³⁾. It also provides the depth to the spinous process and epidural space in centimetres (Figure A). We sought to evaluate its use on our labour ward.

Methods

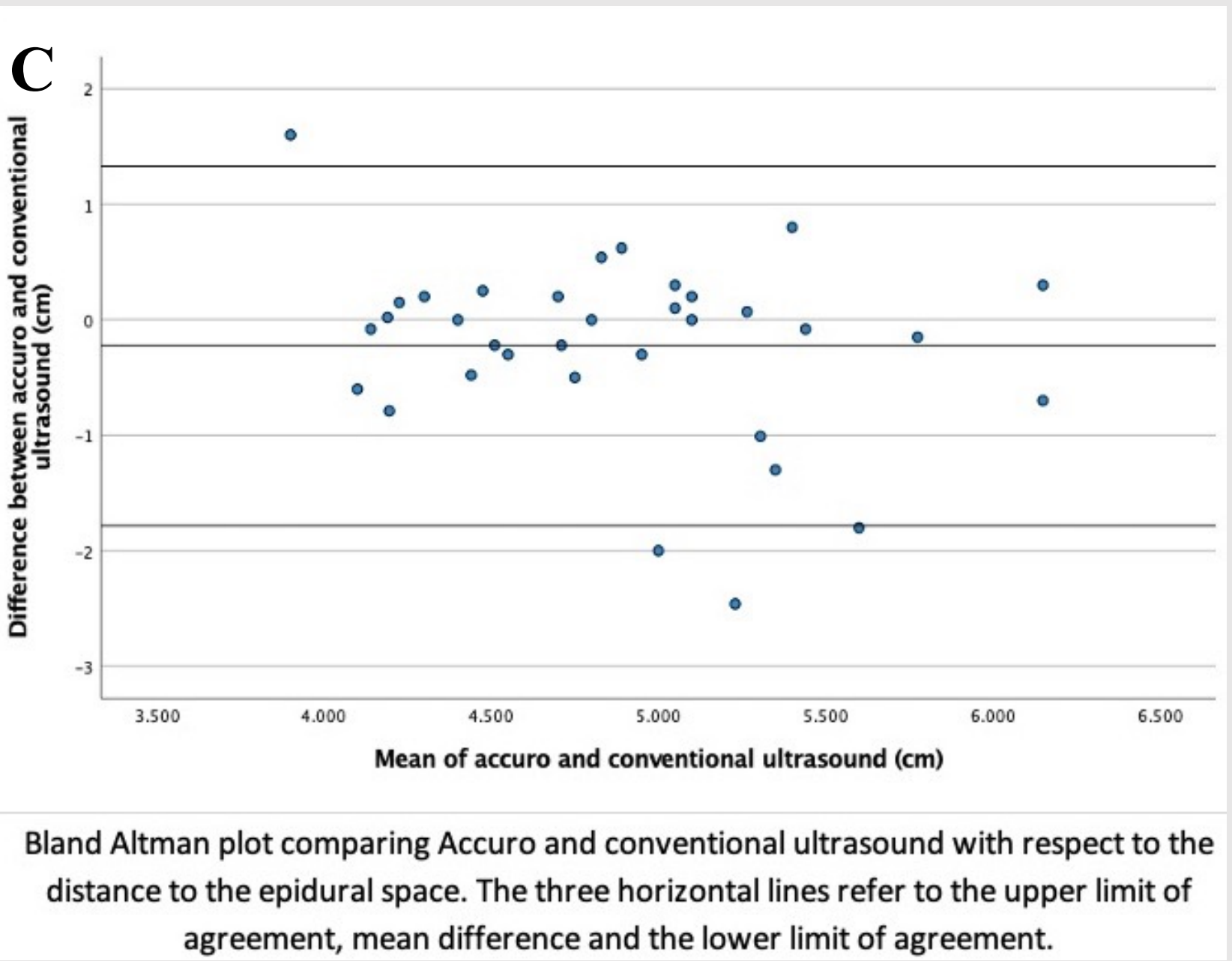
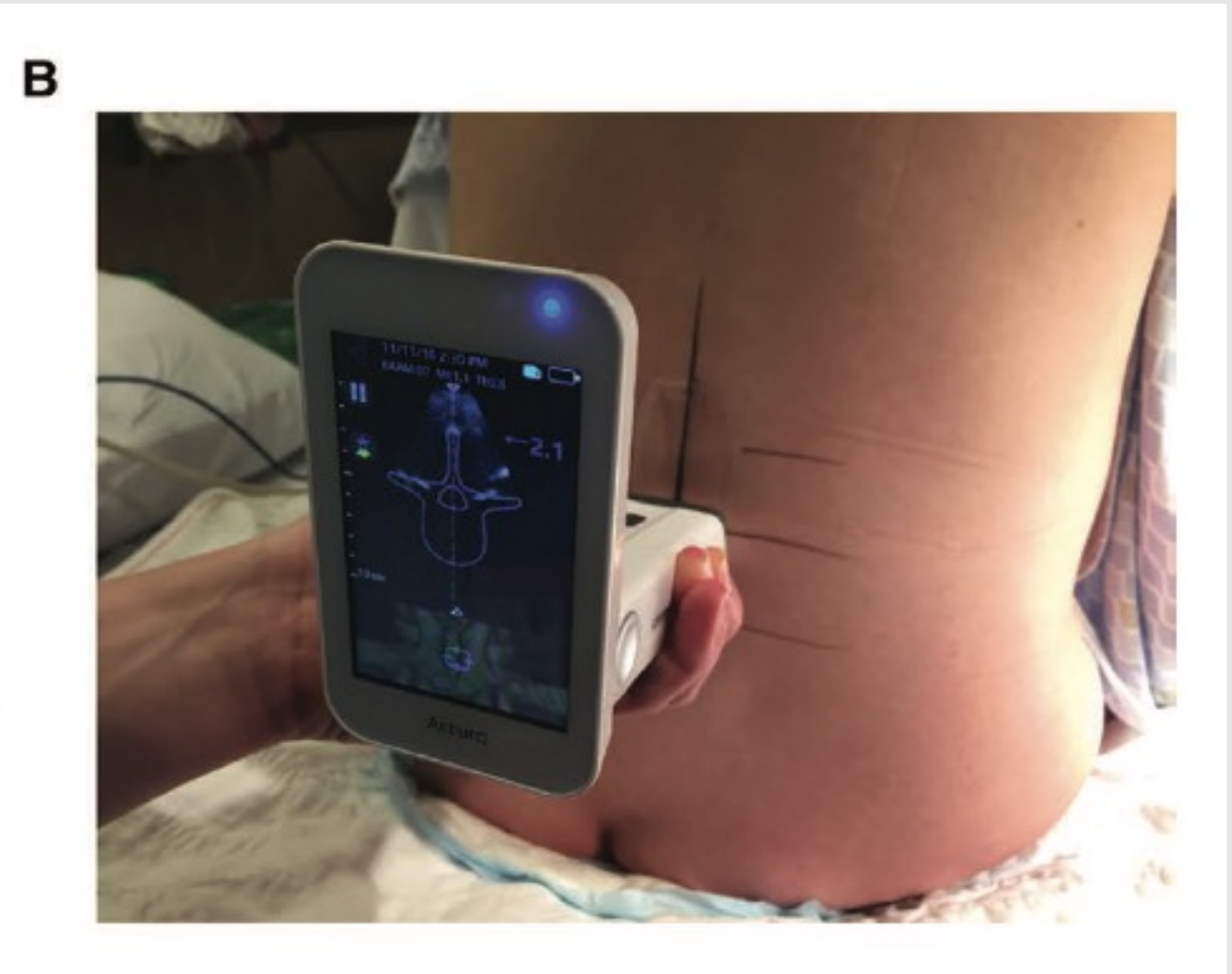
Approval for this service evaluation was gained from the governance team. Over a period of 4 months we compared the Accuro to conventional ultrasound. Obstetric patients requiring labour analgesia or obstetric operative intervention (epidural, spinal or combined-spinal-epidural) had their lumbar vertebrae scanned. The ultrasound operators were specialty registrars and obstetric anaesthetic consultants. The experience of those performing the neuraxial procedure varied from junior anaesthetic trainees, to senior obstetric anaesthetic consultants.

Initially conventional ultrasound was used to locate and mark the L3/4 intervertebral space, by scanning superiorly from the sacrum, in the longitudinal paramedian view. A transverse view was then used to identify the midline and measure the distance to the epidural space. Subsequently the Accuro, which is designed to only acquire neuraxial images in the transverse view, was used to find the midline and measure the distance to the epidural space, in the same L3/4 space (Figure B). The Accuro locator needle guide was then used to mark the needle insertion site. The distance to epidural space was recorded, even if spinal anaesthesia was planned.

Further information was also collected: number of needle reinsertions/redirections, and depth at which loss of resistance occurred with a Tuohy needle.

References

1. Young B, Onwochei D, Desai N. Conventional landmark palpation vs. preprocedural ultrasound for neuraxial analgesia and anaesthesia in obstetrics - a systematic review and meta-analysis with trial sequential analyses. *Anaesthesia* 2021; 76: 818–831.
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3. Caicedo J, Balki M, Arzola C, et al. 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. *Canadian Journal of Anaesthesia* 2021; 68: 1711–1712.



Results

A total of 34 patients were included. Median (IQR) body mass index was 26 (17–35) kg/m². No patients had had previous lumbar surgery, and scoliosis was present in 12%. Spinous processes were assessed to be easy, moderate or difficult to palpate in: 59%, 26%, and 15%, respectively. The ultrasound operator was a consultant in 29% and speciality registrar in 71%. The neuraxial operator was a consultant, speciality registrar, fellow, core trainee or obstetric novice in: 15%, 47%, 3%, 18% and 18%, respectively.

Comparing the estimated distance with actual distance showed that conventional ultrasound on average, underestimated the distance to the epidural space by 0.43cm. In comparison, the Accuro underestimated the distance to the epidural space, by 0.73cm.

We found the mean difference in distance to epidural space between the Accuro, and conventional ultrasound was 0.225 cm, and the intraclass correlation coefficient was 0.5, indicating moderate agreement, as shown by the Bland Altman plot, (Figure C).

The overall first pass success rate was 50%, and the median number (IQR) of needle insertions and redirections was 1 (0–2) and 1.29 (0–3.29).

Discussion

The Accuro showed moderate agreement with conventional ultrasound in measuring the depth to epidural space. Future studies are required to fully evaluate its use.

When conventional ultrasound measures the distance from skin to the epidural space, it uses the echogenicity from the posterior complex. The Accuro uses the articular process to determine the epidural space depth. This could account for the slightly larger underestimation by the Accuro, and difference between the two ultrasound devices.

Both conventional ultrasound and the Accuro underestimate the distance to the epidural space when compared to the actual distance. The underestimation by both devices may be attributed to probe pressure exerted on skin whilst scanning, causing compression of the subcutaneous tissue and reducing the distance to the epidural space. However, an underestimation provides a margin of safety whilst performing the neuraxial procedure.

Preprocedural ultrasound is thought to be associated with improved siting of neuraxial procedures. Though the adoption of neuraxial ultrasound may be limited due to technical competence in obtaining adequate views. The Accuro could bridge this gap in technical expertise by reducing the learning curve of neuraxial ultrasound, through automated image reconstruction, thereby encouraging widespread use of preprocedural ultrasound. It would also serve as an instructive teaching aid for newcomers to obstetric neuraxial ultrasound.