

Fully Automated Artificial Intelligence Based Software for Bladder Volume Calculation by Two-Dimensional Ultrasound

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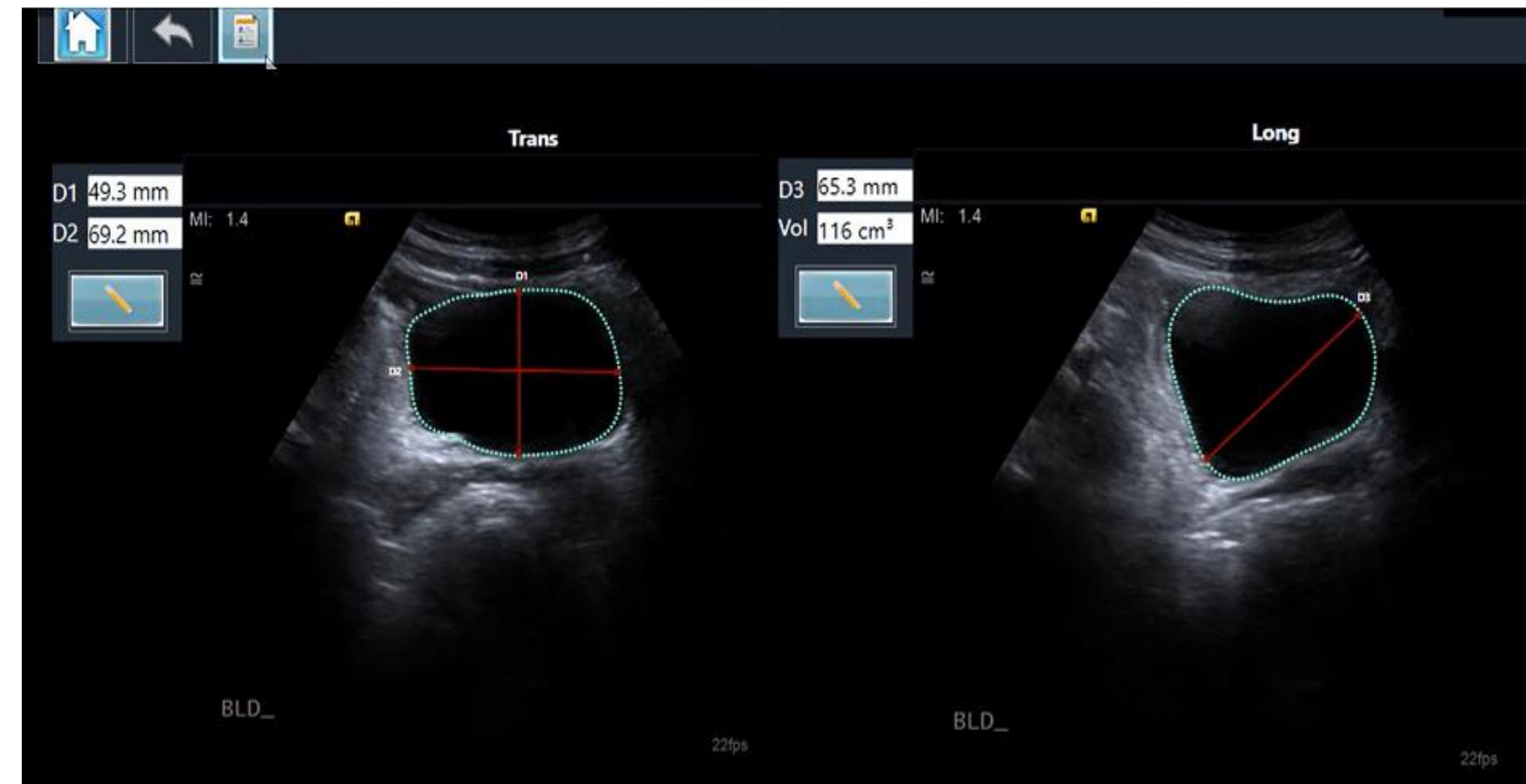
STUDY OBJECTIVE

To evaluate the performance of an artificial-intelligence (AI) based software for fully automated bladder volume calculation using two-dimensional (2D) ultrasound (US).

METHODS

Bladder volume (BV) measurement, using 2D US devices, is routinely done in the radiological setting, manually by an expert sonographer as part of an abdominal US examination. In the point-of-care (POC) environment, BV is measured frequently by dedicated bladder scanners. When using 2D US, BV evaluation is done mostly by visual estimation to assist decision-making for catheter placement in patients presenting with a concern for urinary retention. Both methods are subjective and time consuming. Automated BV calculation will allow rapid BV measurement and improve the clinician's accuracy in both settings. In this study, abdominal US examinations, performed and manually traced by an expert sonographer, were retrospectively collected from a series of urgent care clinics. The scans were automatically processed by LVivo Bladder™ (DiA Imaging Analysis) and the results were compared to the manual measurements.

RESULTS



A total of 114 transverse (Trans) and longitudinal (Long) image pairs of the bladder, from 108 patients, were evaluated in the study (108 pre-voiding and 6 post-voiding) were retrospectively collected from a series of urgent care clinics. Automated evaluation [Fig 1] was possible in 98% of the cases, one outlier was manually excluded due to dropout of the bladder boundaries.

Excellent correlation [Fig 2] was found between automated and manual BV measurement with $r=0.97$ [95% CI: 0.96-0.98], with an average difference and limits of agreement of 17.1 ± 69.7 ml.

Figure 1: Results example of the automated bladder volume calculation

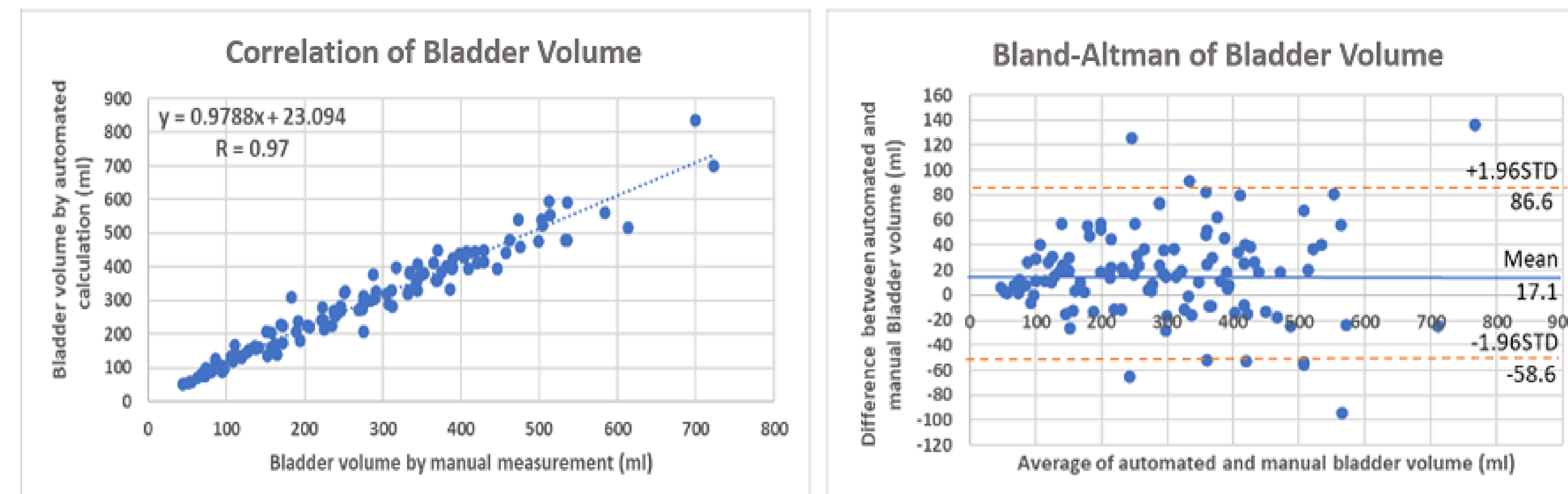


Figure 2. Left: Correlation between manual and automated bladder volume measurement. Right: Bland-Altman plot

CONCLUSION

This study showed that the AI-based software provides accurate, fully automated, quantitative calculation of the bladder volume from 2D US images. This method demonstrated excellent correlation and agreement with manual BV measurement and therefore has the potential to be used for accurate and rapid bladder volume evaluation in the radiology setting and bedside evaluation at the POC.