365
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THREE-DIMENSIONAL BLADDER ULTRASONOGRAPHY WITH THE BLADDERSCAN® OVERESTIMATES POST VOID RESIDUAL ONE WEEK AFTER DELIVERY.

Hypothesis / aims of study

Symptomatic postpartum urinary retention is a frequent complication after childbirth.

The three-dimensional bladder ultrasonography (US, using the BVI 3000®, Verathon, WA, USA) (BladderScan®)is often used in the Netherlands as a method of measurement to determine post void residual (PVR) after delivery. With this study, we intend to ascertain whether the BladderScan® is a reliable instrument for measurement of PVR in patients with postpartum urinary retention who conducted a micturition trial one week after delivery.

Study design, materials and methods

To answer this question, we performed a prospective cohort study. We have gathered data of 21 women after delivery. All of them had a urinary retention of over 1000ml within 4 to 5 hours postpartum. Conform protocol, an indwelling catheter was applied for one week. After removal of the indwelling catheter in the morning, a micturition trial was conducted in the afternoon. In our protocol, a catherisation is a normal procedure for evaluating PVR, but the BladderScan® is used as well. In this study, PVR was measured with the BladderScan®. All women were catheterised after the scan. Clean intermittent catheterisation(CIC) is the gold standard for measuring PVR.

The measurement of PVR was conducted by a continence nurse specialist who is instructed in how to conduct a reliable measurement by the firm Verathon, developers of the BladderScan®. All measurements were conducted according to the instructions of the Bladderscan.

Statistical analysis was performed using IBM SPSS Statistics version 20.0. A two-sided p-value < 0.05 was considered to indicate statistical significance. To determine difference between PVR data of the BladderScan® and CIC we used the Wilcoxon test. For categorical characteristics frequencies were analysed in contingency tables with χ^2 statistics. Continuous variables are depicted as median with interquartile range (IQR). We calculated the sensitivity, specificity and positive predictive value of our PVR measurements with BladderScan®.

Results

We have gathered data of 21 women after delivery. In all patients a BladderScan® and CIC was performed. In 17 patients, the micturition trial was performed after 1 week. Two patients were measured after 2 weeks (because the first measurement after one week was > 200 ml and they preferred an indwelling catheter). One patient was measured after 24 hours and one patient was measured after three weeks (both because of patient preference). Median BladderScan® PVR was 378 ml (IQR 335-574) and median CIC PVR was 150 ml (IQR 35-200). In one patient, the BladderScan® measured ≤ 200ml, and in 20 patients the Bladderscan indicated that there was a PVR > 200ml (table 1). However, in 16 of these 20 patients, CIC showed a PVR ≤ 200ml. The average PVR difference between measurements with the BladderScan® and CIC was 285 ml (p <0.001). With a cut-off point of 200 ml PVR volume, the sensitivity of the BladderScan® was 100% and the specificity was 5,9%. Positive predictive value was 20%.

Table 1

Clean Intermittent Catheterisation				
BladderScan®		≤ 200 ml	> 200 ml	Total
	≤ 200 ml	1	0	1
	> 200 ml	16	4	20
	Total	17	4	21

X^2 p=1.00

Interpretation of results

The firm Verathon indicates that a deviation of PVR should be less than 20% (1). However, the median percentual difference between CIC and BladderScan® is 276% (IQR 100-745%) in our study. Because of the overestimation of the PVR measurements of BladderScan® 16 patients (81%) received unnecessary CIC. Unnecessary CIC leads to discomfort for the patient and higher risk for urinary tract infection.

Only one study (2) has been found which states that the BladderScan® BVI 3000® is a sound, non-invasive method of measuring PVR. In this study, 20 measurements were conducted with the BladderScan®. In two patients, the PVR was overestimated by the BladderScan® (669ml versus 200ml and 434 ml versus 50ml). The explanation given for this overestimation is that blood clots in the uterus may have been measured instead of bladder volume. However, this study started measuring 6 hours postpartum up (until a bladder volume of <300 ml). The BladderScan® measurements of >1000 ml and unability to void <6 hours were regarded as exclusion criteria.

Our study is performed in a different group, one week postpartum versus 6 hours postpartum in the reference study (2). The overestimation of the BladderScan® PVR measurements could be explained by difficult discrimination between bladder and uterus. We speculate that the volume of the uterus is included in the PVR results of the BladderScan®.

Further research is needed to analyse whether BladderScan® PVR measurements directly after birth also lead to an overestimation of the PVR volumes. If this overestimation is established the BladderScan® might be used as a reliable measurement device if a correction is applied. If a standard correction could not be applied, it is desirable to conduct further

research to a different reliable, non-invasive method of measuring PVR postpartum. An example of this could be PVR measurement through imaging with an abdominal echo.

Concluding message
These results indicate that measurement of PVR one week postpartum using the BladderScan® is not a reliable method. In 81% of all cases, catheterisation was unnecessary.

References
1. BVI3000-users-manual, 2015, Verathon;47-49
2. van Os AFM, Van der Lindern PJQ. Reliability of an automatic ultrasound system in the postpartum period in measuring urinary retention. Acta Obstet Gynecol Scand 2006;85:604-607

Disclosures