380
Yip S, Sahota D, Chang A
The Chinese University of Hong Kong

TO DETERMINE THE PRECISION AND ACCURACY OF ULTRASOUND MEASUREMENTS OF POST VOID RESIDUAL BLADDER VOLUME (PVRBV) IN POST-PARTUM WOMEN: A VALIDATION STUDY

Aims of Study
To determine the precision and accuracy of ultrasonic assessment of the post void residual bladder volume (PVRBV) in post-partum women.

Methods
Ultrasound estimated PVRBV were performed on 99 consecutive women with post-partum urinary retention, in order to validate 11 published trans-abdominal ultrasound bladder volume-estimation formulae:

Formulae	Derived from	Reference
$V1 = (W \times Dl \times H - 3.14) \div 2.17$	Empirical data	McLean and Edell 1978 [1]
$V2 = (Pi \times W \times Dl \times H) \div 6$	Ellipsoid	Griffiths *et al.* 1986 [2]
$V3 = (8 \times Al \times At) \div (3 \times Pi \times Dt)$	Ellipsoid	Griffiths *et al.* 1986 [2]
$V4 = 0.75 (Al \times At)^{3/4}$	Sphere	Griffiths *et al.* 1986 [2]
$V5 = Al \times W$	Empirical data	Griffiths *et al.* 1986 [2]
$V6 = H \times Dl \times W$	Empirical data	Pedersen *et al.* 1975 [3]
$V7 = H \times Dl \times W \times 0.7$	Empirical data	Poston *et al.* 1983 [4]; Kiely *et al.* 1987 [5]
$V8 = H \times Dl \times W \times 0.625$	Empirical data	Hakenberg *et al.* 1983 [6]
$V9 = (H \times W \times (Dl + Dt)) \div 2$	Empirical data	Hakenberg *et al.* 1983 [6]
$V10 = H \times Dl \times 6.6$	Empirical data	Hakenberg *et al.* 1983 [6]
$V11 = W \times H \times 12.56$	Empirical data	Orgaz *et al.* 1981 [7]

Pi = 3.1416
H = cephalo-caudal diameter in the longitudinal scan (cm)
W = widest diameter in the transverse scan (cm)
Dl = anterior-posterior diameter in the longitudinal scan (cm)
Dt = anterior-posterior diameter in the transverse scan (cm)
Al = area in the longitudinal scan (cm)
At = area in the transverse scan (cm)
Hv = maximum bladder diameter in the horizontal (supero-inferior) axis (cm)
Dv = maximum bladder diameter in the vertical (postero-anterior) axis (cm)

This ultrasound predicted volume was compared with the immediately collected catheterized volume. Comparison of individual formula with the catheterized volumes was performed using the Intraclass Correlation Coefficient (concordance), and difference plots (bias, linearity of the difference). All volumes were transformed logarithmically to ensure a Normal distribution.

Results
The post-partum bladder maintained its ellipsoid appearance. Two-way Analysis of Variance (ANOVA) showed the variance of the individual formulae ranged from 83.42 to 3463.66 (SD 9.13 to 58.85). The four formulae with the least variance had an Intraclass Correlation Coefficient ranging from 0.93 to 0.96, and a mean difference between volume estimated by the formula and catheterized volume ranging from -0.0454 to -0.1071 (SD 0.0924 to 0.1129). The error between the value predicted by the formulae and that of the catheterized volume was linear in only one formula: $V2 = (Pi \times W \times Dl \times H) \div 6$.

Conclusions
The results of this study have shown that ultrasonic assessment of the PVRBV in the post-partum period is accurate, and it can be used in place of the invasive trans-urethral catheterization.

References

[1] McLean GK, Edell SL. Determination of bladder volumes by grey scale ultrasonography. Radiology 1978;128:181-2.

[2] Griffiths CJ, Murray A, Ramsden PD. Accuracy and repeatability of bladder volume measurement using ultrasonic imaging. J Urol 1986;136:808-12.

[3] Pedersen JF, Bartrum RJ, Grytter C. Residual urine determination by ultrasonic scanning. Am J Roentgenol 1975;125:474-8.

[4] Poston GJ, Joseph AEA, Riddle PR. The accuracy of ultrasound in the measurement of changes in bladder volume. Br J Urol 1983;55:361-3.

[5] Kiely EA, Hartnell GG, Gibson RN, Williams G. Measurement of bladder volume by real-time ultrasound. Br J Urol 1987;60:33-5.

[6] Hakenberg Owm Ryall RL, Langlois SL, Marshall VR. The estimation of bladder volume by sonocystography. J Urol 1983;130:249-51.

[7] Orgaz RE, Gomez AZ, Ramirez CT, Torres JLM. Applications of bladder ultrasonography. I. Bladder content and residue. J Urol 1981;125:174-6.