Prostate volume estimation: is there need for a change in the standard method?

As men age, prostate enlargement often leads to complications such as obstruction of the bladder neck and urinary retention with potential consequences on the kidney. Therefore, knowledge of prostate volume is required to help clinicians effectively manage their patients with medicines or surgery. Transrectal ultrasound is the most common method used when estimating prostate volumes. These ultrasounds are programmed to estimate prostate volume by a simple formula: L x H x W × 0.52, named as the “ellipsoid formula” based on prostate dimensions where L = length, H = height and W = width. However, this formula is not very accurate. Another formula called the “bullet formula” (L x H x W × 0.65) was proposed to improve accuracy in 2009. Even though it did increase accuracy somewhat, the bullet formula was not integrated in clinical practice. These conflicting formulas prompted our research team to determine the best possible formula to estimate prostate volumes by considering the true fresh prostate volumes for comparison purposes.

Freshly resected prostates were obtained from 153 patients. These prostates were weighed and measured for their length, height and width. Next, their volumes were established by multiplying their mass by their density. Measured volumes from freshly resected prostates along with their respective ultrasound-obtained dimensions were then used to calculate a new coefficient from the rearranged algebraic formula: Coefficient = V/L x H x W (where L, H and W were the dimensions obtained by ultrasound, and V was the true prostate volume from fresh prostates). This led to a calculated average coefficient of 0.66, thus yielding a new formula: L x H x W × 0.66. To test this newfound equation against the ellipsoid and bullet formulas, linear regression plots were created and compared. Three different regressions were drawn after removal of outliers. The regression using the ellipsoid formula yielded the equation $0.7278x + 5.1463$ with an R^2 of 0.55. When using our novel formula, the linear regression equation was improved to $y = 0.9309x + 5.6897$ with an R^2 of 0.64. Finally, when assessing the bullet formula, the equation was $y = 0.8867x + 7.1574$ with an R^2 value of 0.60. Evidenced by these results, our formula with 0.66 as the coefficient performed better at estimating prostate volume as compared to the bullet formula, and especially the ellipsoid formula, the current standard. Furthermore, we were interested in finding out if a relationship exists between prostate volume and formula used. We noticed that the ellipsoid formula is more applicable to smaller prostates (less than 30 cc), while the bullet and our novel formula conform better to medium- to larger-sized prostates (more than 30 cc), as frequently found in patients consulting urologists or family doctors for lower urinary tract symptoms.

This new coefficient provides a more accurate estimation of true prostate volume compared to the universally established ellipsoid coefficient. This finding supports a proposal to change the ellipsoid formula to L x H x W × 0.66 in equipment measuring prostate volumes.

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Publication

Improving ultrasound-based prostate volume estimation
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BMC Urol. 2019 Jul 24