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Title: THE ULTRASOUND MEASUREMENT OF PROSTATE VOLUME: SUPRAPUBIC VERSUS TRANSRECTAL IMAGING

Aims of Study:

The measurement of prostate volume is useful in defining the nature of the problem in a man with LUTS, as well as for planning any surgical intervention. In clinical practice the size of the prostate is often noted during suprapubic ultrasound (SPUS) assessment of bladder volume, but in clinical trials transrectal studies (TRUS) are advocated as an accurate and repeatable measurement. Our data suggest that total volume is as good as any other measurement of the prostate in the prediction of urodynamically defined obstruction. It thus might be useful to know the most accurate way to measure prostate volume from suprapubic images to allow a single comprehensive assessment of the male lower urinary tract. We have compared the imaging and measurements from suprapubic and TRUS images of the prostate.

Methods:

Suprapubic and transrectal imaging of the prostate was carried out in 125 patients. Images of the midline sagittal plane and the largest transverse section of the prostate were digitised and saved in a database. Images were obtained by the same observer three times in 100 men and by 3 different observers in 25. The cranio-caudal length of the prostate was measured from the sagittal images, the width from the max transverse image and AP diameter was measured from both. Prostate diameters were measured by a single observer on the digitised pictures using the Scion graphic package. Data were analysed with the StatView (v. 5.0.1) statistical package.

Results:

Intraobserver variability in suprapubic and transrectal prostate imaging was found to be not clinically relevant.

Table I	Volume 1	Volume 2	Volume 3	p-value
Intraobserver (100 pts)				
Suprapubic	60.6 +/- 24.5	60.2 +/- 23.6	60.2 +/- 23.0	0.1591
Transrectal	55.1 +/- 24.8	55.4 +/- 24.8	55.9 +/- 24.4	0.0892
Interobserver (25 pts)				
Suprapubic	64.7 +/- 29.7	63.4 +/- 27.6	63.2 +/- 27.4	0.0088
Transrectal	61.7 +/- 23.7	62.1 +/- 23.0	62.0 +/- 22.3	0.6117

Intra-observer error in prostate imaging was statistically present but of no more than 1 mm for any distance or 1 ml for any volume and thus was of no clinical importance.

Interobserver variability in prostate imaging was statistically significant but clinically irrelevant as the observed differences were always less than 1 mm and less than 2 ml.

It was discovered that there were significant differences in the prostate volume from the 2 routes if the AP diameter from the transverse image was used. The measurement error was up to 25 mls, a level which was

felt to be clinical significant.

Using the AP diameter from the sagittal image in both routes the differences in volume measurement were statistically significant but of little clinical relevance.

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Table II:

	Prostate diameters (mm)			Prostate Volume (ml)
	C-C	A-P	L-L	
Suprapubic	48.0 (8.3)	44.0 (7.8)	52.5 (8.8)	60.0 (23.7)
Transrectal	48.3 (9.2)	41.2 (7.4)	50.6 (8.1)	55.2 (24.6)
Difference				
Mean	-0.3	3.1	1.8	5.2
95% C.I.	-1.2 to 0.5	1.9 to 4.3	1.0 to 2.7	2.9 to 7.5
†p-value	0.4422	0.0001	0.0001	0.0001

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†Student's t-test

Conclusions:

The technique of suprapubic imaging of the prostate is more restricted than by transrectal route, because an angled view of the prostate is needed to avoid acoustic shadowing from the pubic bones. Thus the AP diameter of the prostate may be inaccurately recorded in this plane. Despite the need for careful placement of the probe on the abdomen repeated measurement by the same observer or by different observers produced no clinically significant differences in the measurements of distance or volume.

Statistically significant differences in prostate volume can be seen between the two routes of imaging but providing the AP diameter is measured in the orthogonal plane to the cranio-caudal length the mean difference is only 5 mls and 95% of patients have a difference of less than 7.2 mls. At present it is assumed that the TRUS deduced volume is more accurate although we are in the process of measuring the absolute prostatic volume by other methods to confirm this.

This study suggests that with the correct technique the prostate volume can be measured accurately during SPUS and that this could be combined with the evaluation of pre-micturition bladder volume and flow rate. It suggests further topics for research into ultrasound imaging of the prostate in patients with voiding dysfunction and it stresses the need for standardisation.

Future work is needed to see if suprapubic imaging can provide the same qualitative information about prostate configuration including the bladder neck and middle lobe as can be obtained by TRUS.

The data regarding prostate volume relative to other parameters such as PSA and urodynamic obstruction needs to be reviewed in the knowledge that an incorrect technique can produce up to 25% error in volume measurement by ultrasound.

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