387

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A CROSS SECTIONAL STUDY OF ULTRASOUND ESTIMATED BLADDER WEIGHT IN A POPULATION OF MEN AND WOMEN WITHOUT LOWER URINARY TRACT SYMPTOMS

Hypothesis / aims of study

The search for a minimally invasive tool to assist in the diagnosis of disorders of the lower urinary tract has led to the use of transabdominal and translabial ultrasound measurement of bladder wall thickness (BWT) and bladder weight (UEBW) to be promoted by some to diagnose bladder outflow tract obstruction or detrusor overactivity. Infravesical obstruction due to benign prostatic enlargement (BPE) leads to hypertrophy of the detrusor and partial outlet obstruction results in a significant increase of bladder weight in animals. Additionally, collagen content in bladder wall specimens is significantly higher in patients with BPE. In one study, a measurement of BWT greater than 5mm by transvaginal ultrasound was an accurate method for diagnosing detrusor overactivity in symptomatic women without outflow obstruction [1] UEBW has additionally been found to be a reliable predictor of infravesical obstruction when compared with pressure flow studies. There is also a highly statistically significant relationship between the bladder weight of cadaver bladders and the UEBW.

The observer variability of the test is relatively consistent making the test easily reproducible Age, resting bladder neck angle, urethral mobility, and maximum urethral closure pressure have all been reported to be associated with an increase bladder wall thickness. Bladder wall thickness in healthy adults has been evaluated but only in a population aged under 40 years, a small increase with age in both men and women was reported.

Given the lack of data from asymptomatic individuals and the rush to use this technique in diagnosis, this study sought to examine the UEBW in asymptomatic men and women with normal bladder health in association with age, body mass index and height in order to establish the extent of normal variation

Study design, materials and methods

Healthy volunteers were recruited from hospital staff, visitors and patients. All were screened using the Bladder Self Assessment Questionnaire [2]. Subjects scoring 3 or above on the questionnaire, having a body mass index of >30kg/m^2 or scoring below 24 on the Folstein Mini-Mental State Examination were excluded from the study. Subjects' weight, height and arm span (as a surrogate for maximum height in later life) were measured and their age and sex were recorded. In addition we calculated body surface area using the Mostellar formula (√height (cm) x weight (kg) / 3600). Each subject underwent 3 measurements of UEBW using the Bladderscan BVM 6500 (Verathon, Aylesbury, England) at a bladder capacity of 2-300ml according to the manufacturer's instructions and a single mean value used for analytical purposes. Subjects whose bladder was not of sufficient capacity at the time of initial scanning were rescanned at twenty minute intervals after taking free fluids until a capacity of at least 200mL was reached. Data from the scans were uploaded via the internet using the proprietary Scanpoint® software from Verathon, (Bucks UK) for verification of scan accuracy and calculation of bladder weight. All data were then entered onto an Excel spread sheet and analysis was performed using Analyse-it for Excel® (Analyse-it Software Ltd, Leeds, England). Correlations between variables were examined using Spearman's test with statistical significance assigned at the 0.05 level.

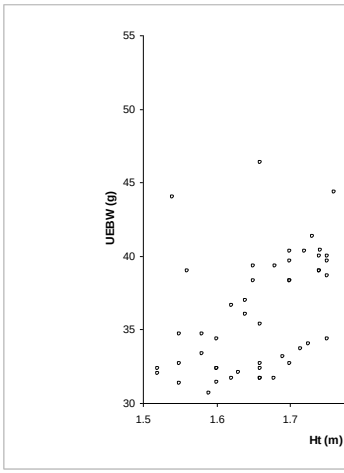
Results

30 men and 40 women were included in the study [Table 1]. There was no correlation between UEBW and BMI or age [Table 2]. Height was the independent variable, correlations: ♂, r_s = 0.81, p<0.0001, ♀ r_s = 0.4, p<0.0104. [Graph]. For each one centimetre increase in height, there was an increase in bladder weight of 0.1g over the range of heights studied.

	20-29	30-39	40-49	50-59	60-69	70+	Total
Male	7	5	5	8	5	0	30
Female	8	9	8	5	10	0	40

			UEBW	
			R_s	p
BMI	Male (n=29)	Mean 24.3 (SD ± 4.4)	+0.04	0.84
	Female (n=37)	Mean 23 (SD ± 2.27)	-0.04	0.80
AGE	Male (n=30)		0.19	0.32
	Female (n=40)		0.07	0.64
BSA	Male (n=29)		0.75	**<0.0001**
	Female (n=37)		0.34	**0.035**
Span	Male (n=30)		0.68	**<0.0001**
	Female (n=40)		0.36	**0.02**

Table 2. Association of BMI, age, body surface area and span with UEBW



Graph 2. Association of UEBW with height in men and women, r_s= 0.78 (95%CI 0.66 – 0.86), p<0.0001

Interpretation of results

We have shown a highly statistically significant association between ultrasound estimated bladder weight (UEBW) and height, span and body surface area in a group of asymptomatic individuals of both sexes. The association with span and body surface area is to be expected, given the dependence of both on height. We, in common with other such studies, did not detect an increase in bladder weight in association with increasing age but over a greater age range than previously described [3]. This is surprising, given the increased collagen deposition in older women and age associated detrusor hypertrophy expected in men with increasing bladder outflow tract obstruction. We were unable to identify subjects over the age of 70 without LUTS in the population available to the researchers. To extend the study thus is clearly desirable. However, it is well recognised that LUTS are highly prevalent in the elderly population.

We were unable to achieve our statistically advised sample sizes for each sex (10 per decade of life), this may limit the interpretation of the male sample, but given the consistency of the findings, these data are likely to reflect the true nature of bladder weight and height. It may be interesting to sample shorter people to see if the association holds.

Concluding message

We have for the first time described a close association between height and UEBW in a group of asymptomatic men and women and recommend that before ascribing pathological significance to increases in UEBW, that this should be taken into account

References

1. Br J Obs Gynae. 1996;103: 904-908
2. Eur Urol 2007; 52(1): 230-7
3. Neurourology and Urodynamics 2006; 25: 308-317

Specify source of funding or grant	**None: equipment loaned by Verathon (UK)**
Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Joint UCL/UCLH Committees on the Ethics of Human Research (Committee A).**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**