17

Carter S. [1], Laniado M. [1], Ockrim J. [1], Marronaro A. [2], Rocco B. [2], Tubaro A. [2]
1. Charing Cross Hospital, London, 2. L'Aquila University School of Medicine, Italy

BLADDER WALL THICKNESS, FLOW RATE, VOIDED VOLUME AND BLADDER VOIDING EFFICIENCY PREDICT THE THE BLADDER OUTLET OBSTRUCTION INDEX

Aims of Study

To determine whether the combination of peak flow rate, bladder wall thickness, and bladder voiding efficiency can be used to predict the extent of bladder outlet obstruction as calculated as the bladder outlet obstruction index (BOOI).

Methods

Design: retrospective analysis of a patient cohort from 1996 to 1999 using pressure flow urodynamics as a criterion standard to determine the bladder outlet obstruction index.

Setting: Teaching hospitals in L'Aquila, Italy, and London, England.

Participants: Men referred by general practitioners with untreated lower urinary tracts symptoms thought to be due to BPH excluding patients with neurological disease, PSA>10 ng/ml and prostate cancer on biopsy.

Urodynamics: performed according to ICS recommendations.

Main Outcome Measures: A multiple linear regression to predict the bladder outlet obstruction index using the following explanatory variables: natural log transformed (ln) Qmax, bladder wall thickness (BWT), residual urine, voided volume, prostate volume, and untransformed bladder voiding efficiency (BVE). The ability of the regression to predict BOOI was determined by the multiple correlation coefficient (Ra^2) adjusted to compensate for the number of additional explanatory variables used. The prediction of a BOOI> 40 was compared by the receiver operating characteristic curve. [SD=standard deviation; CI=95% confidence interval; IQ= interquartile range]

Results

Men had a mean age of 66 years (SD 11), median International Prostate Symptom Score of 15 (IQ 11 to 20), median quality of life score 4 (IQ 3 to 4), and median prostate volume 31 cm^3 (IQ 23 to 44). No obstruction (BOOI<20) was present in 23% of all patients in this study and definite obstruction was present in 48% (BOOI>40).

The table below shows how much each explanatory variable and various combinations contribute to predict BOOI as regards the amount of variation explained (adjusted multiple correlation coefficient). Residual urine was found to be less useful than bladder voiding efficiency so predictions using residual urine are not given.

Qmax	Bladder wall thickness	Voided volume	Bladder voiding efficiency	Prostate volume (by TRUS)	Ra^2
✓					30%
	✓				21%
✓			✓		36%
✓				✓	37%
✓	✓				42%
✓	✓	✓			44%
✓	✓		✓		44%
✓	✓			✓`	44%
✓	✓	✓	✓		46%
✓	✓	✓	✓	✓	49%

From the table, BOOI can predicted best by a combination of Qmax, bladder wall thickness, voided volume, bladder voiding efficiency, and prostate volume. Not including the latter results in a significant prediction of BOOI and is non-invasive.

The multiple linear regression is given by

$$Ln(BOOI+50) = 5.630 + [0.530 \times ln(BWT)] – [0.257 \times ln(Qmax)] – [0.164 \times ln(VV)] - [0.407 \times BVE]$$

Using the above formula, the receiver operating characteristic curve area to predict BOOI>40 was 0.86 (CI 0.80 to 0.91) compared to 0.80 (CI to 0.74 to 0.86) for Qmax alone. Using a predicted BOOI of 25 as a threshold, gave a sensitivity and specificity of 95% and 47% for the above formula compared to 96% and 26% for flow rate alone. Therefore, the regression formula effectively rules obstruction with greater specificity.

Conclusions

Multiple non-invasive variables can be combined to predict BOOI more effectively than by flow rate alone. Fewer patients would need to undergo urodynamic studies to determine whether obstruction is present or not. Predictions of BOOI need to be evaluated as possible prognostic variables predicting outcomes after surgery or medical treatment.