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Title: A PROBABILITY BASED SYSTEM FOR PREDICTING BLADDER OUTFLOW OBSTRUCTION FROM SIMPLE OFFICE ASSEMENT OF THE MAN WITH LUTS

Aims of Study:

A policy of prostatectomy for men with LUTS without prior functional investigation is now considered unacceptable. Urologists continue to rely upon simple tests of symptom score (IPSS), uroflow (Qmax) and residual urine (PVR) although the correlation with bladder outflow obstruction (BOO) is weak, to select patients for treatment. Urodynamic studies are invasive and costly, precluding routine use in most centres. We have previously shown that prostate volume is an important factor in determining the likelihood of urodynamically defined obstruction (1). Combining parameters can improve specificity for obstruction. However concern has been raised as to the statistical error generated by the use of thresholds (cutoffs) on continuous data (2). We explored a probability based system for predicting BOO from simple office procedures.

Methods:

Data from 384 men attending our prostate clinics from 1996 to 1999 was used. Initial assessment included IPSS, Qmax and PVR estimation and TRUS volume measurement. The total prostate volume (TPV) was calculated by the formula W x AP x L x 0.52. All patients underwent urodynamic studies. Pressure flow data were used to calculate the bladder outflow obstruction Index (BOOI) (3).

Statistical Methods:

Multiple linear regression analysis was used to create a model in which BOOI (the outcome variable) was expressed as a combination of continuous explanatory variables. Multiple variables were tested including IPSS, Qmax, TPV, and PVR. All possible interactions were explored and kept in the model if significant. The ability of the predicted BOOI to alter the pre-test probability of BOOI >40 (obstructed) or <20 (unobstructed) was determined by multi-level likelihood ratios. The model was evaluated by split group validation with data randomly divided into a derivation and validation set (40%).

Results:

Qmax, and total prostate volume explained the variation in the observed BOOI (adjusted R2 =0.50, F 75.9, P<0.0001), whilst other variables were unhelpful. These variables were used to create a predicted BOOI (pBOOI) algorithm:

Antilog10 (2.21 - 0.50 log Qmax + 0.18 log TPV) –50 .

When applied to the validation set, a pBOOI >60 (17% population) increased the probability of obstruction from 45% overall to 86% whilst a predicted BOOI <20 (23% population) reduced the chance of significant obstruction to 4% and any level of obstruction from 72% to 31%. Flow rate alone (widely used in clinical practice) gives a predictive value of 70%.

Table: Proportion obstructed in validation set by urodynamics

Actual BOOI	Predicted BOOI	Proportion obstructed by UDS in derivation set	Probability of obstruction in validation set using pBOOI
BOOI >40	BOOI>60	0.87	0.85
	BOOI 40-60	0.64	0.60
	BOOI 20-40	0.33	0.44

	BOOI<20	0.03	0.06
BOOI >20	BOOI>60	0.98	1.00
	BOOI 40-60	0.93	0.91
	BOOI 20-40	0.74	0.75
	BOOI <20	0.36	0.34

Conclusions:

The analysis shows that volume and flow rate are independent predictors of obstruction. Prostate size can be determined from either suprapubic or transrectal ultrasound studies and improves the accuracy of diagnosis in many patients. The development of pBOOI algorithm allows a mathematical calculation on any computer or personal organiser from these two simple objective measures, so that clinicians can determine a probability of obstruction for an individual patient. The model can be easily adapted for the prevalence of obstruction in specific populations to provide greater accuracy. Where the confidence of diagnosis is high (40% of our study group) appropriate treatment can be instigated without recourse to invasive urodynamic study (acknowledging that UDS gives other information than the diagnosis of obstruction). Where pBOOI is 20 - 59.9 outflow obstruction cannot be regarded as a safe diagnosis and the patient should undergo further investigation. This simple algorithm of flow rate and prostate size may prove useful in routine clinical practice by selecting patients in whom comprehensive urodynamic studies are advisable before initiating treatment.

References:

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