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CAN UROFLOWMETRY PARAMETERS PREDICT BLADDER OUTLET OBSTRUCTION IN MEN?

Hypothesis / aims of study

The International Continence Society (ICS) nomogram and the corresponding equation of bladder outlet obstruction index (BOOI) have been used widely to define men with bladder outlet obstruction (BOO). The purpose of this study is to check if men with different grades of obstruction have unique non-invasive free uroflowmetry parameters which could predict the obstructed group accurately.

Study design, materials and methods

Men who had uroflowmetry followed by pressure flow studies in our urodynamic department between 1992 and 2004 were identified. They were divided into three categories based on their BOOI as indicated by ICS nomogram (BOOI= pdet Qmax – 2 Qmax) (1). Those with no obstruction if BOOI<20, equivocal with BOOI= 20-40 and obstructed if BOOI>40.

Multiple linear regression (MLR) model was fitted trying to predict BOOI value using the measurements obtained form the non-invasive uroflowmetry: maximum flow rate (Qmax1), post void residual (PVR1) and bladder voiding efficiency (BVE1). BVE was calculated using the formula [(voided volume (VV)/voided volume + post void residual urine) X100].

Results

During the 12 year study period, 3416 men had routine or video pressure flow studies (PFS). Of those 1080 patients were diagnosed as not obstructed (BOOI<20), 801 equivocal (BOOI 20-40) and 1535 obstructed (BOOI>40).

Free flow and voiding cystometry:

Table 1 shows the mean values of the main uroflowmetry parameters taken at the free flow (Qmax1, VV1, PVR1) before pressure flow studies and those taken during the voiding phase of PFS (Qmax2, VV2, PVR2). It is clear that Qmax is not significantly different in the two tests. As expected, patients with BOO were generally older than patients in the other two groups.

Table 1: Mean uroflowmetry parameters before and during PFS

Patients	Age	Qmax 1	VV1	PVR1	BVE %	Qmax2	VV2	PVR2
Not obstructed	58	15	238	77	84	15	310	54
Equivocal	61	11	204	87	80	10	265	63
Obstructed	64	8	159	97	72	8	223	68

Predicting obstruction using free flow parameters:

Due to the controversy about the reliability of maximum flow rate for small voided volumes (2), only those free flows with voided volume equal or greater than 150mls (1596 patients) were included in the following analysis.

A multiple linear regression (MLR) model was fitted to predict the BOOI value from the non invasive free flow parameters (Qmax1, BVE1, PVR1) and age. The only highly significant variables in the MLR model were Qmax1 ($p<0.001$), BVE1 ($p<0.001$) and PVR1 ($P<0.001$). However, it is important to notice that the R^2 (% of variation in BOOI explained by Qmax1, BVE1 and PVR1 values) is low at 27%. Table 2 shows that predicting BOOI from the MLR model has a sensitivity of 69% and specificity of 71%

			Pred probs from MLR Qmax, BVE, PVR		
			0	1	Total
BOOI >40	0	Count	553	249	802
		% within BOOI >40	69.0%	31.0%	100.0%
	1	Count	139	338	477
		% within BOOI >40	29.1%	70.9%	100.0%
Total		Count	692	587	1279
		% within BOOI >40	54.1%	45.9%	100.0%

Table 2: Classification table from the MLR model which gives the specificity and sensitivity

Using table 3, practitioner can give the patient his risk of being obstructed after having free flow test. This table gives the actual (observed) proportion of obstructed patients (BOOI>40) in each group together with the predicted proportions from the MLR model for the Qmax1 and BVE1 values.

It seems that patients with Qmax1 less than 9 will be obstructed whatever their BVE1 is. On the contrary, if the Qmax1 is greater than 18, no obstruction exists at any BVE1. A Qmax1 between 9 and 10 seems to be the cut off point, below which most patients will be obstructed unless they void to completion.

Pred probs from MLR (Qmax, BVE, PVR mean)

		Qmax group									
		< 5	5 or 6	7 or 8	9 or 10	11 or 12	13 or 14	15 or 16	17 or 18	19 or 20	> 20
BVE %	< 40	1.00	1.00	1.00	.82	.89	.67	1.00	.75	.00	.00
	40 - <50	1.00	1.00	1.00	1.00	1.00	1.00	.83	.00	.00	.00
	50 - <60	1.00	1.00	1.00	1.00	.85	.94	.56	.33	.25	.00
	60 - <70	1.00	1.00	1.00	1.00	1.00	1.00	.64	.00	.00	.00
	70 - <80	1.00	1.00	1.00	1.00	1.00	.72	.11	.00	.00	.00
	80 - <90	1.00	1.00	1.00	1.00	.70	.00	.00	.00	.00	.00
	90 - <100	.	1.00	1.00	.96	.05	.00	.00	.00	.00	.00
	100	1.00	1.00	1.00	.48	.00	.00	.00	.00	.00	.00

Table 3: The probability of being obstructed (BOOI>40) at different Qmax1 and BVE1 values

Interpretation of results

Our data show that Qmax does not change significantly if measured during free low or during PF studies. Previous studies showed that Qmax measured during free flow is an indicator of having BOO (2). Our data confirm these findings but it also highlight the importance of the bladder ability to empty (BVE) in predicting the presence of BOO.

Using these two variables, one can predict obstruction in 69% but it is important to notice that BOOI values are widely variable which could be due to natural variation between patients.

Concluding message

Although uroflowmetry cannot replace pressure-flow studies in the diagnosis of BOO, it can provide valuable information when evaluating men with lower urinary tract symptoms. This becomes more important in those units which have restricted access to formal pressure flow studies.

References:

1- BJUI. 1999; 84: 14-15
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