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Title: A DEFINITION FOR BLADDER OUTLET OBSTRUCTION IN FEMALES BASED ON THE CONCEPT OF RELATIVE RESISTANCE.

Aims of Study.

The ICS definition of bladder outlet obstruction in males is (partly) based on urodynamic observations of the effect of transurethral resection of the prostate. Such a basis is lacking for a definition of female bladder outlet obstruction. We therefore suggest a method to define bladder outlet obstruction (BOO) in females on the basis of the presence or absence of a significant post void residual volume.

Methods.

614 pressure-flow rate measurements in 614 females referred to the outpatient clinic with various symptoms were studied. Measurements with a filled volume smaller than 200 ml were excluded, leaving N=546. A significant residual was defined as either an absolute residual ≥ 100 ml or as a relative residual (residual/filled volume) ≥ 0.2 . The urethral resistance parameters URA and BOOI (the former AG number) were calculated, as well as the parameters $w_{Q_{max}}$ (approximated power per unit of bladder wall area at Q_{max}), w_{20} and w_{80} (the same variable at 20% and 80% of the bladder volume). As the distribution of all parameters was skewed, median and interquartile range were calculated as descriptive statistics. The interquartile range is the range between the 25 and 75% percentiles, and thus contains 50% of the measurements. The potential of combinations of these parameters and Q_{max} and $p_{det.Q_{max}}$ to predict the absence or presence of a significant absolute or relative residual was studied by means of a multivariate logistic regression analysis. The area under the ROC curve, which estimates the percentage of correctly classified measurements in a two-alternative forced choice experiment, was used to compare the different combinations. A final logistic regression model with the ratio of URA and w_{20} as predictor and relative residual as an outcome measure was fitted to the data.

Results.

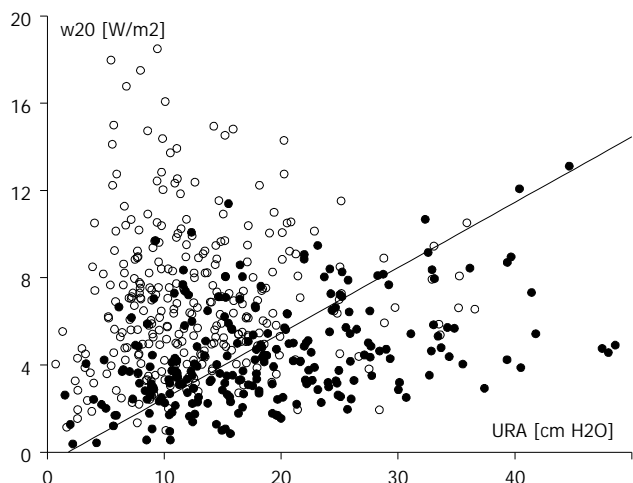
The table shows the median values and interquartile ranges of the calculated parameters in the 546 women.

Parameter	Median	i.q.r.	Unit
fil vol	440	165	ml
abs res	80	138	ml
Q_{max}	13.2	9.7	ml/s
$p_{det.Q_{max}}$	28	18	cm H ₂ O
URA	14	11	cm H ₂ O
BOOI	0.95	32	cm H ₂ O
$w_{Q_{max}}$	5.5	3.4	W/m ²
w_{20}	5.4	4.1	W/m ²
w_{80}	4.7	3.1	W/m ²

43 % of the measurements had an absolute residual ≥ 100 ml, 46% a relative residual ≥ 0.2 . The next table shows the odds ratios of a number of combinations of predictors for absolute or relative residual urine. The table also shows the percentage of correctly classified measurements. The filled volume was always a significant

Explain	Predict	Odds Ratio	Signif	Predict	Odds Ratio	Signif	Predict	Odds Ratio	Signif	% Correct
abs res	fil vol	1.0042	<0.001	Qmax	0.85	<0.001	pdet.Qmax	1.0099	0.061	0.78
abs res	fil vol	1.0038	<0.001	w20	0.64	<0.001	URA	1.13	<0.001	0.84
abs res	fil vol	1.0030	<0.001	w80	0.69	<0.001	URA	1.14	<0.001	0.78
abs res	fil vol	1.0030	<0.001	wQmax	0.70	<0.001	URA	1.14	<0.001	0.78
abs res	fil vol	1.0041	<0.001	w20	0.63	<0.001	BOOI	1.05	<0.001	0.85
rel res	fil vol	0.9996	0.63	w20	0.63	<0.001	URA	1.15	<0.001	0.84
rel res				w20	0.63	<0.001	URA	1.15	<0.001	0.84
rel res							URA/w20	1.96	<0.001	0.84

predictor for absolute residual urine irrespective of the other predictors studied, and never for a relative residual. All models incorporating w_{20} had a comparable percentage of correctly classified measurements. The graph shows w_{20} as a function of URA for the measurements with (•) and without (o) a relative residual ≥ 0.20 , and the logistic regression line correctly classifying 84% of these. As the line almost passes through the origin, URA and w_{20} could be combined in a ratio URA/ w_{20} that had the same predictive power as the two parameters separate.



Conclusions.

As the absolute amount of residual urine depended significantly on the filled volume, the relative residual (residual/filled volume) is more suited to define a criterium for BOO in females. 84% of the measurements could be correctly classified by URA and the contractility at the end of voiding (quantified by w_{20}). The graph illustrates that the threshold of URA for a significant relative residual volume increased strongly with the bladder contractility. Therefore BOO in females should not be defined in terms of an absolute level of the urethral resistance, but rather by a combination of urethral resistance and contractility. This concept may be called relative urethral resistance. Intuitively it is understandable that a certain level of urethral resistance may be obstructive for women with a low bladder contractility, but not for women with a high bladder contractility. Therefore, instead of defining obstruction as a urethral resistance higher than ... (for instance URA>29 or BOOI>40) it is clinically more relevant to define obstruction as a urethral resistance too high with respect to the contractility. The ratio of URA and w_{20} may be used as such a measure for relative obstruction. If this ratio exceeds 3.5, 50% of the measurements are expected to have a relative residual ≥ 0.2 in the tested population. Also in men a definition of infravesical obstruction based on the concept of relative urethral resistance may clinically be more relevant than the currently used definition in terms of an absolute level of resistance.