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A NEW NOMOGRAM TO NONINVASIVELY DIAGNOSE BLADDER OUTLET OBSTRUCTION USING CONDOM CATHETER MEASUREMENTS.

Hypothesis / aims of study

The maximum pressure $P_{cond.max}$ measured in a modified incontinence condom during a mechanical interruption of voiding noninvasively estimates the isovolumetric bladder pressure [1]. By combining this pressure with a separately measured maximum free flowrate $Q_{max.free}$ it is possible to noninvasively diagnose Bladder Outlet Obstruction (BOO) [2]. In a number of patients however, $P_{cond.max}$ underestimates the isovolumetric pressure. This was established by comparing $P_{cond.max}$ with the invasively measured detrusor pressure at maximum flowrate $P_{det.Qmax}$ in pressure flow studies in the same patients. In a practical noninvasive test for BOO it is not possible to deselect patients on the basis of a comparison with invasively acquired data. We developed a nomogram that stratifies patients in the 2 categories obstructed or equivocal and not obstructed on the basis of $P_{cond.max}$ and $Q_{max.free,}$ taking into account possible underestimation.

Study design, materials and methods

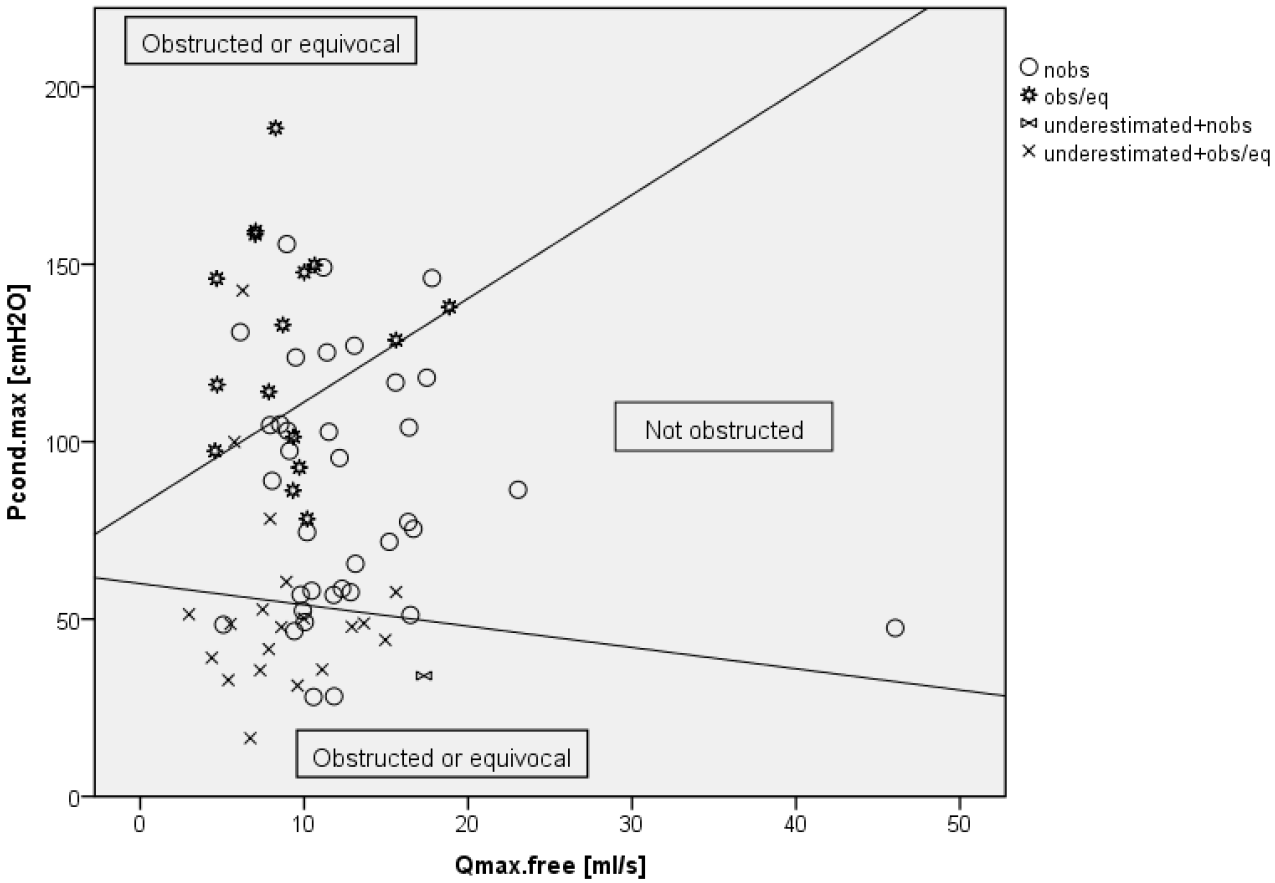
The methods used have been described before [2] and are shortly summarized here : 73 patients eligible for Transurethral Resection of the Prostate on clinical grounds were included. Preoperatively, the patients underwent a free flowrate measurement with a rotating-disc flow meter and two consecutive pressure-flow studies using a water filled 7F double-lumen transurethral catheter. Subsequently one or two non-invasive measurements were done. Patients in whom the $P_{cond.max}$ of the last successful condom measurement was not higher than $P_{det.Qmax}$ in the last successful pressure flow study were labeled “underestimated”. All patients (also the underestimated ones) were labeled “obstructed or equivocal” if the Bladder Outlet Obstruction Index BOOI [3] exceeded 20, or else as “not obstructed”. The resulting data was plotted in the diagram below, and two discrimination lines were used to noninvasively diagnose the patients. All patients above the highest line were labeled “obstructed or equivocal according to the noninvasive test” and those between the lines as “not obstructed according to the noninvasive” test. As the vast majority of the underestimated patients were obstructed or equivocal too (see Interpretation of results) the patients below the lowest line were also labeled “obstructed or equivocal”.

Results

The numbers of patients in the defined categories are given in the table :

Invasive test ↓	Noninvasive test			
	Not obstructed	Obstructed or equivocal	Total	% Correct
Not underestimated + Not obstructed	23	13	36	64%
Not underestimated+ Obstructed or equivocal	4	12	16	75%
Underestimated + Not obstructed	0	1	1	0
Underestimated + Obstructed or equivocal	3	17	20	85%
Total	30	43	73	
% Correct	77%	67%		71%

The figure illustrates the two diagnostic classes and the distribution of the 73 patients. The four invasively diagnosed groups of patients (vertically displayed in the table) are represented by four different symbols:



Interpretation of results

As shown in the classification table, 17 of the 21 patients invasively diagnosed as underestimated were also invasively diagnosed as obstructed or equivocal. This is in accordance with earlier results showing that underestimated patients are significantly more obstructed than not underestimated patients [1]. A causal relationship may be hypothesized, in the sense that obstruction caused underestimation by limiting the bladder pressure to be adequately transferred to the condom. Originally we intended the lower line in the diagram to delineate the underestimated patients. Excluding the patients below this line would leave 51 patients above the line that could be diagnosed noninvasively. However, finding that 15 of the 22 patients below the lowest line were invasively diagnosed as obstructed or equivocal, and considering that there is a rational reason why obstructed or equivocal patients would be underestimated, it makes sense to noninvasively diagnose the patients with a low $P_{cond.max}$, i.e. below the lowest line in the diagram, as obstructed or equivocal. This results in a nomogram that noninvasively correctly diagnoses 23/(36+1)*100%=62% of the (truly/invasively) not obstructed patients and (12+17)/(16+20)*100%=81% of the truly obstructed or equivocal patients. Alternatively stated, 67% of the patients who were diagnosed as obstructed or equivocal by the noninvasive nomogram were indeed obstructed or equivocal according to the invasive pressure-flow study, while 77% of the patients who were not obstructed according to the nomogram were indeed not obstructed according to the pressure-flow study.

Concluding message

Overall in 71% of the 73 patients a noninvasive diagnosis on the basis of the shown nomogram of condom catheter measurements was in agreement with the invasive diagnosis based on a pressure-flow study. This percentage will have to be verified in a separate population of patients.

References

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Disclosures

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