RESULTS

For each volunteer, we pair-wise selected Q_{MAX} (conventional flow meter) and Q_{DISP} (disposable flow meter) values with comparable voided volumes (± 35 ml) [4]. We plotted the difference of both values measured in separate voidings versus the mean, see fig. 2. This figure demonstrates the borders of agreement (open circles; $0 \leq Q \leq 30$) between both measurement devices ($Q_{MAX} - Q_{DISP} = 0.4 \pm 2.6$ ml/s; mean ± SD). The mean value does not significantly differ from zero, indicating that the disposable flow meter is not biased. The measurement range of our prototype was limited to 30 ml/s (see vertical dotted line). The four outliers (closed circles; Q > 30 ml/s) fall outside this range.

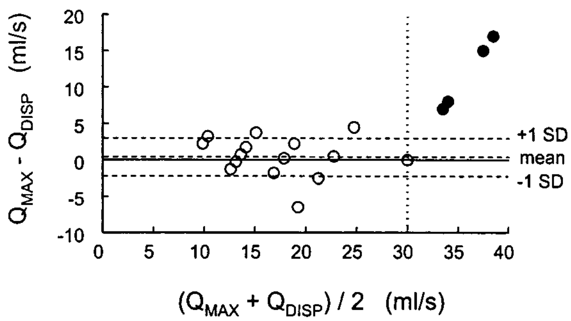

Fig. 2 Difference of the maximum flow rate, Q_{MAX}, (conventional flow meter) and the flow rate related to the number of active exit ports, Q_{DISP}, (disposable flow meter; see also fig. 1) measured in 7 healthy female and male volunteers.

CONCLUSIONS

The self-made disposable flow meter used in the present study is an inexpensive device (estimated costs between $10 and $30) and can be used repeatedly by the same individual to measure maximum flow rates and associated voided volumes at any location. Based on the average difference between the Q_{DISP} values (see calibration table), the accuracy of this disposable is excepted to be between 2 and 3 ml/s. The standard deviation of 2.6 ml/s calculated from the borders of agreement confirms this accuracy, despite the fact that two separate voidings were compared in each volunteer. Different models of the disposable with different accuracy and measurement range can easily be made by adapting the number, the diameter and the distance of the exit ports. In the present model, the maximum flow rate is determined by observing the number of active exit ports. Registration could be automated by fixing indication paper to the ports. The low cost and simplicity of this device, in relation to its accuracy and measurement range might significantly reduce the threshold for uroflowmetry under many conditions.

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ACKNOWLEDGEMENT

This research is supported by the Technology Foundation STW, applied science division of NWO and the technology programme of the Ministry of Economic Affairs.

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Category No. (Please choose one) Abstract No.

Institution, city, country: **Aachen, D; Beijing, CH; Maastricht, NL; Leuven, B; London, UK; Rochester, MN,USA; Brussels, B; Rahway, NJ, USA**

Title (type in CAPITAL LETTERS, leave one blank line before the text):

NORMAL URODYNAMIC DATA: MEASUREMENTS IN ASYMPTOMATIC YOUNG MALES

Aims of Study: Urodynamic signal quality control, data analysis as well as clinical interpretation all require some knowledge of "normal" data. However, for obvious reasons good urodynamic data from "normals" are very rare and much of what we think is "normal or pathological" relies almost exclusively on measurements of symptomatic patients. In particular since the ICS standards on "Good Urodynamic Practice" have been accepted the need for good and accurate "normal "data is even more urgent for further development of urodynamic standards. Interesting examples are the urodynamic classification and quantitation of bladder outflow resistance according to the published provisional ICS standard as well as grading of detrusor contraction strength with suspected changes under obstruction.

Methods

Thirty healthy young male volunteers have been included in the study after careful exclusion of any urological symptoms or other relevant pathology. These normal males have undergone repeated complete urodynamic investigations with filling and voiding pressure/flow studies, PFS, in 4 centers. Following a strict protocol with measurement quality control and centralized data analysis a total of 104 studies have been included and analyzed. Urodynamic key values for the filling and voiding cycle have been determined and investigated carefully for short term reproducibility. From medium fill (20ml/min) cystometry these are "volume at first desire, VFD" and "volume at normal desire, VND". Filling to maximum capacity was avoided to minimize artifacts at voiding. The voiding data are compared with the provisional ICS nomogram, which replaces the old Abrams/Griffiths, and the A/G number consistent with the ICS nomogram. Further we used the Schäfer nomogram and the Obstruction Coefficient OCO (Ref: 1,2) as a compatible numerical format for grading bladder outflow conditions on a continuous scale. The normal data was compared with voiding data before and after surgery of prostatic.
Various concepts have been suggested for grading detrusor contractility, such as maximum isometric pressure, piso, the power factor Wf, the Schäfer nomogram, and the Detrusor Coefficient DECO (Ref:1,2). Again, the determination of "normal" contractility, - and thus the identification of a weak detrusor as well as of a changes in detrusor strength under obstruction -, has been based more on speculation because good urodynamic data was only available from older symptomatic men.

Results: For these asymptomatic young males (mean age 28 yrs) mean values are: VFD = 215 ml, VND = 361 ml; maximum flowrate 18.4 ml/s (s.d. ± 4.8 ml/s), related detrusor pressure 43.7 cmH2O(± 9.2 cmH2O), volume voided 357 ml (± 125 ml), OCO = 0.57 (± 0.14; range 0.3 to 0.9), A/G-No = 7(±15; range –28 to 40). All mean measured values and OCO are reproducible within 2%, only the flowrate at second void was 5% higher, and so the mean A/G-Number decreased from 8 to 7. Three men were classified in the ICS "equivocal zone", i.e. OCO>0.75, all with suspicious pressure/flow pattern. Mean OCO after surgery of prostatic obstruction from various studies is OCO = 0.56. The value for DECO was 1.33 (± 0.20; range 0.8 to 2.1), corresponding to Schäfer grade N+, piso of 140 cmH_2O and an estimated Wf of 13 W/m^2. Mean values for symptomatic older men are between DECO 0.68 and 1.15.

Conclusions: The outflow resistance in young unobstructed men is almost identical to older men after surgery for prostatic obstruction. The cut-off for obstruction in the ICS nomogram with an "equivocal" range between A/G No. 20 to 40, is identical to OCO ≥ 1. In the Schäfer nomogram the cut-off for obstruction is > grade I, i.e. OCO > 0.75, more comparable to A/G-No 25. Taking the mean value plus one standard deviation, i.e. OCO = 0.71 as the upper range of "normal outflow conditions", it seems that the definition of normal in the ICS nomogram (excluding "equivocal") and in the Schäfer nomogram with > grade I or OCO > 0.75 fits the "normal data". The detrusor of asymptomatic young men contracts stronger than in older obstructed or unobstructed men. The detrusor strength in normal subjects is not related to outflow conditions. The values accepted as proof of compensatory hypertrophy under obstruction are actually well within the range of normal contractility for young men. The currently accepted values for normal and strong contractility should be reconsidered.

Ref. 1: ICS 1995 abstract rbt 275; Ref. 2: ICS 1997 abstract 162