Correlation between a new visual prostate symptom score (VPSS) and uroflowmetry parameters in men with lower urinary tract symptoms

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Objective. A visual prostate symptom score (VPSS) compared with the international prostate symptom score (IPSS) for evaluation of lower urinary tract symptoms (LUTS) can be completed without physician assistance by a significantly larger proportion of men with limited education. We aimed to evaluate the correlation of the VPSS and IPSS with uroflowmetry parameters.

Methods. Men with LUTS were requested to complete the IPSS and VPSS, consisting of pictograms to evaluate urinary frequency, nocturia, force of the stream and quality of life. The maximum (Qmax) and average urinary flow rate (Qave), voided volume (VV) and post-void residual (PVR) urine volumes were measured. Statistical analysis was performed using the Mann-Whitney and Spearman's tests.

Results. The study included 93 men (mean age 64 years, range 33 - 85), with VV >150 ml in 66 (71%) and <150 ml in 27 (29%) subjects. In the group with VV >150 ml there were significant negative correlations between the IPSS and Qmax (r=-0.30, p=0.016), the IPSS and Qave (r=-0.29, p=0.018), the VPSS and Qmax (r=-0.38, p<0.002) and the VPSS and Qave (r=-0.37, p<0.003). The VPSS question on the subject's assessment of his urinary stream showed a significant negative correlation with the Qmax (r=-0.37, p=0.002) and Qave (r=-0.31, p=0.011), but the IPSS question on the subject's urinary stream did not correlate significantly with the Qmax or Qave.

Conclusions. The VPSS is equivalent to the IPSS in terms of correlation with Qmax and Qave and can therefore be used instead of the IPSS to evaluate LUTS in men with limited education.

S Afr Med J 2012;102:245-248.

The international prostate symptom score (IPSS) is widely used to assess the severity of lower urinary tract symptoms (LUTS) in men with bladder outlet obstruction (BOO) and to evaluate the response to medical or surgical therapy for benign prostatic obstruction (BPO).[1] LUTS do not correlate well with prostate volume, maximum urinary flow rate (Qmax), post-void residual (PVR) urine volume or BOO as determined by urodynamic evaluation.[2-6] Some studies have indicated that, although symptom scores may correlate with certain urodynamic parameters, these parameters do not correlate well with BOO.[7]

It has been suggested that invasive urodynamic evaluation (pressure-flow study) is indicated to prove that a patient's LUTS are caused by BOO before invasive therapy is selected.[8] However, for logistic reasons invasive urodynamic evaluation is not feasible in most men with LUTS. The IPSS is therefore widely used in combination with uroflowmetry to guide treatment decisions and to evaluate therapeutic response in men with LUTS probably caused by BOO.[1]

An important problem with the IPSS is that many patients find it difficult to comprehend. Studies showed that 30 - 70% of men could not complete the IPSS because they found the questions difficult to understand,[9] and this problem was more common in men with a lower level of education.[10]

Van der Walt *et al.*[11] recently developed a visual prostate symptom score (VPSS) using pictograms to assess four IPSS questions related to frequency, nocturia, weak stream and quality of life (QoL). The VPSS correlated significantly with the IPSS and could be completed without physician assistance by a greater proportion of men with limited education, indicating that it may be more useful than the IPSS in patients who are illiterate or have limited education.[11]

We aimed to evaluate the correlation between the VPSS and IPSS and non-invasive uroflowmetry parameters in men with LUTS.

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Patients and methods

The study was approved by the local institutional human research ethics committee. Men referred with LUTS were requested to complete the IPSS comprising the following questions: Q1 – incomplete emptying, Q2 – frequency, Q3 – intermittency, Q4 – urgency, Q5 – weak stream, Q6 – straining, Q7 – nocturia, Q8 – QoL due to urinary symptoms (maximum score 41). They were also requested to complete the VPSS (Fig. 1) comprising pictograms to evaluate the following questions: Q1 – frequency, Q2 – nocturia, Q3 – force of the urinary stream, Q4 – QoL (maximum score 23). Study subjects who were unable to complete the questionnaires on their own were assisted by a doctor.

A full medical history was obtained and physical examination, digital rectal examination (DRE) and dipstick urine analysis were performed. The Qmax, average urinary flow rate (Qave) and voided volume (VV) were measured using a Urodyn 1000 Plus uroflowmeter, after which the PVR was measured using a Toshiba JustVision 200 ultrasound machine with a 2.3 MHz probe. A single urinary flow measurement was obtained in each subject. Serum creatinine and prostate-specific antigen (PSA) were also assayed.

Statistical analysis was performed using MS Excel and GraphPad Instat software, with the Mann-Whitney test for comparison of means and Spearman's test for correlation analysis. A two-tailed p-value <0.05 was accepted as statistically significant.

Results

During the period August 2009 - August 2010, a total of 96 men were enrolled (mean age 64 years, range 33 - 85). Uroflowmetry was performed in 93 men, with VV >150 ml in 66 (71%) cases and VV

<150 ml in 27 (29%). The mean total IPSS was 20.9 (range 1 - 41) and the mean total VPSS was 13.7 (range 4 - 23). On DRE the prostate was clinically benign in 72 (77%) of the men and malignant in 21 (23%). The mean serum creatinine was 107.5 (range 65 - 232) µmol/l and the mean serum PSA was 30.7 (range 0.2 - 1601) ng/ml.

There were no significant differences with regard to age, mean IPSS and mean VPSS in the groups with VV ≥150 ml or <150 ml (Table I). The correlation between total IPSS and VPSS was statistically significant in both groups, but the correlations between Qmax and Qave versus total IPSS and VPSS, respectively, were only significant in the group with VV ≥150 ml (Table II). The correlations between Qmax and Qave and the subject's assessment of his urinary stream were statistically significant for the VPSS (Q3) but not the IPSS (Q5) in the group with VV ≥150 ml but not in the group with VV <150 ml (Table II).

There were statistically significant correlations between age and Qmax (r=-0.22, p=0.039), age and VV (r=-0.32, p=0.001) and age and serum PSA (r=0.21, p=0.042), but not between age and total IPSS, total VPSS, Qave, PVR or serum creatinine.

There were significant correlations between VV and Qmax (r=0.611, p<0.000) as well as Qave (r=0.543, p=0.001), and between PVR and Qmax (r=-0.225, p=0.03) as well as Qave (r=-0.284, p=0.006).

In the study group as a whole, Qmax correlated significantly with total IPSS as well as VPSS (Fig. 2). The correlations between Qave and total IPSS as well as VPSS were also significant in the study group as a whole (Fig. 3).

Discussion

The concept of the VPSS was based on the observation by an author (AEG) that illiterate or poorly educated men found it impossible to complete the IPSS, even with physician assistance. In contrast, patients easily comprehended a simple diagram showing a urinating man, in which the patient can indicate the force of the urinary stream

Table I. Comparison of age, symptom scores and urinary flow parameters in subjects with VV ≥150 ml v. <150 ml

	VV ≥150 ml	VV <150 ml	*p*-value
No. of patients (%)	66 (71%)	27 (29%)	
Mean age (yrs) (range)	63.1 (33 - 85)	65.8 (48 - 81)	0.298
Mean IPSS (maximum score 41) (range)	20.2 (4 - 33)	22.3 (1 - 41)	0.324
Mean VPSS (maximum score 23) (range)	13.3 (4 - 21)	14.7 (7 - 23)	0.215
Qmax (ml/s) (range)	14.8 (3.4 - 46.2)	8.1 (1.5 - 18.6)	**<0.001**
Qave (ml/s) (range)	7.8 (2.3 - 31.2)	4.1 (0.9 - 9.3)	**<0.001**
VV (ml) (range)	279.6 (151 - 663)	98.1 (20 - 148)	**<0.001**
PVR (ml) (range)	116 (0 - 477)	149.7 (0 - 600)	0.337

VV = voided volume; IPSS = international prostate symptom score; VPSS = visual prostate symptom score; Qmax = maximum urinary flow rate; Qave = average urinary flow rate; PVR = post-void residual urine volume.
The *p*-values in bold are statistically significant.

Table II. Comparison of correlations between symptom scores and urinary flow parameters in subjects with VV ≥150 ml v. <150 ml

	VV ≥150 ml		VV <150 ml	
	Correlation coefficient (r)	*p*-value	Correlation coefficient (r)	*p*-value
IPSS total v. VPSS total	0.73	**<0.001**	0.92	**<0.001**
IPSS total v. Qmax	-0.30	**0.016**	-0.07	0.743
VPSS total v. Qmax	-0.38	**0.002**	-0.01	0.980
IPSS total v. Qave	-0.29	**0.018**	-0.16	0.410
VPSS total v. Qave	-0.37	**0.003**	-0.10	0.619
IPSS QoL v. Qmax	-0.16	0.211	+0.14	0.477
VPSS QoL v. Qmax	-0.12	0.344	+0.09	0.660
IPSS QoL v. Qave	-0.16	0.214	-0.11	0.590
VPSS QoL v. Qave	-0.15	0.225	-0.06	0.767
IPSS Q5 v. Qmax	-0.15	0.219	+0.01	0.948
VPSS Q3 v. Qmax	-0.37	**0.002**	-0.30	0.132
IPSS Q5 v. Qave	-0.11	0.370	-0.02	0.922
VPSS Q3 v. Qave	-0.31	**0.011**	-0.39	**0.043**

VV = voided volume; IPSS = international prostate symptom score; VPSS = visual prostate symptom score; Qmax = maximum urinary flow rate; Qave = average urinary flow rate; QoL = quality of life; Q3 = question 3; Q5 question 5.
The *p*-values in bold are statistically significant.

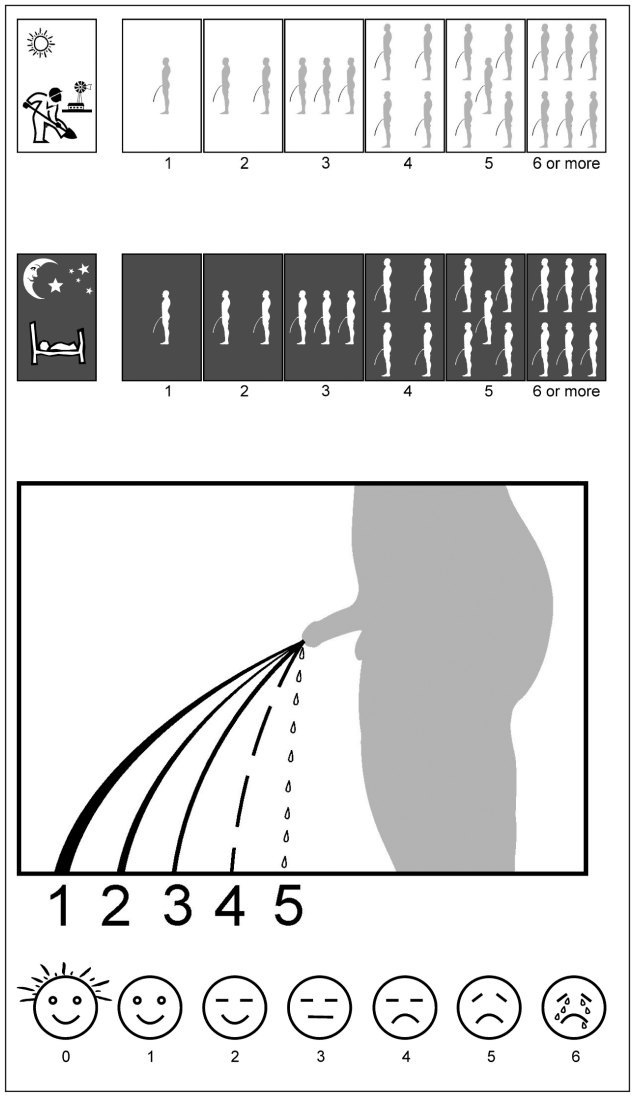

Fig. 1. Visual prostate symptom score (VPSS) (© Stellenbosch University).

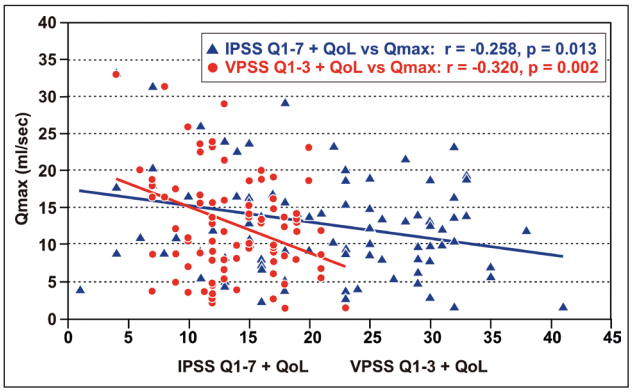

Fig. 2. Correlation between Qmax and IPSS and VPSS, respectively, including the QoL question (Qmax = maximum urinary flow rate, IPSS = international prostate symptom score, VPSS = visual prostate symptom score, QoL = quality of life).

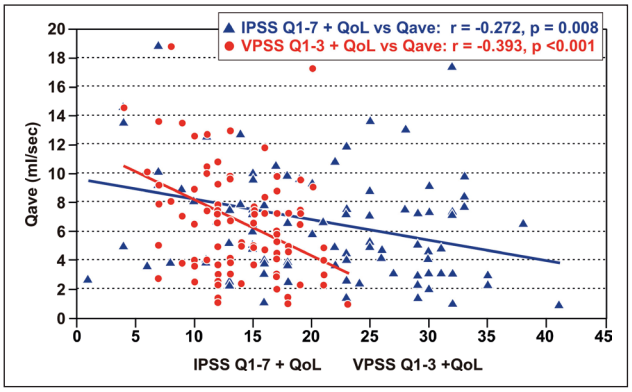

Fig. 3. Correlation between Qave and IPSS and VPSS, respectively, including the QoL question (Qave = average urinary flow rate, IPSS = international prostate symptom score, VPSS = visual prostate symptom score, QoL = quality of life).

corresponding to his own (Q3 in the VPSS, Fig. 1). However, the validity or reliability of this pictogram was not formally evaluated, and the perception of its usefulness was based on clinical observation only. The VPSS pictograms evaluating daytime urinary frequency, nocturia and QoL and the prospective evaluation protocol were developed by the first two authors and a medical illustrator.

Whereas community-based studies show a positive correlation between patient age and symptom scores evaluating LUTS, in an outpatient setting there may be a negative correlation, because older patients may visit the outpatient department with lower scores than younger patients.[5,12] In our study there was no significant correlation between age and total IPSS or VPSS, although there were relatively weak but statistically significant negative correlations with Qmax and VV, and a positive correlation with serum PSA.

The International Consensus Committee on BPH recommended that uroflowmetry data with VV <150 ml should be regarded as unreliable. The proportion of men unable to produce a VV >150 ml during uroflowmetry has been reported as varying from 20% to 5%.[5] In this study the VV was <150 ml in 29% of cases, possibly because it was not a population-based study but a selected group of men with relatively severe LUTS. However, for logistic reasons it was not possible to repeat the uroflowmetry studies, and the analysis is based on a single study for each subject. Interestingly, the correlation of IPSS versus VPSS was somewhat stronger in the group with VV <150 ml (0.92) than in the group with VV >150 ml (0.73), but the correlation of IPSS and VPSS with Qmax and Qave was statistically significant only in the group with VV >150 ml (Table II).

Previous studies have evaluated the correlation between symptom scores and uroflowmetry parameters. An analysis of 466 men 40 - 79 years old reported the following Spearman's rank correlation coefficients: American Urological Association symptom index (AUA-SI) v. prostate volume 0.19, prostate volume v. Qmax 0.21, and AUA-SI v. Qmax -0.35 ($p<0.001$).[2] Bosch *et al.*[12] reported a weak correlation of the IPSS with total prostate volume, Qmax and PVR. A study of 227 men evaluated with the IPSS and pressure-flow studies to determine the presence of BOO reported that Pearson's test showed a significant positive correlation between symptoms and the presence of BOO.[7]

A study of 196 men reported the following Pearson's correlation coefficients: IPSS v. QoL 0.65 ($p<0.001$), IPSS v. Qmax -0.12 (not significant), QoL v. Qmax -0.19 ($p=0.008$), Qmax v. PVR -0.21 ($p=0.003$), and prostate volume v. Qmax -0.19 ($p=0.008$).[3] They reported the following correlation coefficients: IPSS v. QoL score 0.45 ($p<0.001$), QoL score v. Qmax -0.13 ($p=0.005$), and QoL v. PVR 0.10 ($p=0.03$), but correlations for IPSS v. Qmax, PVR and prostate volume, and QoL v. prostate volume were not significant.[3]

In a study of 460 men 41 - 88 years old, Wadie *et al.*[4] reported the following Spearman's correlation coefficients: total IPSS v. Qmax 0.1 ($p=0.04$), total IPSS v. Qave 0.16 ($p<0.01$), obstructive scores v.

Qmax (0.16, $p<0.01$) and Qave (0.2, $p<0.01$), and irritative scores v. Qmax and Qave not significant.[4] They concluded that non-invasive urodynamics (uroflowmetry) only had a fair to moderate correlation with pressure-flow measurement.[4] Seki *et al.*[6] studied 557 men with symptomatic improvement (25% or more reduction of total IPSS) at 3 months after transurethral resection of the prostate, and found that their LUTS were primarily due to BOO. They reported statistically significant correlations between total IPSS and Qmax (-0.20), QoL score and Qmax (-0.14), total IPSS and PVR (0.13), and QoL score and PVR (0.11).[6]

Our study showed statistically significant correlations of the IPSS v. Qmax (r=-0.28) and Qave (r=-0.29), and of the VPSS v. Qmax (r=-0.42) and Qave (r=-0.41). The correlation coefficients were of similar magnitude to other studies and were slightly higher for the VPSS than the IPSS. The relatively weak correlations could be partly due to using only single-void flow rate measurements in this study.[13] However, the magnitude of these modest correlations is similar to those in other diseases where strong relationships exist. For example, in patients with coronary artery disease the correlation between plasma cholesterol and coronary artery occlusion has been reported as 0.15, and in patients with asthma, QoL and asthma symptom scores showed correlations with 1-second forced expiratory volumes of -0.25 - -0.28.[2]

It is interesting that in this study there was a relatively strong correlation between total IPSS and VPSS scores in the group with VV >150 ml (0.73) and in the group with VV <150 ml (0.92, $p<0.001$), even though the correlations between total IPSS and VPSS on the one hand and Qmax and Qave on the other hand were not significant in the group with VV <150 ml (Table II). It is also interesting that the question relating to the force of the urinary stream in the VPSS (Q3) but not in the IPSS (Q5) showed a statistically significant correlation with Qmax and Qave in the group with VV >150 ml (Table II). This correlation was of the same order of magnitude as the correlations of total IPSS and VPSS v. Qmax and Qave (around 0.3), suggesting that Q3 of the VPSS on its own may prove as useful as the complete IPSS or VPSS. However, further study is indicated to confirm these findings.

Conclusions

The VPSS correlates significantly with the IPSS, regardless of VV, and the VPSS is equivalent to the IPSS in terms of correlation with Qmax and Qave in men with LUTS. This indicates that the VPSS can be used instead of the IPSS for the assessment of symptom severity in men with LUTS who are illiterate or have limited education.

Acknowledgements. Carol Lochner, visual artist employed by Stellenbosch University, created the pictograms for the VPSS. The South African Urological Association provided research funding for this project.

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Accepted 17 November 2011.

An eerie silence;
Birds, crickets, bees, trees are still -
Rain is imminent.

Haiku: Peter Folb