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THE CORRELATION BETWEEN BLADDER OUTLET OBSTRUCTION AND LOWER URINARY TRACT SYMPTOMS AS MEASURED BY THE INTERNATIONAL PROSTATE SYMPTOM SCORE

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ABSTRACT

Purpose: We studied the relationship between lower urinary tract symptoms as measured by the international prostate symptom score (I-PSS) and urodynamic findings in elderly men.

Materials and Methods: We evaluated 803 consecutive patients with lower urinary tract symptoms via the I-PSS and urodynamics with pressure-flow studies.

Results: A statistically significant correlation was found between all I-PSS questions (except intermittency) and objective parameters of obstruction. However, the clinical significance of this finding is minimal because a large overlap of symptom scores exists among patients with different grades of bladder outlet obstruction. The filling component of the I-PSS correlated somewhat better with obstruction than did the voiding component.

Conclusions: It seems impossible to diagnose bladder outlet obstruction from symptoms alone. It does not even seem possible to define subgroups in which further urodynamic examination is indicated.

KEY WORDS: prostate, bladder neck obstruction, urinary tract, urodynamics

Bladder outlet obstruction in men due to benign prostatic hyperplasia (BPH) has presented a clinical problem throughout medical history. It has been estimated that BPH affects approximately 50% of men 60 years old¹ and some estimate the prevalence to be approximately 80% by age 80 years.² The incidence and clinical significance of BPH have been increasingly difficult to evaluate, since the indications for medical intervention have shifted from attempts to preserve life to those improving quality of life. As the emphasis has shifted from the effect of BPH and its sequelae on the length of life to earlier treatment of bothersome complaints, the incidence of BPH related symptoms affecting maintenance of a normal or reasonable life-style has assumed increasing importance. Also, as we move into an era when alternatives to surgery are increasingly used to treat BPH, the time has come to consider the minimum diagnostic criteria that should be established before any medical or surgical treatment is recommended.

A central concept in urology is that BPH causes prostatic enlargement, which in turn may lead to bladder outlet obstruction and lower urinary tract symptoms. Therefore, clinical BPH has been characterized by the combination of 3 parameters: lower urinary tract symptoms, bladder outlet obstruction and increased prostate volume due to hyperplasia.³ Treatment policy is based on symptoms to relieve bladder outlet obstruction. Moreover, the best indicator of successful treatment remains relief of symptoms. It is unclear if, in the absence of symptoms, down grading of bladder outlet obstruction should be considered an additional indicator of treatment success. The gold standard to evaluate grade of bladder outlet obstruction is urodynamic studies with pressure-flow analysis.⁴ Because of the invasive nature of these studies they are seldom performed and, consequently, only limited data are available to answer this question.

Several symptom scores have been developed to assess symptom severity in a more formal manner.⁵⁻⁸ In 1992 the American Urological Association symptom score was published, and it has been endorsed by the World Health Organization as the international prostate symptom score (I-PSS,

see Appendix).⁹ This score has been integrated into evaluation of patients with lower urinary tract symptoms (caused by BPH) and has been recommended as a valid tool in the diagnosis of bladder outlet obstruction.¹⁰

Despite increasing reports on the relationship between lower urinary tract symptoms and bladder outlet obstruction, the correlation between the 2 parameters remains unproved.^{11,12} Most urologists agree that only patients with bladder outlet obstruction should undergo surgical intervention. Nevertheless, the decision for surgery is usually based primarily on the nature and severity of presenting symptoms. Therefore, the relationship between symptoms and bladder outlet obstruction is an important issue. We conducted a study on a large series of patients with lower urinary tract symptoms to delineate the relationship between preoperative voiding symptoms according to the I-PSS and urodynamic findings.

MATERIALS AND METHODS

We studied 803 consecutive patients with lower urinary tract symptoms and/or BPH. All patients underwent a standardized diagnostic evaluation consisting of history (including the I-PSS), physical examination (including digital rectal examination), biochemistry (including prostate specific antigen), urinalysis and culture, urine cytology and urodynamic investigations (including pressure-flow studies). Total I-PSS less than 8 indicated mild, 8 to 19 moderate and more than 19 severe symptoms.¹² The total score of I-PSS questions 2, 4 and 7 represents the filling component of the I-PSS, while that of questions 1, 3, 5 and 6 represents the voiding component.

Urodynamic investigations were performed with an 8F transurethral catheter and an 8F transrectal catheter, both of which were equipped with a microtip pressure sensor. Before cystometry, the bladder was emptied through the lumen of the transurethral catheter to quantify residual urine after free uroflowmetry. The pressure sensors were set at zero to atmospheric pressure before introduction. The bladder was filled with water at 20°C with a filling speed of 50 ml. per minute with the patient supine. Filling was stopped when the patient expressed a strong urge to void and mic-

TABLE 1. *Baseline characteristics of the clinical and urodynamic parameters*

	No. Pts.	Mean \pm SD	Median (range)
Age (yrs.)	803	64 \pm 8.7	63.8 (38-89)
Prostate vol. (cm. ³)	733	44 \pm 22	38 (13-170)
Linear passive urethral resistance relation	801	—	2 (0-6)
Urethral resistance factor (cm. water)	798	36 \pm 19	32 (2-122)
Detrusor pressure at maximum flow (cm. water)	803	57 \pm 28	52 (2-212)
Minimum urethral opening pressure (cm. water)	797	28 \pm 18	24 (0-114)
Maximum flow rate (ml./sec.)	795	11 \pm 5	10 (1-49)
Maximal bladder contraction force (W.)	583	10 \pm 5	9 (0.4-53)
I-PSS:			
Total	803	17.1 \pm 7.1	17 (0-35)
Voiding component	803	9.8 \pm 4.7	10 (0-20)
Filling component	803	7.4 \pm 3.7	7 (0-15)

turition while standing was allowed in private. The digitally stored data were analyzed with equipment developed at our department. To obtain useful information from pressure-flow study curves, it is necessary to relate detrusor pressure to the corresponding flow. To quantify the grade of bladder outlet obstruction the concept of the linear passive urethral resistance relation was used.⁴ Patients with scores 0 and 1 on this scale do not have urodynamic obstruction, while those with scores 2 and 3 have moderate and those with higher scores have severe obstruction. Another method of grading bladder outlet obstruction is by using the urethral resistance factor, calculation of which is based on the point of maximum flow and corresponding detrusor pressure.¹³ A urethral resistance factor of more than 29 cm. water indicates obstruction. Finally, the minimal urethral opening pressure was calculated on the basis of the passive urethral resistance relation curves, adjusted to the lower pressure portion of the pressure-flow graph.¹⁴

For statistical analysis we used descriptive statistics and the Spearman correlation coefficient to describe the association between I-PSS questions and the various urodynamic parameters.

RESULTS

Descriptive statistics with respect to the patient age, prostate volume and urodynamic parameters are summarized in table 1. Mean patient age plus or minus standard deviation was 64.3 \pm 8.7 years, and mean total I-PSS, and voiding and filling subscores were 17.1 \pm 7.1, 9.8 \pm 4.7 and 7.4 \pm 3.7, respectively. When classified according to I-PSS, the mild symptom group

included 75, moderate symptom group 428, and severe symptom group 300 patients. When classified according to linear passive urethral resistance relation, 249 men had no obstruction and mean total I-PSS was 15.5 \pm 6.9, 330 men had moderate obstruction with mean total I-PSS 17.1 \pm 6.8 and 224 patients had severe obstruction with mean total I-PSS 18.9 \pm 6.9. Because of the large number of patients, average symptom scores were significantly different among these groups. However, the differences were too small and the overlap too great to be of any clinical significance. The relationship between the different I-PSS questions and objective obstruction is summarized in table 2. There was a statistically significant correlation between all individual I-PSS questions and objective parameters of obstruction, except for question 3 (intermittency). In descending order, the best (but still weak) correlation between linear passive urethral resistance relation and I-PSS was found for questions 4 ($r = 0.20$) and 7 ($r = 0.15$), the quality of life question ($r = 0.13$), and questions 2 ($r = 0.13$), 6 ($r = 0.11$), 5 ($r = 0.09$), 1 ($r = 0.08$) and 3 ($r = 0.06$). The correlation between total symptom score and pressure flow studies also is shown in table 2. The filling component correlated somewhat better with obstruction than did the voiding component and total symptom score.

The relationship between voiding questions and grade of obstruction is shown in figure 1. There seemed to be no clear correlation between these 2 entities, which can be of any clinical significance. The relationship between filling questions and instability is shown in figure 2. There was no correlation between frequency of micturition and instability. In contrast, a significant correlation between urgency and nocturia with instability was observed, although it was weak. Finally, the relationship between obstruction and total symptom score is shown in figure 3. There was a clear shift to more obstruction with more symptoms and vice versa. However, again the overlap was large, which renders clinical significance of the I-PSS arbitrary.

DISCUSSION

During the years several indexes have been developed to measure subjective symptoms in patients with BPH. It is generally accepted that the I-PSS is a reliable and valid instrument to measure severity of symptoms and symptom progression with time.¹⁵

The development of filling and voiding symptoms, and the interrelationship between bladder function and BPH are complex due to an incomplete understanding of the pathophysiology of BPH, and the exact relationship between symptoms and bladder outlet obstruction. The traditional pathophysiological concept is that prostatic enlargement causes

TABLE 2. *Spearman correlation coefficients for results of different I-PSS questions, filling component, voiding component and total score compared to different urodynamic parameters*

I-PSS question:	Spearman Correlation Coefficient				
	Median	Linear Passive Urethral Resistance Relation	Urethral Resistance Factor	Detrusor Pressure at Maximum Flow	Minimum Urethral Opening Pressure
1	2	0.08	0.06 (not statistically significant*)	0.08	0.10
2	3	0.13	0.12	0.12	0.13
3	2	0.06 (not statistically significant*)	0.06 (not statistically significant*)	0.04 (not statistically significant*)	0.05 (not statistically significant*)
4	2	0.20	0.17	0.22	0.18
5	4	0.09	0.10	0.09	0.09
6	1	0.11	0.10	0.10	0.06 (not statistically significant*)
7	2	0.15	0.16	0.13	0.11
Quality of life	4	0.13	0.13	0.12	0.14
Total I-PSS:	17	0.18	0.17	0.17	0.16
Filling component	7	0.21	0.19	0.21	0.19
Voiding component	10	0.12	0.11	0.11	0.10

* All other coefficients were statistically significant at $p < 0.05$.

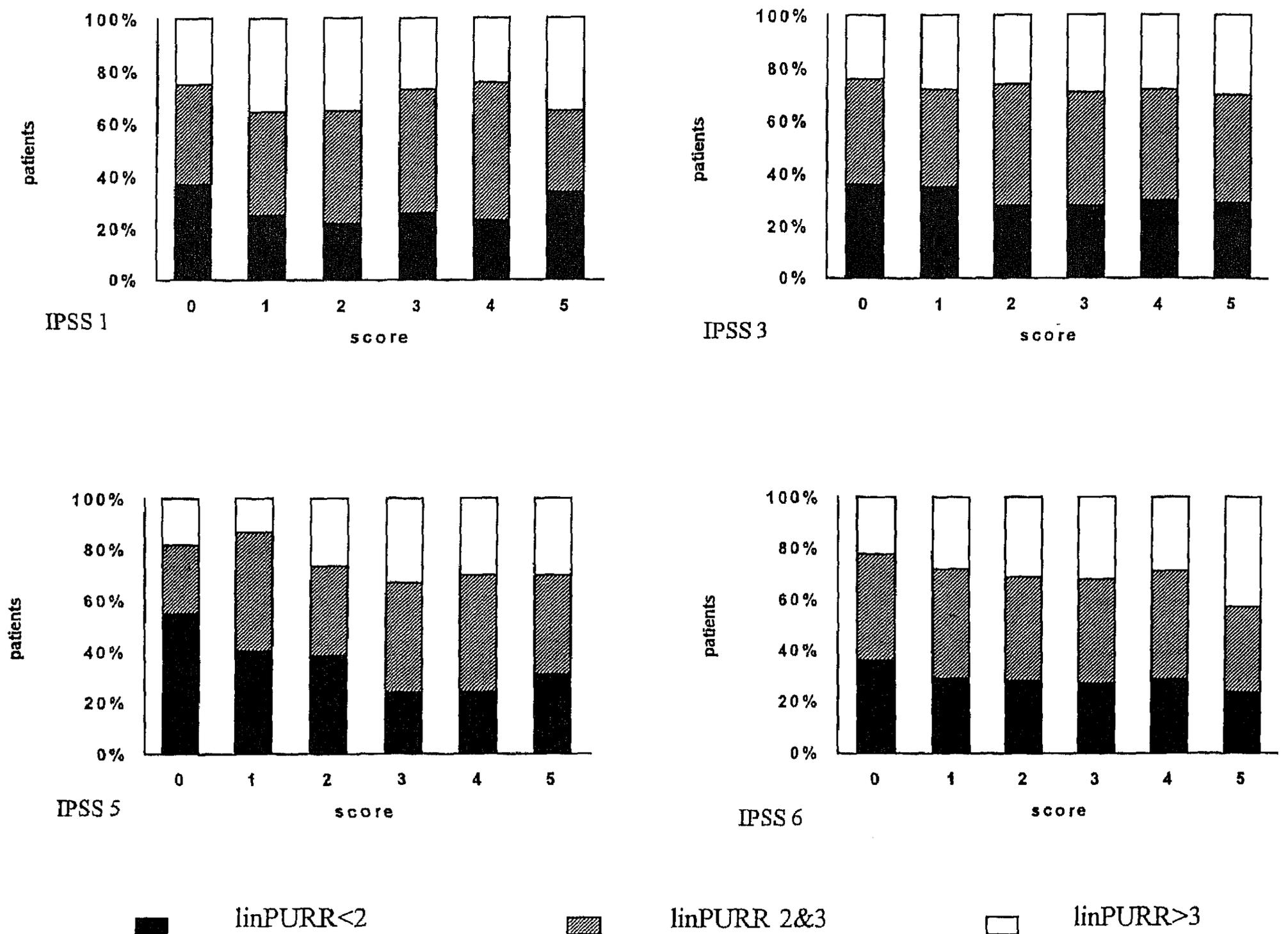


FIG. 1. Distribution of grade of bladder outlet obstruction as measured by linear passive urethral resistance relation (*linPURR*) according to symptom score for voiding questions 1, 3, 5 and 6 of I-PSS.

bladder outlet obstruction, which in turn may lead to a symptom complex, formerly known as prostatism.¹⁶ Optimally, a symptom questionnaire should measure the cause of the complaints, which is important in view of the choice of therapy. If a patient predominantly has complaints caused by bladder outlet obstruction a more invasive approach is recommended, while a patient without bladder outlet obstruction should be treated otherwise.¹⁷ Currently, urologists mainly use symptoms as a basis for choice of therapy. Thus, the correlation between symptoms and objective measures of outlet obstruction is important.

We investigated the relationship between results of urodynamic studies and lower urinary tract symptoms as measured by the I-PSS. Earlier studies showed no or only a weak correlation between lower urinary tract symptoms and bladder outlet obstruction.^{11,12} Also, Rosier et al recently found that symptoms cannot differentiate between patients with and without urodynamic bladder outlet obstruction.¹⁸ We found a similar result. Of our patients 249 (31%) did not have obstruction according to the linear passive urethral resistance relation, which is in accordance with other studies.¹⁹ Although one would expect only minimal symptoms in these patients, 31% had severe symptoms (total I-PSS more than 19, fig. 3, B). A trend was observed between the grade of bladder outlet obstruction and severity of symptoms but the correlation was weak (fig. 3, A). Consequently, a patient with a given severity of symptoms cannot be identified as having or not having obstruction (fig. 3, B). In 15% of patients with minimal symptoms severe bladder outlet obstruction may be

found, while 25% of patients with severe symptoms show no obstruction. For total I-PSS the correlation coefficient is only $r = 0.18$ (table 3) which is not clinically significant (the explained variance is only $0.18^2 = 3\%$).

A more detailed analysis was performed to explain this poor correlation. Possibly, certain (groups of) questions correlate better with outlet obstruction. Symptoms associated with bladder outlet obstruction due to BPH have been documented for many years as obstructive (voiding) and irritative (filling). Voiding symptoms are known to be a direct result of obstruction to the prostatic urethra, and include incomplete emptying of the bladder, intermittency, straining and weak stream. Filling symptoms include frequency, urgency and nocturia, and are believed to result from detrusor instability, which is said to arise secondary to bladder outlet obstruction. In contrast to earlier studies, filling symptoms correlated better with grade of bladder outlet obstruction than did voiding symptoms.²⁰ The correlation coefficient for filling symptoms according to the linear passive urethral resistance relation is $r = 0.21$ compared to only $r = 0.12$ for voiding symptoms. The same finding applies to the urethral resistance factor, detrusor pressure at maximum flow and minimum urethral opening pressure. More detailed information regarding the relationship between voiding questions and bladder obstruction is summarized in figure 1, in which the weak correlation is visualized. A similar study was performed regarding filling questions and bladder instability (fig. 2). There appeared to be no statistically significant correlation between complaints of frequency and bladder insta-

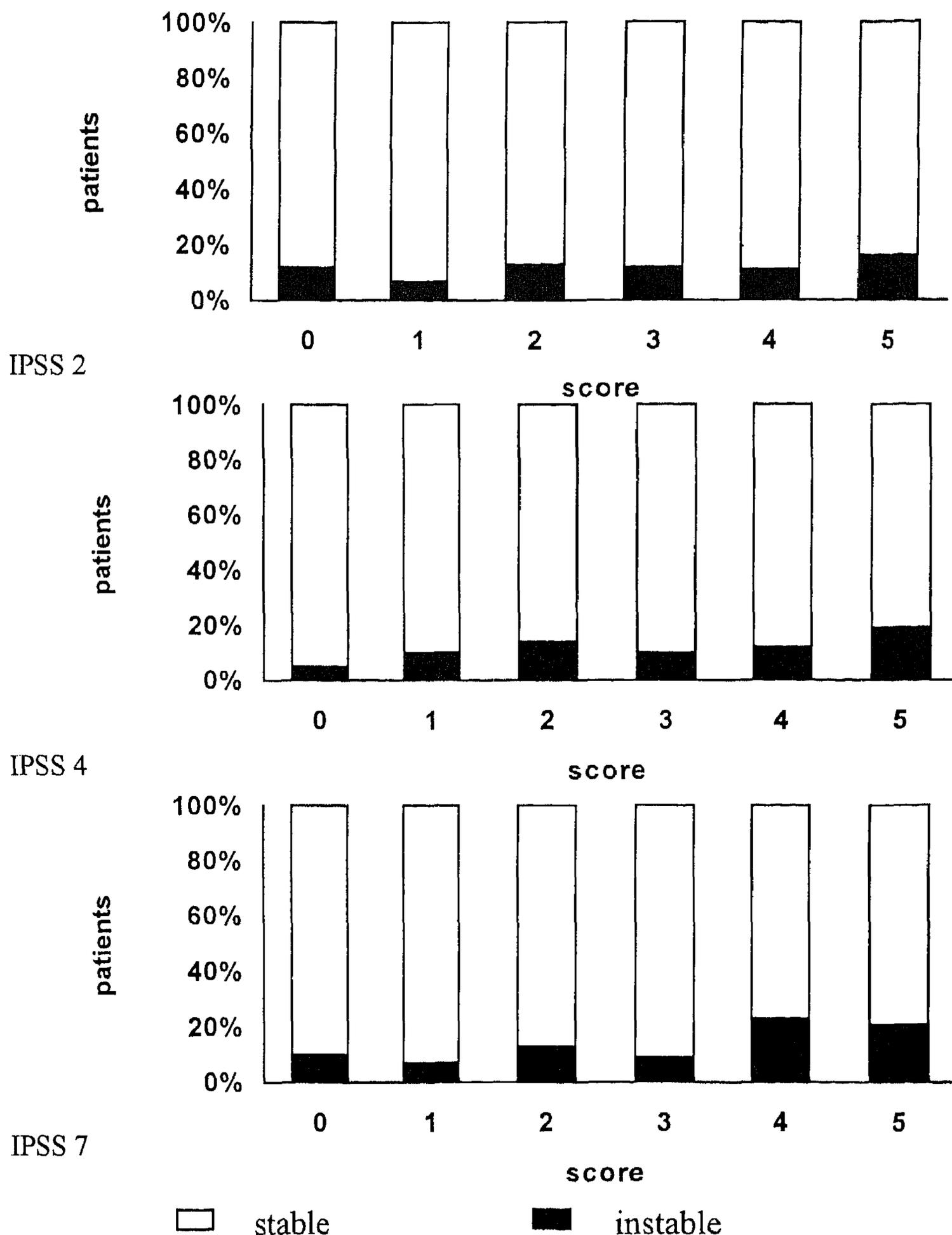


FIG. 2. Distribution of instability by symptom score for filling questions 2, 4 and 7 of I-PSS

bility. On the other hand, urgency complaints and nocturia showed a weak correlation with bladder instability. How can this finding be explained? The I-PSS measures only a limited number of symptoms. These questions have been derived from clinical experience and knowledge of BPH. Most probably, they indeed can quantify severity of symptoms. However, they do not correlate with grade of bladder outlet obstruction. To improve the current questionnaires, the International Continence Society BPH study was initiated, the aim of which is to investigate the relationship between results of urodynamic studies and a wide range of urinary symptoms.²¹ It is intended that this questionnaire be developed for use in research and clinical practice. Another approach to obtain information about bladder outlet obstruction without performing urodynamic studies with pressure-flow analysis was reported by Rosier et al.¹⁸ It appeared that prostate size and results of uroflowmetry measurements pro-

vide useful nonurodynamic indicators for bladder outlet obstruction. A combination of these investigations has been used to derive a urologically validated, noninvasive, disease specific, clinical prostate score.

CONCLUSIONS

From our study and the aforementioned results one may conclude that symptoms cannot be used to diagnose bladder outlet obstruction accurately. Therefore, symptoms should not be used as a major indication for surgery. Also, based on symptoms alone, we were unable to define subgroups that may benefit from further urodynamic examination. Therefore, a better understanding of the pathophysiology of lower urinary tract symptoms is needed, since only then will we be able to optimize treatment of patients with lower urinary tract symptoms and/or bladder outlet obstruction.

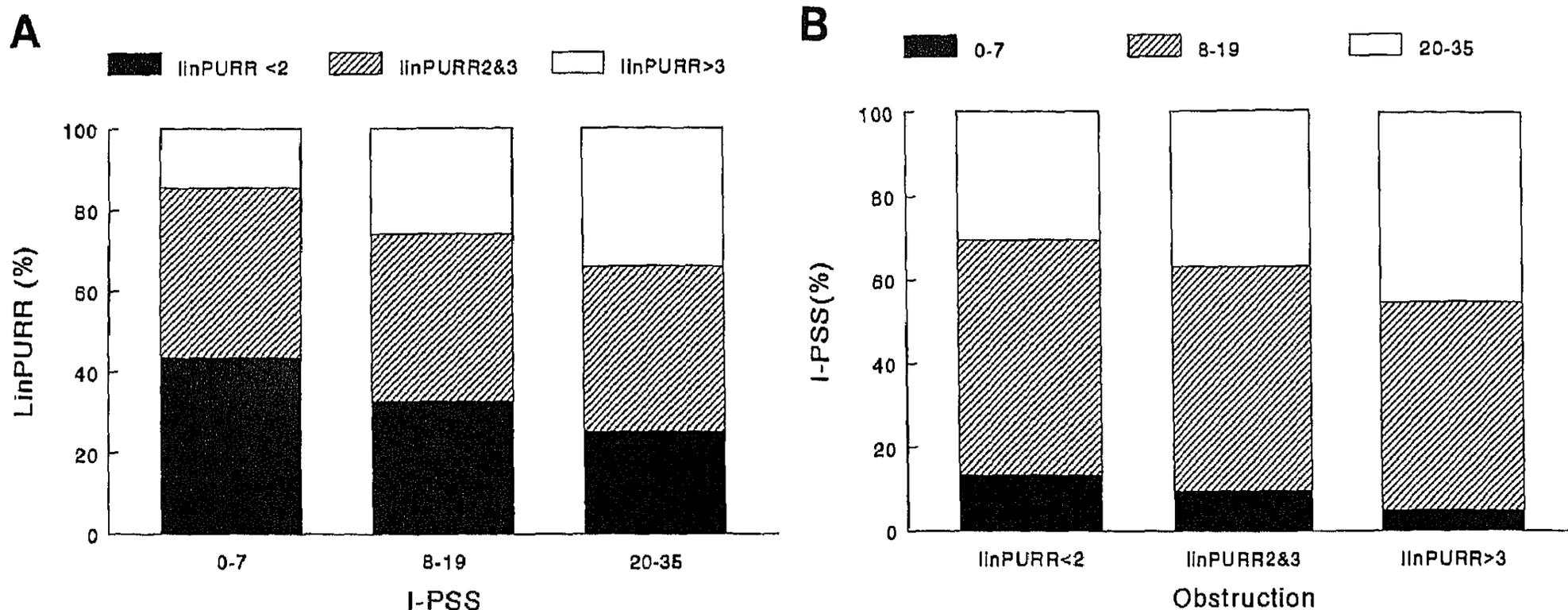


FIG. 3. Relationship between total I-PSS (A) and bladder outlet obstruction (B) classified as mild, moderate and severe (I-PSS 0 to 7, 8 to 19 and 20 to 35, respectively), and linear passive urethral resistance relation (*linPURR* less than 2, 2 and 3, and more than 3, respectively).

APPENDIX: I-PSS

	Not at All	Less Than 1 Time in 5	Less Than Half the Time	About Half the Time	More Than Half the Time	Almost Always
1. Over the past month, how often have you had a sensation of not emptying your bladder completely after you finished urinating?	0	1	2	3	4	5
2. Over the past month, how often have you had to urinate again less than 2 hours after you finished urinating?	0	1	2	3	4	5
3. Over the past month, how often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5
4. Over the past month, how often have you found it difficult to postpone urination?	0	1	2	3	4	5
5. Over the past month, how often have you had a weak urinary system?	0	1	2	3	4	5
6. Over the past month, how often have you had to push or strain to begin urination?	0	1	2	3	4	5
	None	1 Time	2 Times	3 Times	4 Times	5 or More Times
7. Over the past month, how many times did you most typically get up to urinate from the time you went to bed at night until the time you got up in the morning?	0	1	2	3	4	5
Total I-PSS Score S =						
Quality of Life Due to Urinary Symptoms						
	Delighted	Pleased	Mostly Satisfied	Mixed, About Equally Satisfied and Dissatisfied	Mostly Dissatisfied	Unhappy Terrible
1. If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?	0	1	2	3	4	5 6

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