Neurourology and Urodynamics 17:99–108 (1998)

# Relationships Between Lower Urinary Tract Symptoms and Bladder Outlet Obstruction: Results From the ICS-''BPH'' Study

**Jean J. M. C. H. de la Rosette,[1]* Wim P. J. Witjes,[1] Werner Schäfer,[2] Paul Abrams,[3] Jenny L. Donovan,[4] Tim J. Peters,[4] Richard J. Millard,[5] Cai Frimodt-Møller,[6] Paraskevas Kalomiris,[7] and the ICS-''BPH'' Study Group**

*[1]Department of Urology, University Hospital Nijmegen, Nijmegen, The Netherlands*
*[2]Department of Urology, Universitäts Klinik Aachen, Aachen, Germany*
*[3]Bristol Urological Institute, Southmead Hospital, Bristol, United Kingdom*
*[4]Department of Social Medicine, University of Bristol, Bristol, United Kingdom*
*[5]Department of Urology, Prince Henry Hospital, Little Bay, New South Wales, Australia*
*[6]Department of Urology, Gentofte Hospital, University of Copenhagen, Hellerup, Denmark*
*[7]Department of Urology, General Hospital of Sparta, Sparta, Greece*

Despite the lack of evidence in the literature for close relationships between lower urinary tract symptoms and bladder outlet obstruction, the majority of urologists rely on symptomatology when selecting patients for prostatic surgery. We investigated the relationships between a wide range of lower urinary tract symptoms from the ICS*male* questionnaire and the results of urodynamic pressure and flow studies. We evaluated 933 patients with lower urinary tract symptoms suggestive for bladder outlet obstruction from 12 countries who participated in the ICS-''BPH'' study with the ICS*male* questionnaire and urodynamic pressure and flow studies. Spearman rank correlation coefficients were obtained between symptoms and measures of bladder outlet obstruction. There was little or no correlation between a wide range of symptoms and the results of free uroflowmetry and pressure and flow studies. From symptoms alone, it is not possible to diagnose bladder outlet obstruction. Pressure and flow studies and symptom profiles measure different aspects of the clinical condition that should be viewed separately in the evaluation and treatment decision of the patient presenting with lower urinary tract symptoms. *Neurourol. Urodynam. 17:99–108, 1998.* © 1998 Wiley-Liss, Inc.

**Key words: symptoms; urodynamics; prostatic hyperplasia**

## INTRODUCTION

Lower urinary tract symptoms (LUTS), traditionally labelled as *prostatism*, are accepted by most cultures as an inevitable consequence of aging [Garraway et al.,

*Correspondence to: Jean J.M.C.H. de la Rosette, M.D., Ph.D., P.O. Box 9101, 6500 HB Nijmegen, The Netherlands. E-mail: J.delaRosette@uro.azn.nl

Received 3 June 1997; Accepted 10 September 1997

1991]. The term *prostatism* implies both cause and remedy, whereas in reality the condition results not only from infravesical bladder outlet obstruction (BOO) caused by the enlarged prostate gland but also from motor or sensory abnormalities of detrusor and urethral function or even from changes in habits and lifestyle that commonly occur as men grow older [Schäfer et al., 1988].

Despite the lack of evidence in the literature for close relationships between LUTS and BOO, more than half of the U.K. urologists rely on symptomatology when selecting patients for prostatic surgery [Emberton et al., 1995]. The remaining urologists use urine flow studies to measure the urinary stream and to quantify the effect of treatment. However, the reliability of this method is not optimal because there is a great variability in consecutive measurements [Golomb et al., 1992]. Furthermore, in up to 25% of patients with LUTS, the poor urinary stream is not due to BOO caused by the enlarged prostate gland but to a hypoactive detrusor muscle [Schäfer et al., 1988]. Conversely, approximately 7% of patients with normal flow rate have obstruction [Gerstenbert et al., 1982]. Urodynamic investigation with pressure and flow analysis is used as the gold standard for the quantification of the degree of obstruction in elderly men [Abrams and Griffiths, 1979]. Precise grading of obstruction is becoming increasingly important in the evaluation and comparison of new treatment modalities in the treatment of patients with LUTS and BOO. Based on this precise grading of obstruction, stratification of therapeutic options has recently become available [Rollema and van Mastrigt, 1991; Tubaro et al., 1995].

Besides the assessment of objective voiding parameters, the development and use of a valid symptom questionnaire are prerequisites in the evaluation of patients' symptoms and the measurement of outcome in clinical studies. In the past decades, at least six symptom questionnaires have been introduced and employed in patients with LUTS [Boyarsky et al., 1976; Madsen and Iversen, 1983; Fowler et al., 1988; Barry et al., 1992; Epstein et al., 1992; Hansen et al., 1995]. In four of these questionnaires, the reliability and validity have been assessed in groups of patients with the diagnosis of clinical BPH [Fowler et al., 1988; Barry et al., 1992; Epstein et al., 1992; Hansen et al., 1995], but in only one has the relationships between symptoms and clinical objective measurements including the urodynamic diagnosis of BOO been investigated [Barry et al., 1993; Ko et al., 1995; Ezz El Din et al., 1996].

Abrams [1994] suggested the following redefinition of terminology. BPH is a histological diagnosis that has been shown by Berry et al. [1984] to occur in 88% of men older than 80 years. Although BPH is prevalent, in some patients the gland enlarges, and this condition is termed *benign prostatic enlargement.* In approximately half of patients with benign prostatic enlargement, BOO results. BOO due to benign prostatic enlargement is now termed *benign prostatic obstruction* [Abrams, 1994].

In 1991, the International Continence Society (ICS) started an international multicentre study of patients with LUTS suggestive of BOO–the ICS-''BPH'' (benign prostatic hyperplasia) study. The aim was to validate a new questionnaire incorporating all urinary symptoms, related problems, and quality-of-life issues that could be indicative of BOO, detrusor instability, and detrusor underactivity. The aims of this study were to (1) investigate the relationships between the results of urodynamic studies and a wide range of urinary symptoms, (2) develop and validate an ICS-''BPH'' symptom questionnaire for use in research and clinical practice, and (3) compare pre- and posttreatment symptoms with the urodynamic confirmation of BOO

to be able to define the characteristics of patients who would be more likely to benefit from currently used therapies.

In the present study, the relationships between a wide range of urinary symptoms and BOO were investigated.

## PATIENTS AND METHODS

In the ICS-''BPH'' study, 1,271 patients older than 45 years of age attending urology departments in 12 countries with LUTS suggestive of BOO completed the ICS*male* questionnaire between January 1992 and December 1994. Patients were excluded from the study if they had an abnormal result of the mid-stream urinary specimen analysis or if they had significant other urological disease (such as prostate cancer), neurological disease, previous prostatic surgery, or were taking medication active on the lower urinary tract. If other pathologies such as urethral strictures or diverticulas were suspected, it was left to the discretion of the individual urologist to investigate the patients with additional methods such as urethral cystoscopy. Among these, 933 patients had evaluable pressure and flow studies.

All patients were evaluated at baseline by medical history. LUTS were evaluated by the ICS*male* questionnaire, which was designed to be completed by the patient. The ICS*male* questionnaire contains 22 questions measuring 20 urinary symptoms, with 19 questions also assessing the degree of problem that they cause, 7 condition-specific quality-of-life questions, and 4 items concerning sexual functioning [Donovan et al., 1996]. The majority of questions have five possible ranked responses from 1 to 5 (Fig. 1), with 1 indicating the least severe and 5 the most severe. The problem questions have four response categories, ranging from *not a problem* to a *serious problem* (see Fig. 1). The questionnaire was developed in English and then professionally translated into 10 other languages. Each translation was then back-translated and checked by a lay advisor or senior urologist from each country who was nominated as a national coordinator for the ICS-''BPH'' study. Patients were also evaluated by physical examination including digital rectal examination with estimation of the prostatic volume and an optional ultrasonographic examination of the prostate. Each patient had up to three free urine flow measurements including ultrasonic estimation of residual urine (the highest maximum flow rate being used for the analysis), followed by a pressure and flow study according to the ICS standards [Abrams et al., 1988]. Patients' bladders were filled at 50 ml/min; intravesical and intra-abdominal pressure were measured. Detrusor pressure was derived by electronic subtraction (detrusor pressure = intravesical pressure − intra-abdominal pressure). From the voiding phase, the maximum urine flow rate and the detrusor pressure at maximum flow were recorded. These data were plotted on a Schäfer linear passive urethral resistance relation (Lin-PURR) nomogram to quantify the obstruction from grade 0 (no obstruction) to 6 (severe obstruction) [Schäfer et al., 1989].

Spearman's rank correlation coefficients were calculated between each separate symptom question and the following urodynamic measures: Lin-PURR classification, detrusor pressure at maximum flow, and maximum free flow rate. The statistical significance of these correlations was ascertained with a two-sided *P* value. In addition, to remove any confounding effect of age on these relationships, partial rank

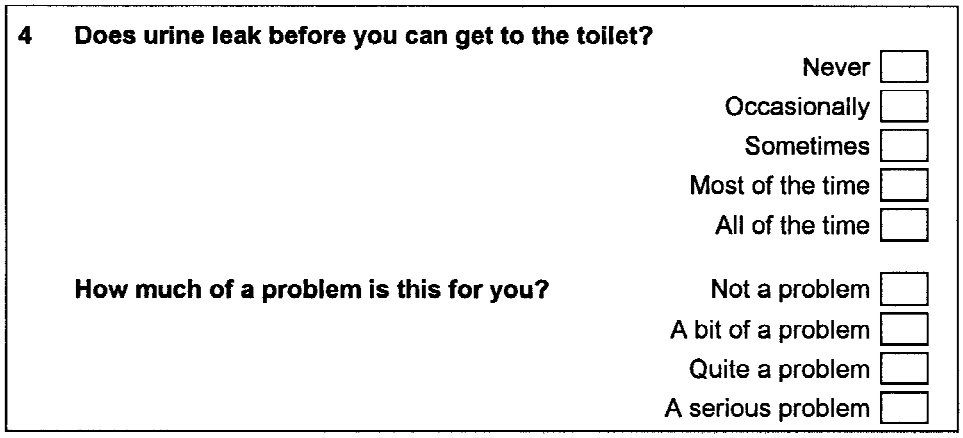


Fig. 1. An example of a question from the ICS*male* questionnaire, asking about the prevalence and bothersomeness of a symptom (urge incontinence).

correlation coefficients were calculated. Specifically, each correlation between symptoms and urodynamic measures were recalculated partialled for age.

Furthermore, with chi-square tests, the prevalence of each symptom was compared between patients who had obstruction (Lin-PURR $\leq 3$) and those who did not (Lin-PURR $< 3$). Similarly, symptom prevalence was compared between those with a residual urine volume after free flowmetry of below and above 100 ml and between those with a calculated bladder capacity (voided volume + residual volume) of below and above 300 ml.

## RESULTS

Table I and Figures 2 and 3 present descriptive statistics of the urodynamic variables for the study patients. For the maximum free flow rate (Fig. 2) and detrusor pressure at maximum flow, the means are higher than the medians (Table I), indicating that the distributions of these values are skewed to the right. The prevalence of each of the reported symptoms have been presented previously [Peters et al., 1997].

Table II presents the Spearman rank correlation coefficients and *P* values for the relationships between each symptom question and the urodynamic measures. Although a substantially greater number of these correlations achieve statistical significance than would be expected by chance alone, the largest coefficient is about 0.20, and even those of magnitude 0.10 are highly statistically significant because of the large sample size involved. Considering combinations of symptoms within the groups of storage and voiding symptoms did not lead to stronger associations with BOO than for the individual symptoms. The relationships between each symptom question and urodynamic measures were recalculated after adjustment for age. The results were not noticeably different when compared with the correlation coefficients in Table II, indicating that age has little or no confounding effect on these relationships.

Table III shows the results of the comparison of the prevalence of each symptom between the groups with ($n = 563$) and without ($n = 370$) BOO. The prevalence of urge and urge incontinence were significantly higher in the groups with BOO. This

**TABLE I. Descriptive Statistics of the Urodynamic Parameters of the Study Patients**

| | Mean ± SD | Median (range) |
|---|---|---|
| Maximum free flow rate (ml/s) | 12.3 ± 6.3 | 11.0 (1.0–55.0) |
| Detrusor pressure at maximum flow (cm water) | 68 ± 30 | 63 (15–200) |
| Lin-PURR category | 3.0 ± 1.4 | 3.0 (0–6) |

finding is in accordance with the low (albeit statistically significant) correlations presented in Table II. In addition, the prevalence of urinary retention was marginally significantly ($0.01 < P < 0.05$) higher in the group with BOO.

Table III also presents the results of the comparison of the prevalence of each symptom between the groups with (n = 300) and without (n = 622) a residual volume of at least 100 ml after free uroflowmetry and between the groups with (n = 450) and without (n = 471) a calculated bladder capacity of at least 300 ml. The prevalences of hesitancy, urgency, repeated urination, and strain to start were significantly higher in the group with a larger residual volume. The prevalences of intermittency and burning were marginally significantly ($0.01 < P < 0.05$) higher in the group with a higher residual volume. The prevalence of burning was significantly higher in patients with a larger calculated bladder capacity. The prevalence of urge incontinence was marginally significantly ($0.01 < P < 0.05$) higher in the group with a smaller calculated bladder capacity.

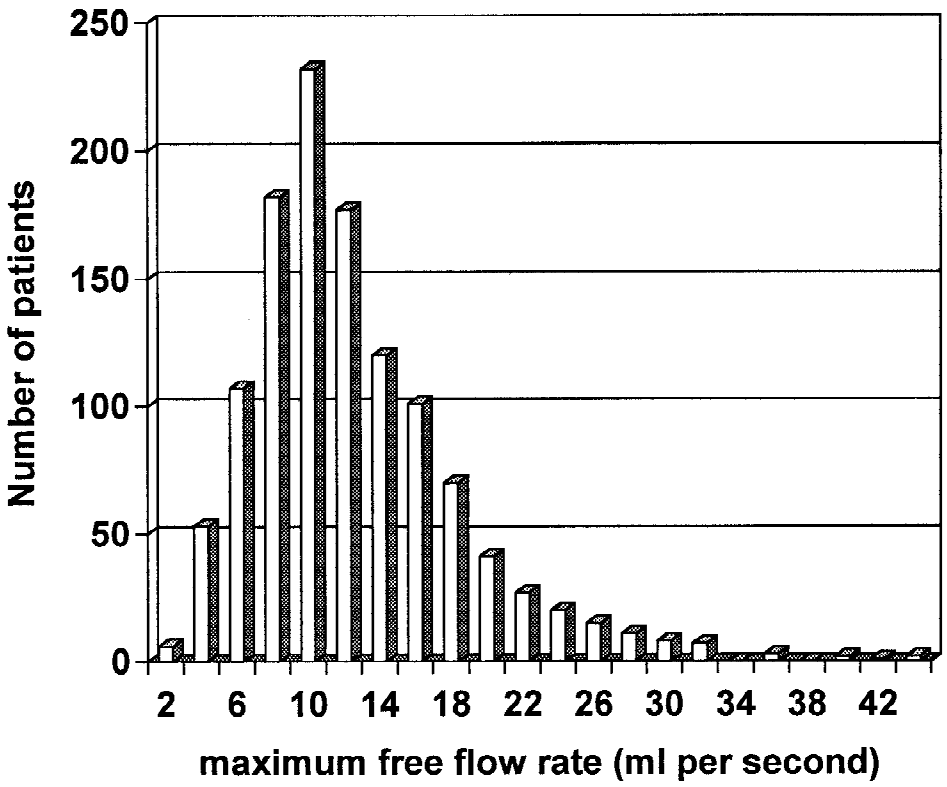


Fig. 2. Histogram of maximum urinary flow rates for the study patients.

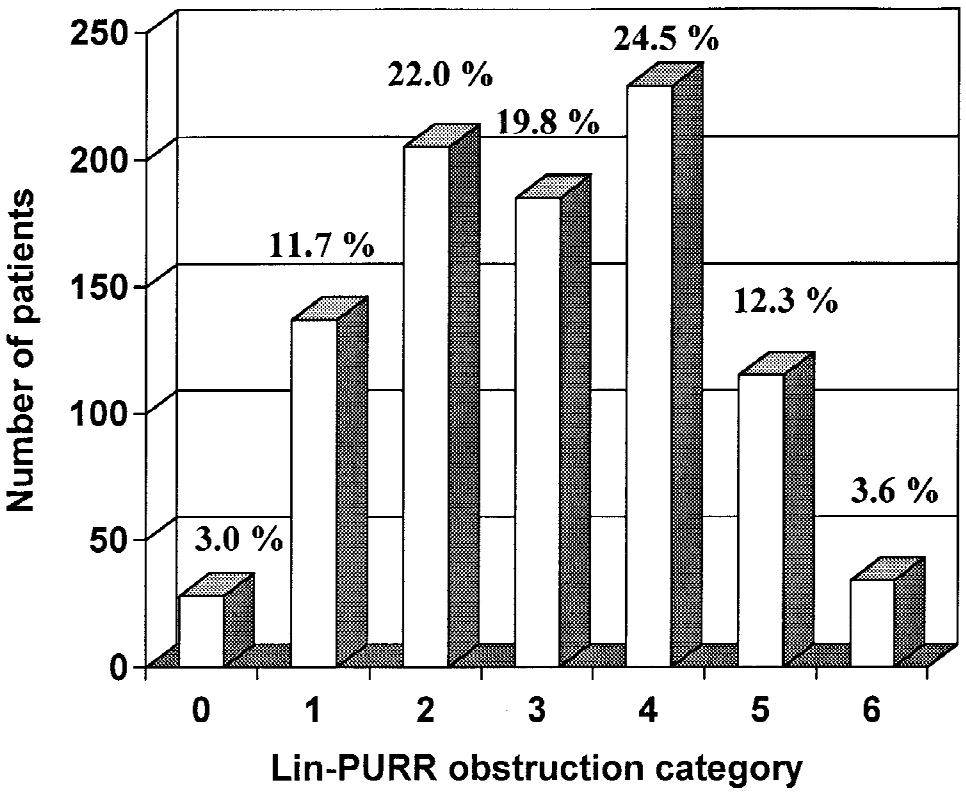


Fig. 3. Histogram of Lin-PURR for the study patients.

## DISCUSSION

The present study has investigated the associations between the various questions from the ICS*male* questionnaire and the results of pressure and flow studies. The results of pressure and flow studies can be classified according to the ICS nomogram, the Abrams-Griffiths nomogram, the Lin-PURR, or other available classification systems. More than 95% of the patients are equally classified when the Abrams-Griffiths nomogram is compared with the Lin-PURR classification. Consequently, at the 4th International Consultation on Benign Prostatic Hyperplasia, held in Paris in 1997, Abrams presented a new nomogram that can be regarded as a consensus between the Abrams-Griffiths nomogram and the Lin-PURR classification. We used the Lin-PURR nomogram to compare our results with those of others [Ko et al., 1995; Ezz El Din et al., 1996].

For only one of the published questionnaires has the relationships with urodynamic measurements been investigated [Barry et al., 1993; Ko et al., 1995; Ezz El Din et al., 1996], specifically the relationship of the American Urological Association (AUA)-7 index (the sum of the specific answers) with the grade of obstruction. No correlations were found for the AUA-7 index in relation to maximum free urinary flow rate, Lin-PURR obstruction category, and detrusor strength [Barry et al., 1993; Ko et al., 1995]. Using the AUA-7 symptom index, the severity of LUTS correlated

**TABLE II. Spearman Rank Correlation Coefficients and Their Significance Levels for Each Symptom With Pressure and Flow Measurements**

| Spearman correlation | Maximum free flow rate | | Detrusor pressure at maximum flow | | Lin-PURR category | |
|---|---|---|---|---|---|---|
| | r | *P* | r | *P* | r | *P* |
| Terminal dribble | <0.01 | 0.97 | 0.02 | 0.46 | 0.02 | 0.53 |
| Reduced stream | −0.19 | <0.01 | 0.04 | 0.19 | 0.06 | 0.06 |
| Intermittency | −0.09 | <0.01 | <0.01 | 0.81 | 0.02 | 0.47 |
| Hesitancy | −0.16 | <0.01 | 0.02 | 0.60 | 0.05 | 0.10 |
| Incomplete emptying | −0.02 | 0.52 | <0.01 | 0.80 | 0.02 | 0.63 |
| Urgency | −0.03 | 0.33 | 0.17 | <0.01 | 0.14 | <0.01 |
| Nocturia | −0.09 | <0.01 | 0.07 | 0.03 | 0.07 | 0.02 |
| Repeated urination | −0.02 | 0.57 | 0.04 | 0.24 | 0.03 | 0.41 |
| Strain to continue | −0.06 | 0.04 | <−0.01 | 0.78 | <0.01 | 0.81 |
| Postmicturition dribble | 0.09 | <0.01 | −0.01 | 0.71 | −0.02 | 0.48 |
| Strain to start | −0.03 | 0.32 | −0.02 | 0.55 | <0.01 | 0.83 |
| Urge incontinence | 0.02 | 0.53 | 0.15 | <0.01 | 0.11 | <0.01 |
| Frequency (times) | −0.07 | 0.03 | 0.03 | 0.33 | 0.05 | 0.15 |
| Burning | −0.04 | 0.20 | 0.09 | <0.01 | 0.10 | <0.01 |
| Bladder pain | −0.02 | 0.52 | 0.05 | 0.15 | 0.07 | 0.04 |
| Incontinence no cause | −0.02 | 0.50 | 0.04 | 0.19 | 0.03 | 0.36 |
| Sit to urinate | −0.11 | <0.01 | 0.02 | 0.53 | 0.02 | 0.45 |
| Stress incontinence | 0.07 | 0.02 | 0.01 | 0.66 | <−0.01 | 0.92 |
| Urinary retention | −0.10 | <0.01 | 0.08 | 0.01 | 0.10 | <0.01 |
| Nocturnal incontinence | −0.01 | 0.71 | 0.02 | 0.59 | 0.01 | 0.66 |
| Strength of stream | −0.21 | <0.01 | 0.05 | 0.10 | 0.09 | <0.01 |
| Frequency (intervals) | 0.07 | 0.02 | −0.09 | <0.01 | −0.10 | <0.01 |

well with overall health status but not with free urinary flow rate, prostate size, degree of bladder trabeculation, and the amount of postvoid residual urine [Barry et al., 1993]. This result is not surprising because the AUA-7 questions concern a heterogeneous group of storage and voiding symptoms (frequency, intermittency, urgency, nocturia, weak stream and hesitancy, and the feeling of incomplete bladder emptying). Combining symptoms within the storage and voiding groups made no difference to the results of the present study.

The main finding of the present study was that there is little or no correlation between the various symptoms and the data from either the pressure flow study or the maximum free flow rate. This result is in agreement with a previous study that investigated the correlation between the diagnosis of BOO and individual symptoms of the International Prostate Symptom Score (IPSS), a symptom score that is the same as the AUA-7 questionnaire but with the addition of an extra question on the overall quality of life [Ezz El Din et al., 1995]. Although the previous study concluded that there was a statistically significant correlation between the specific questions of the IPSS and objective grade of obstruction, the clinical significance of this finding is doubtful because none of the Spearman rank correlation coefficients was above 0.23, indicating very weak correlations. Furthermore, there was considerable overlap of symptom scores among patients with different grades of BOO [Ezz El Din et al., 1995].

The impact of age on the prevalence of symptoms has been described before. For instance, although an increasing trend has been observed with increasing age in a population-based study [Jolleys et al., 1997], the present group of patients exhibited

**TABLE III. Prevalence (%) of Each Symptom in the Groups With (n = 563) and Without (n = 370) Bladder Outlet Obstruction With (n = 300) and Without (n = 622) a Residual Volume ⩾100 ml After Free Uroflowmetry and in the Groups With (n = 450) and Without (n = 471) a Calculated Bladder Capacity ⩾300 ml**

| | Lin-PURR category | | | Residual volume (ml) | | | Bladder capacity (ml) | | |
|---|---|---|---|---|---|---|---|---|---|
| | ⩾3 | <3 | *P** | ⩾100 ml | <100 ml | *P** | ⩾300 ml | <300 ml | *P** |
| Terminal dribble | 94 | 93 | 0.69 | 92 | 93 | 0.33 | 93 | 92 | 0.59 |
| Reduced stream | 94 | 92 | 0.39 | 93 | 94 | 0.67 | 92 | 94 | 0.20 |
| Intermittency | 89 | 87 | 0.40 | 92 | 86 | 0.02 | 89 | 87 | 0.35 |
| Hesitancy | 84 | 81 | 0.23 | 89 | 82 | <0.01 | 86 | 82 | 0.14 |
| Incomplete emptying | 80 | 82 | 0.40 | 83 | 79 | 0.13 | 82 | 79 | 0.37 |
| Urgency | 78 | 67 | <0.01 | 80 | 72 | <0.01 | 73 | 76 | 0.19 |
| Nocturia | 74 | 73 | 0.94 | 76 | 75 | 0.75 | 72 | 78 | 0.06 |
| Repeated urination | 73 | 69 | 0.11 | 78 | 70 | <0.01 | 73 | 72 | 0.66 |
| Strain to continue | 68 | 69 | 0.86 | 71 | 67 | 0.31 | 70 | 67 | 0.25 |
| Postmicturition dribble | 67 | 69 | 0.49 | 70 | 66 | 0.19 | 69 | 66 | 0.39 |
| Strain to start | 60 | 64 | 0.32 | 67 | 56 | <0.01 | 62 | 58 | 0.26 |
| Urge incontinence | 52 | 42 | <0.01 | 51 | 46 | 0.25 | 44 | 52 | 0.02 |
| Frequency | 47 | 44 | 0.33 | 51 | 46 | 0.25 | 45 | 50 | 0.13 |
| Burning | 44 | 38 | 0.08 | 45 | 37 | 0.01 | 44 | 35 | <0.01 |
| Bladder pain | 42 | 37 | 0.08 | 44 | 39 | 0.17 | 43 | 38 | 0.16 |
| Incontinence no cause | 20 | 19 | 0.93 | 30 | 18 | 0.09 | 19 | 21 | 0.45 |
| Sit to urinate | 17 | 18 | 0.92 | 25 | 18 | 0.49 | 19 | 19 | 0.91 |
| Stress incontinence | 15 | 16 | 0.69 | 14 | 14 | 0.82 | 13 | 14 | 0.65 |
| Urinary retention | 10 | 6 | 0.04 | 10 | 9 | 0.55 | 8 | 10 | 0.33 |
| Nocturnal incontinence | 8 | 10 | 0.73 | 10 | 9 | 0.88 | 10 | 9 | 0.90 |

**P* value indicates the comparison of prevalences between both groups using the chi-square test.

a broadly negative correlation between the prevalence of symptoms from the ICS*male* questionnaire and increasing age [Peters et al., 1997]. Possible explanations put forward for these observations were that the selection process of the patients is of considerable importance and that the tolerance of LUTS may increase with age. To correct for the possible confounding effect of age on the relationship between the prevalence of symptoms and urodynamic measurements, the correlation coefficients were adjusted for age. In any event, the confounding effect of age on the relationship between each symptom and the urodynamic measures was negligible, indicating that the relationships are independent of the age pattern.

In conclusion, there are objective methods that quantify both urine flow rate and BOO. In addition, there are valid and reliable methods to quantify the presence of LUTS. These methods measure different aspects of the clinical condition that should be viewed separately in the evaluation and treatment decision of the patient presenting with LUTS. Because previous studies have indicated that inclusion of pressure flow data in the preoperative evaluation and patient selection for interventional therapies such as transurethral resection of the prostate and transurethral microwave thermotherapy may improve the overall clinical results [Rollema and van Mastrigt, 1991; Tubaro et al., 1995], the conclusion from the present study is that future studies on obstruction should be directed to investigate whether a combination of noninvasive measurements will be sensitive and specific enough to predict accurately the presence of bladder outlet the individual patient.

Future analyses of the ICS-''BPH'' study will provide vital information on the relative potential of symptoms and urodynamic and other clinical parameters to predict a favourable response to current and innovative treatments. Only then can the treatment of LUTS be individualized according to the pathophysiology, symptomatic complaints, and expectations of the patient.

## ACKNOWLEDGMENTS

The ICS-''BPH'' Study Group thank the other participants who have contributed to the study: Mr. Chapple, Sheffield (United Kingdom), Dr. Schick, Quebec (Canada), Dr. Gajewski, Halifax (Canada), Dr. Nordling, Bagsvaerd (Denmark), Dr. Walter, Ålborg (Denmark), Dr. Höfner, Hannover (Germany), Dr. Thuroff, Wuppertal (Germany), Dr. Porru, Cagliari (Italy), Dr. Bosch, Rotterdam (The Netherlands), Dr. Dabhoiwala, Amsterdam (The Netherlands), Dr. Matos Ferreira, Lisbon (Portugal), Dr. Mendes Silva, Lisbon (Portugal), Dr. Kinn, Danderyd (Sweden), Dr. Rertzhog, Sundsvall (Sweden), Dr. Nissenkorn, Kfar Saba (Israel), Dr. Kondo, Nagoya (Japan), Dr. Osawa, Okinawa (Japan), Dr. Tong Long Lin, Taipei (Taiwan), and Prof. Barbalias, Patras (Greece). We thank SmithKline Beecham for their major sponsorship of this study. Our gratitude also goes to Merck Sharp and Dohme; Bard; Pfizer; Yamanouchi; and Laboratories Labat whose educational grants made this study possible.

## REFERENCES

Abrams P (1994): New words for old: lower urinary tract symptoms for 'prostatism'. Br Med J 308: 929–930.

Abrams PH, Griffiths DJ (1979): The assessment of prostatic obstruction from urodynamic measurements and from residual urine. Br J Urol 51:129–134.

Abrams P, Blaivas JG, Stanton SL, Andersen JT (1988): Standardization of terminology of lower urinary tract function. Neurourol Urodyn 7:403–427.

Barry MJ, Fowler FJ, O'Leary MP, Bruskewitz RC, Holtgrewe HL, Mebust WK, Cockett ATK, and the Measurement Committee of the American Urological Association (1992): The AUA symptom index for benign prostatic hyperplasia. J Urol 148:1549–1557.

Barry MJ, Cockett ATK, Holtgrewe HL, McConnell JD, Sihelnik SA, Winfield HN (1993): Relationship of symptoms of prostatism to commonly used physiological and anatomical measures of the severity of benign prostatic hyperplasia. J Urol 150:351–358.

Berry SJ, Coffey DS, Walsh PC, Ewing LL (1984): The development of human benign prostatic hypertrophy with age. J Urol 132:474–479.

Boyarsky S, Jones G, Paulson DF, Prout GR (1976): A new look at bladder neck obstruction by the Food and Drug Administration regulators: Guidelines for investigation of benign prostatic hypertrophy. Trans Am Assoc Genital Urin Surg 68:29–32.

Donovan JL, Abrams P, Peters TJ, Kay HE, Reynard J, Chapple C, de la Rosette J, Kondo A (1996): The ICS-''BPH'' study: The psychometric validity and reliability of the ICS*male* questionnaire. Br J Urol 77:554–562.

Emberton M, Neal DE, Black N, Harrison M, Fordham M, McBrien MP, Williams RE, McPherson K, Devlin HB (1995): The National Prostatectomy Audit: The clinical management of patients during hospital admission. Br J Urol 75:301–316.

Epstein RS, Deverka PA, Chute CG, Panser L, Oesterling JE, Lieber MM, Schwartz S, Patrick D (1992): Validation of a new quality of life questionnaire for benign prostatic hyperplasia. J Clin Epidemiol 45:1431–1445.

Ezz El Din K, Kiemeney LALM, de Wildt MJAM, Rosier PFWM, Debruyne FMJ, de la Rosette JJMCH (1996): The correlation between bladder outlet obstruction and lower urinary tract symptoms as measured by the international prostate symptom score. J Urol 156:1020–1025.

Fowler FJ, Wennberg JE, Timothy RP, Barry MJ, Mulley AG, Hanley D (1988): Symptom status and quality of life following prostatectomy. JAMA 259:3018–3022.

Garraway WM, Collins GN, Lee RJ (1991): High prevalence of benign prostatic hypertrophy in the community. Lancet 338:469–471.

Gerstenberg TC, Andersen JT, Klarskov P, Ramirez D, Hald T (1982): High flow infravesical obstruction in men: Symptomatology, urodynamics and the results of surgery. J Urol 127:943–945.

Golomb J, Lindner A, Siegel Y, Korczak D (1992): Variability and circadian changes in home uroflowmetry in patients with benign prostatic hyperplasia compared to normal controls. J Urol 147:1044–1047.

Hansen BJ, Flyger H, Brasso K, Schou J, Nordling J, Thorup Andersen J, Mortensen S, Meyhoff H-H, Walter S, Hald T (1995): Validation of the self-administered Danish Prostatic Symptom Scrore (DAN-PSS-1) system for use in benign prostatic hyperplasia. Br J Urol 76:451–458.

Jolleys JV, Donovan JL, Nanchahal K, Peters TJ, Abrams P (1994): Urinary symptoms in the community: How bothersome are they ? Br J Urol 74:551–555.

Ko DSC, Fenster HN, Chambers K, Sullivan LD, Jens M, Goldenberg SL (1995): The correlation of multichannel urodynamic pressure-flow studies and AUA symptom index in the evaluation of benign prostatic hyperplasia. J Urol 154:396–398.

Madsen PO, Iversen P (1983): A point system for selecting operative candidates. In Hinman F Jr (ed): ''Benign Prostatic Hypertrophy.'' New York: Springer Verlag, pp 763–765.

Peters TJ, Donovan JL, Kay HE, Abrams P, de la Rosette JJMCH, Porru D, Thuroff MJ and the ICS-''BPH'' Study Group (1997): The ICS-''BPH'' study: The bothersomeness of urinary symptoms. J Urol 157:885–889.

Rollema HJ, van Mastrigt R (1991): Objective analysis of prostatism: A clinical application of the computer program CLIM. Neurourol Urodyn 10:71–76.

Schäfer W, Nopponey R, Rübben H, Lutzeyer W (1988): The value of free flow rate and pressure flow-studies in the routine investigation of BPH patients. Neurourol Urodyn 7:219–221.

Schäfer W, Waterbär F, Langen PH, Deutz FJ (1989): A simplified graphical procedure for detailed analysis of detrusor and outlet function during voiding. Neurourol Urodyn 8:405–407.

Tubaro A, Carter S, de la Rosette J, Höfner K, Trucchi A, Ogden C, Miano L, Valenti M, Jonas U, Debruyne F (1995): The prediction of clinical outcome from transurethral microwave thermotherapy by pressure-flow analysis: A European multicenter study. J Urol 153:1526–1530.