

THE REASON WHY PROSTATIC HYPERPLASIA CAUSES LOWER URINARY TRACT SYMPTOMS*

Masataka YANO**, Kosaku YASUDA**, Satoshi KITAHARA**,
C. NAKAJIMA**, Y. IIMURA**, and T. YAMANISHI***

Asian Med. J. 44 (2): 91-96, 2001

Abstract: In benign prostatic hyperplasia (BPH), the lower urinary tract changes both functionally and organically in association with the enlargement of prostate. Thereby, lower urinary tract symptoms (LUTS) are manifested. LUTS are classified into symptoms in the storage phase and in the voiding phase. The former includes urinary frequency, nocturia, urinary urgency, and incontinence. These are caused by detrusor enlargement and increased bladder sensation which occur in association with urethral resistance increased by urethral compression resulting from BPH. The symptoms caused by difficult voiding due to urethral compression by enlarged prostate are called voiding symptoms, which include urinary hesitation, prolongation of micturition time, weakening of stream, and so on. Aging, cerebral disease, vertebral disease, spinal disease, and heart disease present lower urinary tract symptoms very similar to those associated with BPH and these diseases complicate symptoms of BPH.

Key words: Benign prostatic hyperplasia; Lower urinary tract symptoms; Storage symptoms; Voiding symptoms

Introduction

Benign prostatic hyperplasia (BPH) is fundamentally a disease that causes morbidity through the urinary symptoms with which it is associated.¹⁾ Symptoms related to micturition are called lower urinary tract symptoms (LUTS),²⁾ which are classified into those which occur in the storage phase (storage symptoms) and those which occur in the voiding phase (voiding symptoms). The former includes urinary frequency, urinary urgency, nocturia (3 or more times voiding at night), and urinary incontinence. The latter includes micturition pain, hesitation, prolongation of voiding, interruptions of voiding, weak stream, sensation of residing straining for voiding, and terminal dribbling.

Most LUTS are characteristic of various lower urinary tract diseases, espe-

* This article is a revised English version of a paper originally published in the Journal of the Japan Medical Association (Vol. 123 No. 2, 2000, pages 205-209). The Japanese text is a transcript of a lecture originally aired on September 21, 1999, by the Nihon Shortwave Broadcasting Co., Ltd., in its regular program "Special Course in Medicine".

** Department of Urology, Dokkyo University School of Medicine, Koshigaya Hospital

*** Department of Urology, Chiba University, School of Medicine

Table 1 International Prostate Symptom Score (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 or so, 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 or so, how often have you had to urinate again less than two hours after you finished urinating?	0	1	2	3	4	5
3. Over the past month or so, 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 or so, how often have you found it difficult to postpone urination?	0	1	2	3	4	5
5. Over the past month or so, how often have you had a weak urinary stream?	0	1	2	3	4	5
6. Over the past month or so, how often have you had to push or strain to begin urination?	0	1	2	3	4	5
7. Over the last 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?	None	1 time	2 times	3 times	4 times	5 or more times
	0	1	2	3	4	5

I-PSS = sum of questions 1-7 = ____

Quality of life due to urinary symptoms

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?	Delighted	Pleased	Mostly satisfied	Mixed (about equally satisfied and dissatisfied)	Mostly dissatisfied	Unhappy	Terrible
		0	1	2	3	4	5

Reference: Barry M.J., Fowler, F.J., O’Leary, M.P. *et al.*: the American Urological Association Symptom Index for benign prostatic hyperplasia. *J Urol* 148: 1549, 1992.

cially bladder outlet obstructions. BPH also has several characteristic symptoms. WHO has recommended the use of a standard called “International Prostate Symptom Score (IPSS)”, which scores the seven listed symptoms, for severity judgement³⁾ (Table 1). However, it has already been proven that this scoring standard is not sufficient to estimate or judge the volume of the prostate (benign prostatic enlargement: BPE) or the degree of lower urinary tract obstruction.⁴⁾

In this review we discuss the mechanism by which BPE causes LUTS and the reason why BPH cannot be exactly diagnosed from these symptoms in cases with BPE.

Mechanism Through Which BPE Causes LUTS

An enlarged prostate oppresses the urethra, or obstructs it, and increases urethral resistance and the work of the detrusor for micturition. This results in

Table 2 Mechanism of Urinary Tract Disturbance in BPH

1. Voiding disturbance
A. Organic (BPE)
1) Obstruction
2) Compression of the external urethral sphincter
3) Extension of the prostatic capsule
4) Compression of the bladder base
5) Elongation of the prostatic urethra
B. Functional
1) Increase in α -receptor in the prostate
2) Detrusor bladder neck dyssynergia
3) Inability of the external urethral sphincter
4) Dyscontractility of the detrusor due to bladder distension
2. Storage disturbance
A. Organic (Low compliance bladder)
B. Functional
1) Detrusor overactivity
2) Overdistension of the detrusor

detrusor hypertrophy. As urethral obstruction progresses, the postvoid residual urine volume increases. That is, to whatever extent the detrusor hypertrophies, it cannot void urine sufficiently, and the condition becomes decompensatory (Table 2). LUTS are manifested due to such lower urinary tract changes associated with BPE. Thus the manifested symptoms are considered to be specific urinary symptoms to BPE.

BPE obstructs the urethra, and, thereby, a voiding disturbance occurs. This is also fundamentally important in BPH. The above mentioned voiding symptoms, such as hesitancy, prolongation, weak stream, etc., are found in 60–90% of BPH patients. In our experience, hesitancy is the most important of the voiding symptoms in BPH. We explain the reason below.⁵⁾

The possible mechanisms of bladder outlet obstruction due to BPE are (1) the enlargement of the prostate resulting in extension of the urethra and prostatic capsule and (2) the increase in tonus of the smooth muscle in the prostate.⁶⁾ As is well known, in the drug therapy of BPH, an anti-androgen is used to reduce the size of the gland and an α -blocker to decrease smooth muscle tone.⁷⁾ Our series of studies have demonstrated that an α -blocker not only decreases smooth muscle tone but also resolves detrusor bladder neck dyssynergia in the voiding phase. When the detrusor contracts, the α -blocker makes the internal urethral orifice open synchronously.

As bladder outlet obstruction progresses due to BPE, the detrusor sensitivity to the stimulus increases and, in this condition, the bladder contracts suddenly even when a small amount of urine, with which no desire to void occurs in normal conditions, accumulates in the bladder. This condition is called detrusor overactivity, or unstable bladder. Unstable bladder causes urinary urgency or urge incontinence. Urinary incontinence is a troublesome condition and the patient frequently goes to the toilet.

Hypertrophy of the detrusor results in bladder wall thickening due to which

Table 3 Other Factors Complicating BPH Symptoms or Causing Similar Symptoms

1. Detrusor hyperactivity with incomplete contraction
2. Cardiac disease
3. Renal failure
4. Cerebral infarction
5. Vertebral or spinal cord disease
6. Bladder neck obstruction
7. Prostatitis
8. Others

the detrusor smooth muscle cannot stretch smoothly in the storage phase. Such a condition is called low-compliance bladder. In this condition, not much urine can be held in the bladder and urinary frequency occurs. It has been reported that benign prostatic enlargement (BPE) causes extension of the urethra and prostatic capsule, and sensory nerves present in the capsule are stimulated. Unstable bladder is thus induced in the filling phase. In our experience, urinary frequency and nocturia are the most important of the storage symptoms in BPH. In the stage of decompensation of the detrusor, intravesical pressure increases due to bladder wall thickening and large postvoid residual urine volume, and urine cannot be transferred to the bladder through the ureter. In this condition, hydroureter and hydronephrosis lead to chronic postrenal failure advance.⁸⁾ As such a condition advances, voiding symptoms increase in severity and large residual urine volume is found in the bladder. Urine cannot be voided without straining. In patients having a lot of postvoid residual urine due to difficulty in voiding, an abdominal pressure by turning over in bed or in standing up sometimes causes urinary incontinence which is a symptom in the storage phase. This is called overflow incontinence. In addition, abdominal distension associated with residual urine and hydronephrosis and edema due to renal failure also occur. As mentioned above, BPH triggers so many urinary symptoms that it is difficult to determine which symptoms are specific to BPH.

Other Factors Complicating BPH Symptoms or Causing Similar Symptoms

The prostate becomes enlarged at the age of 40 years or later. Age-associated urinary disturbance may sometimes change BPH symptoms or cause similar symptoms. Factors complicating BPH symptoms include the aging of lower urinary tract tissue, changes in urine-producing circadian rhythm due to changes in vasopressin secretion, lower limb edema due to cardiac dysfunction, vertebral or spinal diseases, cerebral infarction and so on (Table 3).

The change in urinary symptoms by aging is a significant factor which alters BPH-specific symptoms. A change in the lower urinary tract which arises through aging is the aging of the bladder. The aging of the bladder causes a degeneration of detrusor tissue, resulting in the formation of more junctions between smooth

muscles. Thus, the detrusor becomes overactive (unstable bladder). In this condition, a minimal stimulus to the bladder (small volume of urine) causes detrusor contraction. Unstable bladder is a major cause of urinary frequency, urgency and urinary incontinence. Fibrous tissue deposits between the detrusor muscle and, thereby, the bladder cannot dilate smoothly and it becomes difficult to fill with urine. This condition is low-compliance bladder, which becomes causative of urinary frequency. On the other hand, detrusor degeneration leads to the reduction in bladder contraction and induces voiding symptoms such as prolongation of micturition time, weakening of stream, etc.

Due to the above reasons, detrusor hyperactivity with incomplete contraction (DHIC) is often found in elderly people.⁹⁾ In DHIC, unstable bladder generally co-exists with detrusor incomplete contraction. It has been known that the incidence of this phenomenon increases remarkably at the age of 70 years. In DHIC, storage disturbance such as urinary frequency and urinary incontinence is found together with voiding disturbance such as increased postvoid residual urine volume. In the presence of increased residual urine volume, urinary tract infection is often found. This condition is very similar to lower urinary tract symptoms in BPH. In other words, the same lower urinary tract symptoms as those in BPH occur even in BPH-free females aged over 70 years.

It is well known that circadian rhythm of vasopressin secretion changes with aging. The decrease in vasopressin secretion at night leads to nocturnal polyuria, which causes nocturia.

In heart disease with lower limb edema, the volume of circulating blood increases during night sleeping and urine volume increases at night. This causes nocturia.

In vertebral or spinal disease and cerebral infarction, it is likely that voiding-related central nervous system may be damaged. This is called neurogenic bladder. The most common phenomenon is detrusor overactivity (detrusor hyperreflexia) which is caused by supra-nuclear lesion of nerves innervating the detrusor. Like unstable bladder in BPH, this condition causes urinary urgency or urge incontinence. In spinal disease, detrusor-sphincter dyssynergia is often found. In this condition, the external urethral sphincter contracts to close the urethra when the detrusor contracts and, thus, voiding is disturbed. This voiding symptom due to non-synergic contraction of the external urethral sphincter is similar to urethral obstruction due to BPH.

Conclusion

In BPH, the lower urinary tract changes both functionally and organically in association with the enlargement of prostate. Thereby, LUTS are manifested. LUTS are classified into symptoms in the storage phase and those in the voiding phase. The former includes urinary frequency, nocturia, urinary urgency, and incontinence. These symptoms are caused by detrusor enlargement and increased bladder sensation which occur in association with urethral resistance increased by urethral compression resulting from BPH. The symptoms caused by difficult voiding due to urethral compression by enlarged prostate are called voiding symptoms and

include urinary hesitation, prolongation of micturition time, weakening of stream, etc.

In this article, the authors have pointed out that aging, cerebral disease, vertebral disease, spinal disease, and heart disease present lower urinary tract symptoms very similar to those associated with BPH and also that these diseases complicate symptoms of BPH.

REFERENCES

- 1) Witjes, W.P.J., Rosette, J.M., Donovan, J.L. *et al.*: The International Continence Society "Benign prostatic hyperplasia" study: International differences in lower urinary tract symptoms and related bother. *157*: 1295-1300, 1997.
- 2) Abrams, P.: New words for old: Lower urinary tract symptoms for "prostates". *BMJ* 308: 929-930, 1994.
- 3) Denis, L., Griffiths, K., Khoury, S. *et al.*: 4th International Consultation on Benign Prostatic Hyperplasia (BPH): Proceedings 4, Plymbridge Distributors Ltd., Plymouth, 1997, pp.265-321.
- 4) Chancellor, M.B. and Rivas, D.A.: American Urological Association Symptom Index for women with voiding symptoms: Lack of index specificity for benign prostatic hyperplasia. *J Urol* 150: 1706-1709, 1993.
- 5) Chalfin, S.A. and Bradley, W.E.: The etiology of detrusor hyperreflexia in patients with infravesical obstruction. *J Urol* 127: 938-941, 1982.
- 6) Caine, M. and Perlberg, S.: Dynamics of acute retention in prostatic patient and role of adrenergic receptors. *Urology* 9: 399-403, 1977.
- 7) Holtgrewe, H.L.: Current trends in management of men with lower urinary tract symptoms and benign prostatic hyperplasia. *Urology* 51 (Suppl 4A): 1-7, 1998.
- 8) Sarmina, I. and Resnick, M.I.: Obstructive uropathy in patients with benign prostatic hyperplasia. *J Urol* 141: 866-869, 1989.
- 9) Resnick, N.M. and Yalla, S.V.: Detrusor hyperactivity with impaired contractile function. An unrecognized but common cause of incontinence in elderly patients. *JAMA* 257: 3076-3081, 1987.