

with the mental component one (table 1). Among women, urgency, nocturia and weak stream showed a significant correlation with the physical component summary score, and any symptom questions did not show a correlation with the mental component one.

The storage symptom score showed much better correlations with most of SF-36 subscale scores than the voiding symptom score did (table 3). As a result, among both men and women, the correlation of storage symptom score with each SF-36 summary measure was much closer than that of voiding symptom score, which was not statistically significant (table 2).

The storage symptom score significantly correlated with all but mental health subscale scores among women, and with all subscale scores except bodily pain and social functioning among men (table 3). Among women, the storage symptom score significantly correlated with the physical component summary score, but not with the mental component one (table 2). Among men, on the contrary, the storage symptom score showed a closer correlation with the mental component summary score than the physical component one. Age showed a weak correlation with the physical component summary score among men.

#### Comorbid Diseases

The QoL status may be affected by many physical and mental problems other than LUTS. The numbers of respondents suffering from comorbid diseases were as follows (male, female): diabetes mellitus (14, 1), back or joint pain (14, 10), history of cancer (18, 5), circulatory diseases including hypertension (36, 14), cerebrovascular disorder (7, 0), renal (3, 2), digestive (20, 2), gynecological (0,

6) and respiratory (1, 1) diseases. When comorbid diseases were added as additional independent variables in multiple regression analysis, the statistical relations between storage and voiding symptoms and the disease-specific or generic QoL were not changed from those mentioned above (table 4).

**Table 1.** Standardized regression coefficients between each symptom question of I-PSS and the disease-specific (I-PSS QoL and BPH impact index) or generic QoL (physical and mental component summary measures of SF-36) indices (multiple regression analysis controlling age)

	I-PSS QoL	BPH impact	Physical component	Mental component
<i>Men</i>				
Incomplete empty	0.18*	-0.05	0.15	0
Frequency	0.13	0.13	-0.12	0.22
Intermittency	-0.02	0.11	0.02	-0.12
Urgency	0.19*	0.20*	-0.06	-0.34*
Weak stream	0.43*	0.35*	-0.20*	-0.10
Straining	-0.04	0.02	-0.02	0.04
Nocturia	0.15*	0.08	-0.13	-0.21*
<i>Women</i>				
Incomplete empty	0.18	0.33*	-0.13	-0.12
Frequency	0.27*	0.13	0.06	-0.08
Intermittency	0.06	-0.02	0.21	-0.14
Urgency	0.26*	0.32*	-0.38*	-0.27
Weak stream	-0.01	-0.01	-0.30*	0.47
Straining	0.16	0.06	0.24	0.10
Nocturia	0.22*	0.26*	-0.30*	-0.12

\*  $p < 0.05$ : Significant positive or negative correlation for disease-specific or generic QoL index, respectively.

**Table 2.** Correlations between QoL indices and LUTS and age in multiple regression analysis

	Storage		Voiding		Age	
	b	p value	b	p value	b	p value
<i>Men</i>						
I-IPSS QoL	0.39	<0.0001*	0.45	<0.0001*	-0.02	0.76
BPH impact	0.32	<0.0001*	0.38	<0.0001*	-0.02	0.81
Physical component	-0.23	0.01*	-0.04	0.65	-0.15	0.046*
Mental component	-0.26	0.005*	-0.11	0.21	0.04	0.58
<i>Women</i>						
I-IPSS QoL	0.59	<0.0001*	0.33	0.0003*	-0.04	0.57
BPH impact	0.54	<0.0001*	0.28	0.008*	0.03	0.77
Physical component	-0.56	<0.0001*	0.12	0.38	-0.08	0.46
Mental component	-0.25	0.10	0.19	0.21	-0.04	0.76

b = Standardized regression coefficient. \*  $p < 0.05$ .

Only back or joint pain in men and gynecological diseases in women weakly correlated with I-PSS QoL and BPH impact index, respectively (table 4). Among men, the physical component summary score of SF-36 was significantly influenced by back or joint pain and weakly by circulatory diseases and cerebrovascular disorder (ta-

ble 4). Among women, history of cancer showed a significant correlation with the mental component summary score (table 4). In the total population including both sexes, any comorbid diseases did not show a significant correlation with disease-specific QoL indices, whereas back or joint pain ( $p < 0.0001$ ) and circulatory diseases

**Table 3.** Standardized regression coefficients between storage or voiding symptom score of I-PSS and each subscale score of SF-36 (multiple regression analysis controlling age)

	PF	RP	BP	GH	VT	SF	RE	MH
<i>Men</i>								
Storage	-0.27*	-0.30*	-0.08	-0.21*	-0.23*	-0.16	-0.30*	-0.26*
Voiding	-0.07	-0.05	-0.19*	-0.19*	-0.05	-0.17	-0.01	-0.12*
<i>Women</i>								
Storage	-0.54*	-0.55*	-0.45*	-0.62*	-0.57*	-0.44*	-0.37*	-0.20
Voiding	0.15	0.38	0.02	-0.01	0.15	0.20	0.41	-0.01

PF = Physical functioning; RP = role-physical; BP = bodily pain; GH = general health; VT = vitality; SF = social functioning; RE = role-emotional; MH = mental health. \*  $p < 0.05$ ; Significant negative correlation.

**Table 4.** Standardized regression coefficients between each QoL index and storage or voiding symptom score of I-PSS and comorbid diseases in men and women (multiple regression analysis controlling age)

	I-IPSS QoL	BPH impact	Physical component	Mental component
<i>Men (n = 172)</i>				
I-IPSS				
Storage	0.35**	0.31**	-0.22*	-0.28**
Voiding	0.46**	0.40**	-0.04	-0.07
Diabetes mellitus (14)	-0.06	-0.08	0.00	0.02
Back or joint pain (14)	0.14*	0.08	-0.27**	-0.02
Cancer history (18)	-0.07	-0.11	-0.10	-0.02
Circulatory (36)	0.05	0.01	-0.16*	-0.14
Cerebrovascular (7)	0.01	-0.02	-0.15*	-0.13
Renal (3)	0.04	-0.09	0.03	-0.05
Digestive (20)	0.03	0.02	-0.11	-0.07
Gynecological (0)	-	-	-	-
Respiratory (1)	-0.05	-0.04	-0.10	0.01
<i>Women (n = 67)</i>				
I-IPSS				
Storage	0.73**	-0.69**	-0.50**	-0.36*
Voiding	0.23*	0.21*	0.10	0.21
Diabetes mellitus (1)	-0.00	0.11	-0.19	-0.01
Back or joint pain (10)	-0.06	-0.00	-0.22	0.19
Cancer history (5)	0.10	0.05	-0.14	-0.26*
Circulatory (14)	-0.04	-0.08	-0.11	0.06
Cerebrovascular (0)	-	-	-	-
Renal (2)	0.15	0.08	0.11	0.13
Digestive (2)	-0.11	-0.21	0.08	0.24
Gynecological (6)	0.15	0.25**	-0.04	-0.19
Respiratory (1)	-0.16	-0.14	-0.11	-0.17

A meaningful regression coefficient was considered to be positive for disease-specific QoL index and negative for summary measure of SF-36 (\*  $p < 0.05$ , \*\*  $p < 0.01$ ).

( $p = 0.004$ ) significantly correlated with the physical component summary measure. Neither the storage nor voiding symptom score was associated with any comorbid diseases.

## Discussion

Using the culturally and linguistically validated questionnaires (I-PSS, BPH impact index and SF-36), we examined how the LUTS affect the disease-specific (I-PSS QoL and BPH impact indices) and generic (SF-36) QoL in men and women. The impact of LUTS on QoL has been studied using disease-specific or generic QoL measure in men and women [1–8]. The impact of storage symptom on disease-specific QoL appears to be greater than that of voiding symptom [2, 20], although the reversed finding in men was reported from Japan [14]. Physical health appears to be more associated with LUTS than mental health, while mental health was associated with LUTS among Korean men [7]. However, few studies have addressed how the impact of LUTS on QoL is differentially estimated by disease-specific and generic QoL measures.

The severity of LUTS estimated by the I-PSS was significantly associated with both disease-specific and generic QoLs in men and women, while the association was more pronounced for disease-specific measure [3, 7]. As for the disease-specific QoL, the voiding symptom had a greater QoL impact than the storage symptom among men, but the finding was reversed among women. This sex difference in the disease-specific QoL impact of LUTS is consistent with a previous report from Japan [8, 14]. In general, voiding symptoms are more prevalent in men [4, 14], as in the present study. It has been known that severer LUTS tend to show more evidently the association with disease-specific QoL perception [3]. The distribution of symptom severity in a study population may affect the statistical results of QoL impact estimated by disease-specific measure.

Among both men and women, the storage symptom had a significant impact on the generic QoL, but the voiding symptom did not. In view of the clinical importance of overactive bladder syndrome, it would be interesting that storage symptoms have a greater impact on generic QoL. Generic QoL may be affected by many physical and mental problems other than LUTS [21]. It is possible that comorbid diseases are prevalent in the individuals with severe storage symptom [22]. However, neither the storage nor voiding symptom was significantly associated with any comorbid diseases in the present study. The

storage symptom gave a greater impact on the mental health rather than the physical health among men. Among women, on the other hand, the storage symptom had a significant impact on the physical health but not on the mental health. This might be partly attributed to the lower score of mental health in the present female samples. The mean scores of physical and mental component summary measures of SF-36 were 48.4 and 49.2 for men, and 47.7 and 45.5 for women.

The impact of LUTS on health status was differentially estimated by the disease-specific and generic QoL measures. The disease-specific QoL was strongly influenced by both storage and voiding symptoms, while the generic QoL was affected by the storage symptom alone. The impacts of storage and voiding symptoms on QoL also varied with gender. The QoL status estimated by disease-specific measure may be more susceptible to the distribution of symptom severity in a study population. On the other hand, generic QoL may be influenced by comorbid diseases. The present results clearly demonstrated that comorbid diseases affect the generic QoL, especially physical health perception, however have no significant effect on the disease-specific QoL. The interpretation of a result in QoL research demands careful consideration about the distribution of symptom severity and comorbid diseases in a study population.

A potential limitation of our study was that it was not a population-based study, and the subjects were sampled from attendees at the public lectures concerned with urological diseases. Thus, the characteristics of LUTS or QoL status in the sample did not reflect those in the Japanese general population (data not shown). Also, since the questionnaire used in this study included >50 questions, the rate of respondents who completed the questionnaire was relatively low. However, such limitations in the generalization of LUTS or QoL status could not prevent us from examining the relationships between LUTS and QoL perception (the impact of LUTS on health status).

## References

- 1 Hunter DJW, McKee M, Black NA, Sanderson CFB: Health status and quality of life of British men with lower urinary tract symptoms: results from SF-36. *Urology* 1995;45: 962–971.
- 2 Peters TJ, Donovan JL, Kay HE, Abrams P, De La Rosette JJMCH, Porru D, Thüroff JW, the International Continence Society 'Benign Prostatic Hyperplasia' Study Group: The International Continence Society 'Benign Prostatic Hyperplasia' Study: the bothersomeness of urinary symptoms. *J Urol* 1997;157:885–889.

- 3 Girman CJ, Jacobsen SJ, Tsukamoto T, Richard F, Garraway WM, Sagier P-P, Guess HA, Rhodes T, Boyle P, Lieber MM: Health-related quality of life associated with lower urinary tract symptoms in four countries. *Urology* 1998;51:428-436.
- 4 Schatzl G, Temml C, Waldmüller J, Thürrid T, Haidinger G, Madersbacher S: A comparative cross-sectional study of lower urinary tract symptoms in both sexes. *Eur Urol* 2001;40:213-219.
- 5 Okamura K, Usami T, Nagahama K, Maruyama S, Mizuta E: The relationships among filling, voiding subscores from International Prostate Symptom Score and quality of life in Japanese elderly men and women. *Eur Urol* 2002;42:498-505.
- 6 Welch G, Weinger K, Barry MJ: Quality of life of lower urinary tract symptom severity: results from the Health Professionals Follow-up Study. *Urology* 2002;59:245-250.
- 7 Boyle P, Robertson C, Mazzetta C, Keech M, Hobbs R, Fourcade R, Kiemeny L, Lee C, the UrEpiK Study Group: The relationship between lower urinary tract symptoms and health status: the UREPIK study. *BJU Int* 2003;92:575-580.
- 8 Masumori N, Homma D, Tsukamoto T: Web-based research of lower urinary tract symptoms that affect quality of life in elderly Japanese men: analysis using a structural equation model. *BJU Int* 2005;95:1013-1022.
- 9 Barry MJ, Batista JE, Donovan J, Jonas U, Kurth KH, Lukacs B, Norman R, O'Leary M, Prezioso D, Richard F, Tsukamoto T: Measuring the symptoms and health impact of benign prostatic hyperplasia and its treatment; in Chatelain C, Denis L, Foo KT, Khoury S, Mc Connell J (eds): *Benign Prostatic Hyperplasia*. 5th International Consultation on Benign Prostatic Hyperplasia (BPH). Plymouth, Plymbridge, 2000, pp 201-225.
- 10 Barry MJ, Fowler FJ, O'Leary MP, Bruskewitz RC, Holtgrewe HL, Mebust WK, the Measurement Committee of the American Urological Association: Measuring disease-specific health status in men with benign prostatic hyperplasia. *Med Care* 1995;33:AS145-AS155.
- 11 Barry MJ: Evaluation of symptoms and quality of life in men with benign prostatic hyperplasia. *Urology* 2001;58(suppl 6A):25-32.
- 12 Ware JE, Gandek B: Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *J Clin Epidemiol* 1998;51:903-912.
- 13 Araki I, Zakoji H, Komuro M, Furuya Y, Fukasawa M, Takihana Y, Takeda M: Lower urinary tract symptoms in men and women without underlying disease causing micturition disorder: a cross-sectional study assessing the natural history of bladder function. *J Urol* 2003;170:1901-1904.
- 14 Terai A, Matsui Y, Ichioka K, Ohara H, Tera-da N, Yoshimura K: Comparative analysis of lower urinary tract symptoms and bother in both sexes. *Urology* 2004;63:487-491.
- 15 Welch G, Kawachi I, Barry MJ, Giovannucci E, Colditz GA, Willett WC: Distinction between symptoms of voiding and filling in benign prostatic hyperplasia: findings from the Health Professionals Follow-up Study. *Urology* 1998;51:422-427.
- 16 Alonso J, Ferrer M, Gandek B, Ware JE Jr, Aaronson NK, Mosconi P, Rasmussen NK, Bullinger M, Fukuhara S, Kaasa S, Leplège A, the IQOLA Project Group: Health-related quality of life associated with chronic conditions in eight countries: results from the International Quality of Life Assessment (IQOLA) Project. *Qual Life Res* 2004;13:283-298.
- 17 Ware JE Jr, Gandek B, Kosinski M, Aaronson NK, Apolone G, Brazier J, Bullinger M, Kaasa S, Leplège A, Prieto L, Sullivan M, Thunedborg K: The equivalence of SF-36 summary health scores estimated using standard and country-specific algorithms in 10 countries: results from IQOLA Project. *J Clin Epidemiol* 1998;51:1167-1170.
- 18 Ware JE Jr, Kosinski M, Bayliss MS, McHorney CA, Rogers WH, Raczek A: Comparison of methods for the scoring and statistical analysis of SF-36 Health Profile and summary measures: summary of results from the Medical Outcomes Study. *Med Care* 1995;33:AS264-AS279.
- 19 Fukuhara S, Suzukama Y, Bito S, Kurokawa K: *Manual of SF-36 Japanese Version 1.2*. Tokyo, Public Health Research Foundation, 2001.
- 20 Eckhardt MD, van Venrooij GEP, van Melick HHE, Boon TA: Prevalence and bothersomeness of lower urinary tract symptoms in benign prostatic hyperplasia and their impact on well-being. *J Urol* 2001;166:563-568.
- 21 Mozes B, Maor Y, Shmueli A: The competing effects of disease states on quality of life of the elderly: the case of urinary symptoms in men. *Qual Life Res* 1999;8:93-99.
- 22 Coyne KS, Zhou Z, Thompson C, Versi E: The impact on health-related quality of life of stress, urge and mixed urinary incontinence. *BJU Int* 2003;92:731-735.