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Lower Urinary Tract Symptoms, Erectile Dysfunction, and Their Correlation in Men Aged 50 Years and Above: A Cross-Sectional Survey in Beijing, China

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Background: The aim of this study was to investigate the correlation between incidence of lower urinary tract symptoms and erectile dysfunction in men aged ≥ 50 years.





Material/Methods: A cross-sectional study was performed in 1644 men aged >50 years in Beijing. The International Index of Erectile Function (IIEF)-5 and International Prostate Symptom Score were recorded for each patient. Pearson's chi-square test and Spearman correlation coefficients were used to analyze the International Prostate Symptom Scores and lower urinary tract symptoms, and their correlations with erectile dysfunction.

Results: The incidence rates of erectile dysfunction among men with mild, moderate, and severe lower urinary tract symptoms were 85.7, 93.7, and 97.9%, respectively. Interestingly, the total IIEF-5 score significantly correlated with the total International Prostate Symptom Score ($r=-0.335$; $P<0.01$), obstructive symptoms ($r=-0.276$; $P<0.01$), and irritative symptoms ($r=-0.326$; $P<0.01$). The correlation between the severity of lower urinary tract symptoms and that of erectile dysfunction was consistently maintained ($r=0.304$; $P<0.01$). Age significantly correlated with International Prostate Symptom Score ($r=0.388$; $P<0.01$), lower urinary tract symptoms severity ($r=0.457$; $P<0.01$), total IIEF-5 score ($r=-0.533$; $P<0.01$), and erectile dysfunction severity ($r=0.529$; $P<0.01$).

Conclusions: The incidence of lower urinary tract symptoms and erectile dysfunction in aging men increase with age, and the severity of erectile dysfunction is positively correlated with the severity of lower urinary tract symptoms.

MeSH Keywords: **Aging • Erectile Dysfunction • Lower Urinary Tract Symptoms**

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Background

Lower urinary tract symptoms (LUTS) and erectile dysfunction (ED) are highly prevalent disorders in men and increase with age [1–3]. It is reported that LUTS are a risk factor for the development of ED [4]. Several studies have shown improvement in sexual function or desire after transurethral, open prostatectomy, and treatment with phosphodiesterase (PDE) inhibitors or α -blockers in men with benign prostatic hyperplasia [5–10], but some studies have reported no change, or worsening of erectile function and sexual desire [11]. In the present study, we investigated the correlation between LUTS and ED in men aged 50 years and above in Beijing, China.

Material and Methods

A total of 1644 men aged ≥ 50 years and diagnosed with LUTS were enrolled in this cross-sectional study. The study subjects were randomly selected from 15 communities in Beijing. Age was defined as of June 1, 2008. The probabilistic sample included 4 age groups 50–59 years, 60–69 years, 70–79 years, and >80 years. The inclusion criteria were men aged 50 years and above, and living in the selected communities at the time of study. We excluded patients with a history of prostate, urethral, or bladder surgery, neurological disease affecting the voiding mechanism, psychiatric disorders, bladder or prostate neoplasia, urethral stenosis, or the use of drugs that affect urinary or sexual physiology. Written informed consent was obtained from all participants, and the study protocol was approved by the ethics committee of Beijing Friendship Hospital, Capital Medical University, Beijing 100050, China. Lower urinary tract symptoms were assessed in all patients, using the International Prostate Symptom Score (IPSS) questionnaire. Sexual function was assessed by using the International Index of Erectile Function-5 (IIEF-5) questionnaire.

Prevalence and severity of ED was calculated in all 4 age groups (50–59 years, 60–69 years, 70–79 years, and >80 years). The severity of LUTS was sub-classified as irritative (frequency, urgency, and nocturia) and obstructive (incomplete emptying, intermittency, weak stream, and straining) symptoms. Each symptom was scored on a rating scale of 0–5, for an overall composite score of 0–35. Symptoms were classified as mild (IPSS score: 0–7), moderate (IPSS score: 8–19), and severe (IPSS score: 20–35). Based on the abridged 5-item IIEF-5 score, the ED severity was classified as severe (score: 0–7), moderate (score: 8–11), mild (score: 12–21), and no ED (score: >21).

Statistical analysis

The sample size was determined by a multistage stratified sample design using a selection probability that was proportional

to the size of the primary sample units. Stratification was proportional to the number of men older than 50 years. The sample size was designed to ensure a sample error of $<5\%$ to estimate the LUTS or ED prevalence for each age group with a 95% confidence interval (CI).

Differences in the IPSS and IIEF-5 scores between age groups were assessed using the Kruskal-Wallis test. The prevalence in each category of LUTS and ED severity according to different age groups were evaluated with the chi-square test. Spearman's correlation was used to analyze the correlation between LUTS severity and sexual function (based on IIEF-5 score). All statistical analyses were based on 2-sided probabilities using IPSS 11.0.

Results

Demographics of the study subjects

The average age of the 1644 subjects studied was 64.5 ± 9.8 years. The study population comprised 646 subjects <60 years (39.3%), 446 individuals in their 60s (27.1%), 438 subjects in their 70s (26.2%), and 114 patients >80 years (6.9%).

IPSS and IIEF-5 scores

The average IPSS score was 9.9 ± 8.2 , with a mean obstructive symptom score of 5.36 ± 5.44 , and a mean irritative symptom score of 4.49 ± 3.63 . The average IIEF-5 score was 9.4 ± 8.6 . The total IPSS, obstructive symptom, irritative symptom, and the total IIEF-5 scores were different among the 4 age groups ($P < 0.01$). Interestingly, the total IPSS and IIEF-5 scores showed statistically significant correlations with age, and correlation coefficients of 0.388 and -0.533 were obtained, respectively. An inverse correlation was observed between total IPSS and IIEF-5 score ($r = -0.335$; $P < 0.01$), obstructive symptom score ($r = -0.276$; $P < 0.01$), or irritative symptom score ($r = -0.326$; $P < 0.01$), and a consistent correlation was maintained when stratifying based on age except in subjects ≥ 80 years. The IPSS and IIEF-5 scores are shown in Table 1.

Correlation between parameters measuring the severity of LUTS and ED

The IPSS questionnaire scores showed LUTS prevalence rates of 49.2% (809/1644; IPSS score: ≤ 7), 36.4% (599/1644; IPSS score: 8–19), and 14.4% (236/1644; IPSS score: ≥ 20) in subjects with mild, moderate, and severe prostatism, respectively (Table 2). Significant differences were found between the 4 age groups when the analysis was stratified based on age ($P < 0.01$). The severity of the symptoms increased with age ($r = 0.457$; $P < 0.01$).

Table 1. IPSS, IIEF-5, Obstructive, and Irritative Symptom Scores in different life decade ($\chi \pm s$).

Age group (years)	n	IPSS	Obstructive IPSS	Irritative IPSS	IIEF-5
50~	646	6.3±6.5	3.28±4.32	3.02±3.02	14.6±8.1
60~	446	10.3±8.0	5.91±5.46	4.43±3.47	9.0±7.8
70~	438	13.1±8.1	7.13±5.75	5.99±3.49	4.1±6.2
≥80	114	15.6±8.5	8.24±5.61	7.32±3.97	2.3±3.8
Total	1644	9.9±8.2	5.36±5.44	4.49±3.63	9.4±8.6

IPSS – International Prostate Symptom Score; IIEF-5 – International Index of Erectile Function-5.

Table 2. Prevalence of LUTS in different age group [n (%)].

Age group	n	Mild (0 to 7)	Moderate (8 to 19)	Severe (20 to 35)
50~	646	447 (69.2)	164 (25.4)	35 (5.4)
60~	446	207 (46.4)	172 (38.6)	67 (15.0)
70~	438	132 (30.1)	208 (47.5)	98 (22.4)
≥80	114	23 (20.2)	55 (48.2)	36 (31.6)
Total	1644	809 (49.2)	599 (36.4)	236 (14.4)

Table 3. Prevalence of ED in different age groups [n (%)].

Age group	n	No ED	Mild	Moderate	Severe	ED
50~	646	123 (19.1)	344 (53.2)	37 (5.7)	142 (21.9)	523 (80.9)
60~	446	25 (5.7)	145 (32.5)	64 (14.3)	212 (47.5)	421 (94.3)
70~	438	9 (2.3)	59 (13.4)	15 (3.4)	355 (81.0)	429 (97.9)
≥80	114	0 (0.0)	7 (6.1)	7 (6.1)	100 (87.7)	114 (100.0)
Total	1644	157 (9.5)	555 (33.7)	123 (7.6)	809 (49.2)	1487 (90.5)

Table 4. Prevalence of ED due to LUTS severity [n (%)].

LUTS	n	ED			
		No ED	Mild	Moderate	Severe
Mild	809	115 (14.2)	352 (43.5)	54 (6.7)	288 (35.6)
Moderate	599	37 (6.2)	159 (26.6)	52 (8.7)	351 (58.5)
Severe	236	5 (2.1)	44 (18.6)	17 (7.2)	170 (72.2)
Total	1644	157 (9.5)	555 (33.7)	123 (7.6)	809 (49.2)

The mean prevalence of ED was 90.5% (1487/1644; IIEF-5 score: <22) (Table 3). The severity of ED was significantly different among the 4 age groups ($P < 0.0001$), and correlated statistically with age ($P < 0.0001$).

The prevalence of ED due to LUTS severity was 85.7% (694/809), 93.7% (561/599), and 97.9% (231/236) in subjects with mild,

moderate, and severe prostatism, respectively (Table 4). A significant correlation between ED severity and LUTS severity was observed ($r = 0.304$; $P < 0.01$), and this correlation was consistent after stratification by age, except in subjects ≥ 80 years ($r = 0.229$; $P = 0.090$).

Discussion

In this study, we determined the correlation between severity of LUTS, as measured by the IPSS, and sexual function as measured by the IIEF-5 questionnaire.

The results of a large-scale population-based study of men aged 40–70 years, the Massachusetts Male Aging Study (MMAS), demonstrated a high prevalence rate of ED (52%), with nearly 35% of the men reporting moderate-to-severe ED [12]. The prevalence of complete ED is age-dependent, ranging 36–43%, 43–64%, 58–77%, and 87–90% among men aged 40–49, 50–59, 60–69, and >70 years, respectively. In our study, the prevalence of ED increased with age, from 80.9% in 50–59 years old men to 100% in those ≥80 years. The total prevalence of ED was 90.5%. The prevalence of ED in our study was higher compared with other studies but was statistically correlated with age. The IIEF-5 score also statistically correlated with the severity of ED and age. Ferrini et al. [13] reported that ED due to aging is primarily caused by a decrease in smooth muscle cells (SMC), and an increase in collagen within the corpora cavernosa due to increased reactive oxygen species (ROS).

There is increasing interest in the relationship between LUTS and sexual function due to population aging, and a statistically significant correlation between LUTS and ED has been reported by previous studies [14]. However, the principal finding of this study was that LUTS determined by IPSS was independently associated with ED. This correlation may be attributed to the aging process or to other common risk factors, including diabetes or coronary artery diseases. Rosen et al. [4] examined whether controlling such factors may avoid the association or correlation between LUTS and ED, and were able to control this correlation based on age and other co-morbidities in community-based surveys. The association between LUTS and ED persisted in each case. The present study showed a consistent inverse correlation between LUTS severity and IIEF-5 score with respect to stratification of age. Patients who had higher IPSS values had more severe ED, except for men aged 80 years and older. These findings indicate that the aging process in older men may involve other factors that influence the correlation between LUTS and ED. Interestingly, an association between cardiovascular disease and lower urinary tract symptoms, as well as benign prostatic hyperplasia/benign prostatic enlargement and erectile dysfunction, in elderly patients has been demonstrated; indeed, age might activate systemic

vascular risk factors, resulting in disturbed blood flow [15]. In addition, erectile dysfunction was shown to be more prevalent and severe in patients with MS and to correlate with sub-clinical endothelial dysfunction [16].

Although many theories have been proposed to explain the association between ED and LUTS, the underlying mechanism of ED in men with LUTS is not well understood. The possible biological interrelationships between these 2 clinical conditions fall into the following 4 theories [17]: (1) decreased or altered NOS/NO levels in the prostate and penile smooth muscle, (2) Autonomic hyperactivity and metabolic syndrome effects on LUTS, prostate growth, and ED, (3) Alternate pathway mechanism: Rho-kinase activation/endothelia activity, and (4) Pelvic atherosclerosis as a mechanism for LUTS and ED. These theories are not mutually exclusive and may overlap substantially. Risk factors for one often constitute risk factors for another, and second-messenger cascades ultimately leading to smooth muscle contraction and relaxation for either prostatic/bladder neck tissue or erectile tissue may be shared.

The association between LUTS and sexual dysfunction has been investigated in community-based studies. Terai et al. [18] reported that irritative symptoms were significantly associated with erectile dysfunction severity in a health-screening study conducted in Japanese men. Elliott et al. [19] showed that only obstructive LUTS and depression were statistically significant predictors of ED. Ponzolzer et al. [14] emphasized that the obstructive score of IPSS, nocturia, and LUTS score correlated significantly with ED. Our study showed that both irritative IPSS and obstructive IPSS scores significantly correlated with the severity of ED, so the improvement in LUTS could be related to increased erectile function [20].

Conclusions

We have shown that ED is highly prevalent in aging men, with the severity increasing with age. The incidence of LUTS and ED in men increases with age, and the severity of ED is positively correlated with that of LUTS. The presence of LUTS is an independent risk factor for ED. It might be useful to assess erectile function before LUTS treatment.

Competing interests

The authors declare that they have no competing interests.

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