PREVALENCE AND RISK FACTORS OF NOCTURIA AND QUALITY OF LIFE OF NOCTURIA SUBJECTS FROM SHANGHAI

Lei Wang[1#], Bo Liu[2#], Shengsong Huang[2], Qiang Wu[2], Denglong Wu[2]
[1]Department of Urology, Ningbo No.7 People's Hospital, Ningbo 315202, China - [2]Department of Urology, Tongji Hospital of Tongji University, Shanghai 200065, China
# Lei Wang and Bo Liu contributed equally.

ABSTRACT

Purpose: To investigate prevalence and risk factors of nocturia and quality of life of nocturia subjects from Shanghai.

Methods: Investigations by questionnaire were conducted in 3,646 people over 50 years old. The risk factors including the age, hypertension, diabetes and benign prostatic hyperplasia (BPH) etc. were also evaluated.

Results: 1,332 urinated more than twice each night (36.5%), and average age was 72.06. The increased frequency of night urination makes the hours of uninterrupted sleep (HUS) reduce significantly (P<0.001). Overactive bladder (OAB) was a risk factor of nocturia (P<0.001); OAB symptom scores were significantly different between nocturia subjects (urination twice, thrice and quartic) and others (P12≤0.001, P13 =0.002, P14<0.001). The frequent night urination deteriorated the quality of life and sleeping. Hypertension, diabetes, snoring and BPH are risk factors of nocturia.

Conclusion: The increased night urination impacts the HUS, quality of life and sleep quality. The age, hypertension, diabetes, BPH, snoring and OAB are the risk factors of nocturia.

Key words: Night urination, N-QOL score, Risk factors, Epidemiology.

Introduction

The nocturia was defined in 2002 to be 'the complaint that the individual has to wake at night one or more times to void'[1]. Considering that a healthy person may also urinate 0-1 time each night, WHO and researchers usually take the frequency of urination of ≥2 each night as a criterion for nocturia[2, 3]. According to this definition, the nocturia patients have to get up to urinate due to a strong micturition desire, resulting in the interruption of their sleep. However, the increase in urination frequency at night due to other reasons (such as insomnia, anxiety and enuresis etc.) is not defined as nocturia.

With this definition of nocturia, many studies have been carried out to investigate the incidence and risk factors of nocturia. A survey by questionnaire conducted in 5,024 community residents with an average age of 45.8 years in the United States showed that 31% of people suffered from nocturia, of whom the subjects suffering from urination of ≥2 each night account for 14.2%[4]. Liew and other investigators[5] investigated 2,273 residents aged 20-95 years in Singapore, and results showed 55.5% of subjects suffered from nocturia. Since the night urination is often associated with lower urinary tract symptoms and benign prostatic hyperplasia (LUTS/BPH), most people consider that the nocturia is more frequently found in males. A survey conducted in Finland showed that the proportion of males suffering from nocturia was slightly higher than that of females (43% vs. 37%), and the proportion of people with the urination of ≥2 was 13% in males and 12% in females[6] without significant difference.

However, a study by Liew et al showed that the proportion of females suffering from nocturia was higher than males (58% vs. 53%). Burgio et al[7] conducted a survey in 1,000 males and 1,000 females aged 65-106 years in the United States, and concluded that the incidence of nocturia in males was higher than in females (63.2% vs. 53.8%), and the blacks were more likely to develop nocturia than the whites (66.3 % vs. 50.9%, P<0.05). The incidence of nocturia is also very high in Asia. It was reported that the incidence of nocturia was 73.5% in Taiwanese (females over 60 years old)[8], and 72.7% in South Korea (over 40 years old)[9]. It still lacks of epidemiological studies on the night urination in China. This study was conducted to survey the prevalence and risk factors of nocturia and the quality of life of these patients in Shanghai. Our findings may provide a basis for further clinical studies.

Materials and methods

Subjects

Stratified cluster sampling was employed in the present study to randomly recruit subjected from the Putuo District, Jiading District and Xuhui District in Shanghai. Two communities were randomly selected from each district, and a survey by questionnaire was conducted in people over 50 years old from November 2009 to April 2010. A total of 4317 subjected were recruited into present study.

Exclusion criteria

The night urination of ≥2 was a criterion for nocturia. According to the definition of nocturia, the increase in the frequency of night urination caused by insomnia, enuresis and neurasthenia etc. was excluded; the patients whose urination cannot be measured or the frequency cannot be counted due to catheter indwelling, dialysis and after total cystectomy were excluded. Finally, 671 subjects were excluded, and 3646 were included into present study.

Study methods

The questionnaires included the nocturia quality-of-life (N-QOL), Pittsburgh sleep quality index (PSQI), overactive bladder symptom score (OABSS) and the self-designed questionnaire. The following items were included: general conditions, frequency of night urination, self-assessment of

sleep quality, diabetes, hypertension, BPH, overactive bladder (OAB), drinking and smoking. Patients urinating twice or more each night were asked to keep a diary of urination within 72 h.

The N-QOL is divided into three domains: energy & sleep, perplex & attention, and overall appraisal. The highest total score is 52 points, and the higher the score, the better the life quality is. The sum of first 2 domains was obtained (max: 48 points), and the overall appraisal was listed separately in a table for further analysis. The N-QOL was the first questionnaire used to evaluate the impact of night urination on the quality of life of adults[10]. The quality of life related to the night urination is reflected through the night urination evaluated by the patients themselves. This scale has good correlation with the energy and vitality domain in SF-36 form and the sleep quality domain in PSQI.

The PSQI index is used to evaluate the sleep quality of subjects within past 1 month, and contains 19 self-evaluation items and 5 items evaluated by others of which, the 19th self-evaluation item and 5 items evaluated by others are not employed for scoring. The remaining 18 items are composed of 7 components, each component is scored as level 0-3, and the scores of each component are added as a total score of PSQI. The total score ranges from 0 to 2l, and the higher the score, the poorer the sleep quality is.

Statistical analysis

Statistical analysis was performed with SPSS version 13.0, and data were expressed as mean ± standard deviation (±SD). The qualitative data were compared with Chi-square test, exact probability, and logistic multiple linear regression analysis was employed to evaluate the risk factors, including the age, hypertension, diabetes, BPH and stress urinary incontinence, etc.

Results

A total of 3646 subjected were recruited including 1663 males and 1983 females. Of them, 1332 people urinated twice or more each night (36.5%), with an average age of 72.06±10.27 years. Among these subjects, 631 were males, accounting for 47.4% and 701 were females accounting for 52.6% (Table 1 and 2).

Results showed that the prevalence of nocturia was no associated with gender.

The frequency and prevalence of nocturia increased over age.

Age	Male (%)	Female (%)	Totally (%)	χ2	P
50-59	74/516 (14.3)	120/718 (16.7)	194/1234 (15.7)	1.28	0.26
60-69	147/480 (30.6)	171/534 (32.0)	318/1014 (31.4)	0.23	0.63
70-79	237/423 (56.0)	216/426 (49.3)	453/849 (53.4)	2.41	0.12
>80-	173/244 (70.9)	194/305 (63.6)	367/549 (66.8)	6.67	3.25
>50-	631/1663 (37.9)	701/1983 (35.4)	1332/3646 (36.5)	2.62	3.25

Table 1: Proportion of nocturia people in different age groups.

Frequency	Age			
	50	60	>70	>80
0-1	84.10%	68.40%	46.40%	34.70%
2	11.10%	19.90%	27.70%	29.70%
3	3.20%	8.10%	14.10%	19.00%
≥4	1.60%	3.60%	11.80%	16.60%

Table 2: Frequency of night urination of people in different age groups.

N-QOL is divided into 2 domains. There are 12 questions in the 1st domain with the total score of 48 points, reflecting the quality of life, and there is 1 question in the 2nd domain, which reflects the quality of life evaluated by the subjects their own. Results showed that 65.1% of people urinating twice or more each night considered that their quality of life was good, while 11.2% considered that their quality of life was poor; only 36.8% of people with night urination of ≥4 considered that their quality of life was poor. According to frequency of night urination, subjects were grouped and N-QOL score and PSQI score were determined and compared with analysis of variance. Results showed that the increase in night urination significantly deteriorated the quality of life and sleep quality (P<0.05) (Table 3).

Frequency	N-QOL	PSQI	Self-assessment
2	34.69±6.06	2.09±2.59	2.12±1.10
3	29.63±7.63	10.11±4.95	2.04±0.78
≥4	24.26±8.68	14.71±4.01	2.20±0.93
P	<0.001	<0.001	0.311

Table 3: Frequency of night urination, N-QOL score, PSQI score and self-assessment.
Note: the self-assessment score ranges from 0 point to 4 points with 4 points referring the worst quality of life, and 0 referring to a good quality of life.

The uninterrupted sleep (HUS) was compared among subjects with different frequencies of night urination. Results indicated that the increase in night urination remarkably reduced the HUS (P<0.05) (Table 4).

Group	Frequency	HUS	P
1	2	3.75±1.10 h	$P_{12}=0.01$
2	3	2.92±0.81 h	$P_{23}<0.001$
3	≥4	1.66±0.58 h	$P_{13}<0.001$

Table 4: Frequency of night urination and HUS.

The highest score of OABSS is 15 points. OABSS was first applied in Japan and used to evaluate the OAB symptom of subjects with 2 or more times of night urination. One-way analysis of variance showed that OAB was a risk factor for nocturia (P<0.001), and significant correlation between OAB symptom scores and the frequency of night urination (P1-2≤0.001, P1-3=0.002, P1-4<0.001). There was no significant difference in the OAB symptom scores among subjects with night urination of ≥2 (P>0.05), suggesting that the severity of nocturia has no correlation with OAB (Table 5).

Group	Frequency	OAB score
1	0-1	4.27±1.71
2	2	9.50±3.64
3	3	7.43±3.82
4	≥4	8.24±4.02

Table 5: Night urination and OAB.

	Male		Female	
Age	2.482 (2.201-2.799)	<0.01	2.028 (1.841-2.233)	<0.01
DM	3.633 (2.675-4.935)	<0.01	2.008 (1.516-2.660)	<0.01
Hypertension	3.308 (2.460-4.449)	0.01	3.686 (2.816-4.823)	0.01
Cardiac insufficiency	1.071 (0.795-1.442)	<0.653	1.216(0.948-1.559)	0.124
BPH	3.365 (2.579-4.390)	<0.01	-	-
Snoring	1.754 (1.300-2.364)	<0.01	1.721 (1.326-2.237)	<0.01
Smoke	1.076 (0.775-1.493)	<0.01	0.894 (0.414-1.932)	0.776
SUI	-	-	1.129 (0.913-1.397)	0.263

Table 6: Factors with nocturia.

The risk factors for night nocturia were evaluated in males and females independently with Logistic analysis. Results shows that hypertension, diabetes, snoring and benign prostatic hyperplasia were the risk factors for nocturia. Regarding the females, the stress urinary incontinence had no correlation with nocturia (P>0.05) (Table 6).

Discussion

Night urination is a major factor influencing the sleep quality of the elderly. In middle-aged and aged people, the reduced quality of life due to night urination is mainly characterized by the reduction in effective sleep time[11]. The decline in sleep quality easily leads to attention-deficit disorder, fatigue, drowsiness, memory loss, and low work efficiency during daytime, and compromised immunity increasing the susceptibility to diseases. The total score of PSQI is 21 points, less than 5 points means good sleep quality, 5-10 points means intermediate quality, 11-16 points means poor quality, and 17-21 points means extremely poor quality. Our study showed that 17.1% of people had extreme poor sleep quality, of whom 95.2% had 2 or more times of night urination. The PSQI score was also found to correlate with the N-QOL score.

A total of 3646 subjects were recruited into the present study, including 1663 males and 1983 females. Of them, 1332 had 2 or more times of night urination, with an average age of 72.06±10.27 years. Among these subjects, 631 were males, accounting 47.4%, and 701 were females, accounting 52.6%. Similar findings were also noted in the study of Tikkinen et al in which the nocturia was not related to the gender[5].

Schatzl et al found that more than 60% of people with night urination suffered from sleep interruption impacting their quality of life[12]. Nakagawa et al[13] followed 784 patients for 5 years and found patients with nocturia had high risks for falling, fracture and death. Night urination has become one of the high risk factors of hip joint fracture in the elderly. Another earlier survey conducted in Sweden revealed the mortality of the elderly with 3 and more times of night urination was 2 times higher than that of others[14]. Our findings showed that, of people with 2 or more times of night urination, 64.3% considered that their life quality was good, 35.7% thought that night urination influenced their quality of life, of whom 75.8% considered that their quality of life was poor, and 24.2% thought that

their quality of life was extremely poor. The impact of night urination on the quality of life of patients becomes greater along with the increase in night urination, which was consistent with previous findings[5, 6, 15].

However, only 36.8% of people with 4 and more times of night urination considered that their quality of life was poor. Probably, they have adapted to this condition due to a long history of nocturia, which may delay the diagnosis and treatment of primary diseases causing night urination, resulting in the disease development and serious consequences. Our group conducted a follow-up in 6 of subjects undergoing hemodialysis, all of whom suffered from both renal failure due to delayed treatment of primary diseases.

About 52.5% of male subjects with nocturia have benign prostatic hyperplasia of different degrees, but the degree of hyperplasia and severity of nocturia were not compared due to lack of specific imaging findings. Logistic analysis showed that BPH was a risk factor for nocturia (P<0.001), and other risk factors included hypertension, diabetes, snoring etc. It was reported in Japan that the symptoms of nocturia were not significantly improved when the symptoms of lower urinary tract obstruction were alleviated[16]. The latest study conducted by Tikkinen and colleagues[17] found that the impact of BPH on nocturia might be overestimated, only 1/3 of patients with nocturia suffered from BPH, while more than 70% of patients with prostate cancer urinated twice or more each night, and the proportion of prostate cancer in patients with nocturia was 7%. A survey on night urination of 1,200 women aged ≥70 years conducted in Taiwan showed that diabetes, hypertension and urinary incontinence were risk factors for nocturia[8]. However, our results revealed that there was no correlation between female stress urinary incontinence (SUI) and nocturia (P=0.478). This might be attributed to that some women refused to answer or did not answer correctly when they were inquired on the urinary incontinence due to concern of privacy, which may increase the false negative rate, biasing the results.

Moriyama and colleagues[18] investigated 73 patients with obstructive sleep apnea syndrome (OSAS), including 30 patients suffering from nocturia, and results showed that OSAS was a risk factor for nocturia. Meanwhile, the severity of OSAS was positively correlated with the severity of nocturia and the continuous positive airway pressure

therapy can remarkably improve the nocturia[19]. The diagnosis of OSAS is quite complicated, the interviewees are hard to describe by themselves, it is difficult to confirm the diagnosis of OSAS with a simple questionnaire and thus OSAS was not included as a risk factor for analysis in the present study.

The symptoms of nocturia gradually become severer over age[5, 20, 21]. We divided the subjects into 4 age groups. Results showed that, with the increase in age, the proportion of subjects with 2 times of night urination decreased, while that of subjects with 4 times of night urination increased significantly (Table 3). The possible reasons for this phenomenon are:

• the normal function of bladder changes or is damaged over age, such as: the effective capacity of bladder decreases at night, the bladder adaptability declines, and the bladder detrusor is instable[22, 23];

• the change in age-related circadian rhythm which may influence the urine production has always been considered a major cause of night urination[24];

• For males, the development of benign prostatic hyperplasia over age is also a very important factor;

• other diseases such as hypertension, diabetes, heart failure and obstructive sleep apnea syndrome may also be the factors exacerbating the nocturia;

• Smoking and alcoholism are the risk factors in nocturia[21]; the smoking and alcoholism become more heavy and may cause exacerbation in nocturia. However, more studies are needed to further elucidate the correlation between smoking / alcoholism and nocturia.

The night urination is a clinical symptom caused by a variety of factors. Night urination can be categorized into four types according to the causes and 72-h urination diary: nocturnal polyuria, decreased effective capacity of bladder at night, mixed polyuria and polyuria[25].

In the present study, measuring cup and urination diary form were used in all the subjects with 2 or more times of night urination. A total of 632 subjects were surveyed, and 417 urination diary forms were available, including 244 effective questionnaires. Results showed 54.5% were diagnosed with the nocturnal polyuria, 23.0% with decreased effective capacity of the bladder at night, the mixed type was found in 21.3%, and only 1.6% was diagnosed as having polyuria.

The night urination impacts the HUS of sub-jects. The average uninterrupted sleep time of subjects decreases significantly with the increase in the night urination. The goal of treatment for nocturia is to increase the uninterrupted sleep time of subjects as much as possible, to improve their quality of life[26].

Conclusions

Nocturia significantly impacts the quality of sleep in middle-aged and aged people, and thereby influences the quality of life. Thus, increasing attention has been paid to nocturia. Our study on nocturia in Shanghai showed that a large proportion of subjects fail to understand correctly the harm of nocturia, which usually delays the diagnosis and treatment of nocturia resulting in serious adverse consequences. In addition, age, diabetes, hypertension, snoring, benign prostatic hyperplasia and OAB are found to be risk factors for nocturia. The nocturia can be categorized according to the 24-h urination diary, and symptomatic treatment is preferred for the treatment of nocturia better, which may improve the quality of life. However, this is required to be studied in future studies.

References

1) Van Kerrebroeck P, Abrams P, Chaikin D, Donovan J, Fonda D, Jackson S, Jennum P, Johnson T, Lose GR, Mattiasson A, Robertson GL, Weiss J. *The standardization of terminology in nocturia: report from the standardization subcommittee of the International Continence Society*. BJU Int 2002; 90: *11-15*.

2) Hernandez C, Estivill E, Cantalapiedra A. *Impact of nocturia on sleep quality in patients with lower urinary tract symptoms suggesting benign prostatic hyperplasia (LUTS/BPH). The NocSu Study*. Actas Urol Esp 2010; 34: *450-459*.

3) van Kerrebroeck P, Weiss J. *Standardization and terminology of nocturia*. BJU Int 1999; 84: *1-4*.

4) Coyne KS, Zhou Z, Bhattacharyya SK, Thompson CL, Dhawan R, Versi E. *The prevalence of nocturia and its effect on health-related quality of life and sleep in a community sample in the USA*. BJU Int 2003; 92: *948-954*.

5) Liew LC, Tiong HY, Wong ML, Png DC, Tan JK. *A population study of nocturia in Singapore*. BJU Int 2006; 97: *109-112*.

6) Tikkinen KA, Tammela TL, Huhtala H, Auvinen A. *Is nocturia equally common among men and women? A population based study in Finland*. J Urol 2006; 175: 596-600.

7) Burgio KL, Johnson I, Theodore M, Goode PS, Markland AD, Richter HE, Roth DL, Sawyer P, Allman

RM. *Prevalence and Correlates of Nocturia in Community Dwelling Older Adults*. J Am Geriatr Soc 2010; 58: *861-866*.

8) Hsieh CH, Kuo TC, Hsu CS, Chang ST, Lee MC. *Nocturia among women aged 60 or older in Taiwan*. Aust N Z J Obstet Gynaecol. 2008; 48: *312-316*.

9) Choo MS, Ku JH, Park CH, Lee YS, Lee KS, Lee JG, Park WH. *Prevalence of nocturia in a Korean population aged 40 to 89 years*. Neurourol Urodyn 2008; 27: *60-64*.

10) Chartier-Kastler E, Tubaro A. *The measurement of nocturia and its impact on quality of sleep and quality of life in LUTS/BPH*. Eur Urol Suppl 2006; 5: *3-11*.

11) Middelkoop HA, Smilde-van den Doel DA, Neven AK, Kamphuisen HA, Springer CP. *Subjective sleep characteristics of 1,485 males and females aged 50–93: effects of sex and age, and factors related to self-evaluated quality of sleep*. J Gerontol A Biol Sci Med Sci. 1996; 51: *M108-M115*.

12) Schatzl G, Temml C, Schmidbauer J, Dolezal B, Haidinger G, Madersbacher S. *Cross-sectional study of nocturia in both sexes: analysis of a voluntary health screening project*. Urology 2000; 56: *71-75*.

13) Nakagawa H, Niu K, Hozawa A, Ikeda Y, Kaiho Y, Ohmori-Matsuda K, Nakaya N, Kuriyama S, Ebihara S, Nagatomi R. *Impact of nocturia on bone fracture and mortality in older individuals: a Japanese longitudinal cohort study*. J Urol 2010; 184: *1413-1418*.

14) Asplund R. *Mortality in the elderly in relation to nocturnal micturition*. BJU Int 1999; 84: *297-301*.

15) Hernandez C, Estivill E, Prieto M, Badía X. *Nocturia in Spanish patients with lower urinary tract symptoms suggestive of benign prostatic hyperplasia (LUTS/BPH)*. Curr Med Res Opin 2008; 24: *1033-1038*.

16) Yoshimura K, Ohara H, Ichioka K, Terada N, Matsui Y, Terai A, Arai Y. *Nocturia and benign prostatic hyperplasia*. Urology 2003; 61: *786-790*.

17) Tikkinen KA, Auvinen A, Johnson TM, Weiss JP, Keränen T, Tiitinen A, Polo O, Partinen M, Tammela TL. *A systematic evaluation of factors associated with nocturia-the population-based FINNO study*. Am J Epidemiol 2009; 170: *361-368*.

18) Moriyama Y, Miwa K, Tanaka H, Fujihiro S, Nishino Y, Deguchi T. *Nocturia in men less than 50 years of age may be associated with obstructive sleep apnea syndrome*. Urology 2008; 71: *1096-1098*.

19) FitzGerald MP, Mulligan M, Parthasarathy S. *Nocturic frequency is related to severity of obstructive sleep apnea, improves with continuous positive airways treatment*. Am J Obst Gynecol 2006; 194: *1399-1403*.

20) Bing MH, Moller LA, Jennum P, Mortensen S, Skovgaard LT, Lose G. *Prevalence and bother of nocturia, and causes of sleep interruption in a Danish population of men and women aged 60-80 years*. BJU Int 2006; 98: *599-604*.

21) Bing MH, Moller LA, Jennum P, Mortensen S, Lose G. *Nocturia and associated morbidity in a Danish population of men and women aged 60-80 years*. BJU Int 2008; 102: *808-815*.

22) Diokno A, Brown M, Brock B, Herzog A, Normolle D. *Clinical and cystometric characteristics of continent and incontinent noninstitutionalized elderly*. J Urol 1988; 140: *567*.

23) Blanker MH1, Bohnen AM, Groeneveld FP, Bernsen RM, Prins A, Ruud Bosch JL. *Normal voiding patterns and determinants of increased diurnal and nocturnal voiding frequency in elderly men*. J Urol 2000; 164: *1201-1205*.

24) Rembratt A, Norgaard JP, Andersson KE. *Nocturia and associated morbidity in a community-dwelling elderly population*. BJU Int. 2003 Nov; 92(7): *726-30*.

25) Weiss JP, Blaivas JG, Stember DS, Brooks MM. *Nocturia in adults: etiology and classification*. Neurourol Urodyn 1998; 17: *467-472*.

26) van Kerrebroeck P, Rezapour M, Cortesse A, Thüroff J, Riis A, Nørgaard JP. *Desmopressin in the treatment of nocturia: a double-blind, placebo-controlled study*. Eur Urol 2007; 52: *221-229*.

_____

Corresponding Author
DENGLONG WU
Department of Urology, Tongji Hospital
of Tongji University
389 Xincun Road
Shanghai 200065
(China)