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Reciprocal relationship between age-related sleep disruption and urological symptoms

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INTRODUCTION

Nocturia is common in middle-aged and older patients, affecting 40–60% of people > 55 years old [1–3]. It is classically considered to be a urological disorder, whereby excess production of urine at night, or a reduced nocturnal bladder capacity, leads to an awakening to void. An alternative possibility is that sleep disruption, a common feature of aging [4–6], leads to a nocturnal awakening and a decision to void. To explore the associations between urinary symptoms, sleep disruption and daytime sleepiness, we conducted a survey in two groups of older adults: patients visiting our urology clinic and healthy adults volunteering for sleep or circadian rhythm studies in our research laboratory.

METHODS

Subjects in the urology group (UG; $n=144$) were recruited from patients ≥ 55 years old with appointments at the Brigham and Women's Hospital Division of Urology clinic. Subjects in the sleep group (SG; $n=130$) were healthy individuals ≥ 55 years old who were being screened to participate in a research study at Brigham and Women's Hospital Division of Sleep Medicine; we excluded those with sleep, psychiatric or active medical disorders. Written informed consent was obtained from each participant. The Human Research Committee at the Partners HealthCare System approved the protocols, which were conducted in accordance with the Declaration of Helsinki.

All subjects were given three questionnaires: the AUA Symptom Index (AUASI [7]), the Pittsburgh Sleep Quality Index (PSQI [8]; a questionnaire designed to measure subjective sleep quality from the past month), and the Epworth Sleepiness Scale (ESS [9]; a questionnaire to evaluate daytime sleepiness). The questionnaires were scored according to published criteria.

The UG was older than the SG (mean age $\pm$ SD: UG: 63.7 ± 8.8 ; SG: 61.7 ± 6.7 ; Student's t -test, $P=0.03$) and the groups had different sex distributions (UG: 25 women, 119 men; SG: 60 women, 70 men; Fisher's exact test, $P < 0.001$).

Statistical analysis

We compared men and women within each group for their AUASI, PSQI and ESS scores. We then compared the questionnaire scores between the two groups, pooling women and men. Comparisons were done using Wilcoxon's rank-sum test.

To explore the association between urological and sleep-wake complaints, we used Spearman's correlation coefficient (r) analysis in each group to relate AUASI questionnaire scores with scores from the PSQI and ESS questionnaires. We then quantified the relationship between AUASI and PSQI scores with univariate linear regression analysis. To test whether the slopes of the regression lines were significantly different between the groups, and because the groups were different for age and sex composition, we then performed a multivariate linear regression on the pooled data, adjusting for sex, group and age. Statistical tests were run using SAS® software (SAS 9.1.2) and results are presented as mean values (SD).

RESULTS

Within each group, women and men did not have significantly different AUASI, PSQI or ESS scores. The UG had significantly higher AUASI and PSQI scores than the SG, but the ESS scores were not significantly different (Fig. 1).

There was a significant correlation between the AUASI and PSQI scores for the subjects overall ($r=0.49$, $P<0.001$), and for each group (UG: $r=0.39$, $P<0.001$; SG: $r=0.48$, $P<0.001$). The correlation between the AUASI and ESS scores was also significant for the subjects overall ($r=0.35$, $P<0.001$) and for each group (UG: $r=0.18$, $P=0.03$; SG: $r=0.32$, $P<0.001$).

Univariate linear regression modelling found that when the PSQI score increased by 1, the AUASI score increased by a mean (SE) value of 0.87 (0.1) for the UG and 0.96 (0.18) for the SG (Fig. 2).

Multivariate linear regression modelling of the AUASI scores showed significant main effects of group and PSQI on AUASI score, but no significant effect of age ($P=0.2$) or sex ($P=0.84$). The AUASI score was significantly higher in the UG [parameter estimate (SE): 4.8 (1.37); $P<0.001$], and also significantly higher in subjects with higher PSQI scores with a mean (SE) increase in the AUASI score of 0.85 (0.15) for every 1 unit increase in the PSQI score ($P<0.001$). There were no significant two-way interactions on the AUASI score between PSQI and the other main effects.

DISCUSSION

Our analysis showed a significant association between urological complaints and sleep complaints overall, as well as in the two subgroups which were selected to have different levels of urological complaints. Urology clinic patients had higher levels of urological complaints (AUASI score) and higher levels of sleep complaints (PSQI score) than did subjects recruited as part of a sleep research study. This was expected because the latter group had been screened beforehand to exclude medical and sleep disorders. Despite this, the strength of the relationship between urological complaints and sleep complaints was comparable in each subject group. We also found a significant, though less robust, relationship between urological complaints and daytime sleepiness.

There are well known associations between sleep apnoea and nocturia [10-12], but even very healthy older adults without clinical sleep disorders have lighter and more fragmented sleep than younger adults [4-6], which could lead them to be awakened more easily by

internal (bladder stretch signal) or external (noise) stimuli [13]. Once awake, they may then decide to void. In fact, sleep disruption has been suggested as a cause of decreased nocturnal bladder capacity [14;15].

Our finding that the relationship between urological and sleep complaints is of similar strength in older urology patients and in healthy older adults suggests a common mechanism may be at work in both groups, and this mechanism may not be purely urological in nature, because the sleep group had no significant urological disorders. We hypothesize that age-related reductions in sleep quality may play an important causal role in nocturia, and/or may worsen nocturia symptoms in many older adults.

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Abbreviations

AUASI	AUA Symptom Index
PSQI	Pittsburgh Sleep Quality Index
ESS	Epworth Sleepiness Scale
UG	urology group
SG	sleep group

REFERENCES

- (1). 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:M108–15. [PubMed: 8630703]
- (2). Burgio KL, Johnson Li TM, Goode PS, et al. Prevalence and correlates of nocturia in community-dwelling older adults. *J Am Geriatr Soc*. 2010; 58:861–6. [PubMed: 20406317]
- (3). Bliwise DL, Foley DJ, Vitiello MV, Ansari FP, Ancoli-Israel S, Walsh JK. Nocturia and disturbed sleep in the elderly. *Sleep Med*. 2009; 10:540–8. [PubMed: 18703381]
- (4). Bliwise DL. Sleep in normal aging and dementia. *Sleep*. 1993; 16:40–81. [PubMed: 8456235]
- (5). Buysse DJ, Browman KE, Monk TH, Reynolds CF 3rd, Fasiczka AL, Kupfer DJ. Napping and 24-hour sleep/wake patterns in healthy elderly and young adults. *J Am Geriatr Soc*. 1992; 40:779–86. [PubMed: 1634721]
- (6). Dijk DJ, Duffy JF, Czeisler CA. Contribution of circadian physiology and sleep homeostasis to age-related changes in human sleep. *Chronobiol Int*. 2000; 17:285–311. [PubMed: 10841208]
- (7). Barry MJ, Fowler FJ Jr, O'Leary MP, et al. The American Urological Association symptom index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. *J Urol*. 1992; 148:1549–57. [PubMed: 1279218]
- (8). Buysse DJ, Reynolds CF III, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989; 28:193–213. [PubMed: 2748771]
- (9). Johns MW. A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. *Sleep*. 1991; 14:540–5. [PubMed: 1798888]
- (10). Chang SC, Lin AT, Chen KK, Chang LS. Multifactorial nature of male nocturia. *Urology*. 2006; 67:541–4. [PubMed: 16527575]

- (11). Pressman MR, Figueroa WG, Kendrick-Mohamed J, Greenspon LW, Peterson DD. Nocturia. A rarely recognized symptom of sleep apnea and other occult sleep disorders. *Arch Intern Med.* 1996; 156:545–50. [PubMed: 8604961]
- (12). Umlauf MG, Chasens ER, Greevy RA, Arnold J, Burgio KL, Pillion DJ. Obstructive sleep apnea, nocturia and polyuria in older adults. *Sleep.* 2004; 27:139–44. [PubMed: 14998251]
- (13). Endeshaw Y. Correlates of self-reported nocturia among community-dwelling older adults. *J Gerontol A Biol Sci Med Sci.* 2009; 64:142–8. [PubMed: 19164272]
- (14). Weiss JP, Blaivas JG, Stember DS, Chaikin DC. Evaluation of the etiology of nocturia in men: the nocturia and nocturnal bladder capacity indices. *Neurourol Urodyn.* 1999; 18:559–65. [PubMed: 10529704]
- (15). Weiss JP. Nocturia: “do the math”. *J Urol.* 2006; 175:S16–18. [PubMed: 16458734]

FIG 1.
Mean (SD) AUASI, PSQI, and ESS scores of the two study groups

FIG 2.

Individual AUASI scores plotted against PSQI scores, and linear model fits. Grey circles: UG; black circles: SG; grey solid line: linear fit of data from the UG; black solid line: linear fit of data from the SG.