

Prostatic hyperplasia is highly associated with nocturia and excessive sleepiness: a cross-sectional study

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ABSTRACT

Objectives: The objective of this study is to assess the impact of nocturia on sleep in patients with lower urinary tract symptoms (LUTS)/benign prostatic enlargement (BPE) (nocturia \geq 2).

Design: Cross-sectional survey.

Setting: 798 urologists and general practitioners randomly selected from the overall population of urologists and general practitioners of every French region.

Participants: A total of 2179 LUTS/BPE men (aged 67.5 \pm 7.5 years old) were recruited.

Primary and secondary outcome measures:

Validated patients' self-administered questionnaires were used to assess the severity of LUTS/BPE (the International Prostate Symptom Score), sleep characteristics (sleep log) and sleep disorders (the International Classification of Sleep Disorders (ICSD-2) and the DSM-IV). Sleepiness was assessed with the Epworth Sleepiness Scale (ESS). The volume of 24 h diuresis (<or >1500 ml) was measured.

Results: Participants had on average 2.9 \pm 0.9 nocturia episodes (three or more episodes in 67%) and the International Prostate Symptom Score of 15.8 \pm 5.7; 60.9% complained of insomnia according to the ICSD-2, 7.9% of restless leg syndrome and 6.4% of obstructive sleep apnoea. 32.3% had excessive sleepiness (ESS >10) and 3.1% severe excessive sleepiness (ESS >16). Insomnia was mainly nocturnal awakenings with an average wake after sleep onset of 89 \pm 47 min. The number of episodes of nocturia per night correlated significantly with wake after sleep onset and ESS but not with total sleep time and sleep latency.

Conclusion: Nocturia is significantly associated with sleep maintenance insomnia and sleepiness in men with BPE.

INTRODUCTION

Nocturia caused by benign prostatic hyperplasia is a major complaint of men over 50 years who cite sleep disruption (needing to wake up at night to void) as the main reason for visiting their doctor rather than

ARTICLE SUMMARY

Article focus

- Complaint of nocturia and its links with excessive sleepiness.
- Assessment of the impact of nocturia on sleep.

Key messages

- By being disruptive to sleep, the nocturia episodes affected sleep efficiency and quality.
- The number of nocturia episodes was associated with an increased sleepiness in men with benign prostatic hyperplasia.

Strengths and limitations of this study

- This is a cross-sectional study. It would have been more convincing to compare our subjects to a similar group of older people with no benign prostatic hyperplasia. However, our study focused on the frequency of insomnia and on the correlates between benign prostatic hyperplasia and insomnia.

because of any daytime problems with urinating.^{1–6} After excluding chronic and severe diseases such as diabetes or prostatic cancer, nocturia is mostly classified within the 'moderate to severe lower urinary tract symptoms' (LUTS) category, which includes the vast majority of patients. Twenty-nine per cent of men over 50 years old are affected by LUTS.^{1 2} In France, the rate was recently found to be even higher, affecting 57.5% of men over 55 years old and is mainly attributed to a benign prostatic hyperplasia or benign prostatic enlargement (BPE).³ While voiding once or twice per night and going back to sleep is often considered within normal limits by the vast majority of men, several voids per night are likely to be disruptive to sleep.^{4–9} Recently, two studies done in Europe (Denmark and France) have shown that about one-third of men aged 40–80 years reported two or more episodes of nocturia leading to sleep interruption.^{9 10} The prevalence of nocturia increased with age, with the perceived inconvenience and

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quality-of-life (QoL) impairment being most important as the severity of nocturia increased. The vast majority of these patients talked to their general practitioner (GP) but few consulted a specialist even in the most severe cases. Among French subjects presenting two or more nocturia per night, fewer than one-third had consulted a urologist with 20% receiving a urologic treatment within the past 6 months.^{9 10}

Insomnia is also a major complaint in general practice.¹¹ Epidemiological studies performed in general population samples in Western Europe showed a high prevalence of insomnia symptoms, affecting 10%–20% of adults.^{11–15} Insomnia is defined, according to DSM-IV and International Classification of Sleep Disorders (ICSD-2) consensual definitions, as a complaint of “difficulty initiating sleep, nocturnal awakenings, early awakenings and/or non-restorative sleep, occurring at least three nights per week, for more than 1 month and accompanied by daytime consequences”.^{16 17} Nocturnal awakenings with difficulties going back to sleep is one of the major issues, with the worst consequences on daytime functioning the next day. Its prevalence increases significantly with age.^{13–15 18 19} However, surprisingly, almost half of the subjects with insomnia did not discuss it at all with a physician. Of the few individuals who did, fewer than 20% were correctly diagnosed (according to consensual definitions of sleep disorders) and treated.^{14 15 18 19}

LUTS, and more particularly nocturia and insomnia, remain under-reported and under-treated symptoms, leading to a considerable burden and a major public health issue due to their consequences on QoL. Both are highly prevalent in the general population and their respective prevalence increases with age. Both are recurrent causes of visits to GPs. However, the link between nocturia and sleep disorders in ageing men has not been strictly evaluated.

The goal of this cross-sectional multicenter survey (which we called ‘MORPHEE’) was therefore to assess in a subgroup of LUTS/BPE patients the links between nocturia and sleep characteristics and disorders using well-defined and internationally admitted instruments.

METHODS

Centres and patients

The study was organised by the French Urologic Association (AFU), a non-profit professional association whose members are urologic surgeons practicing in France in the public and private systems and GPs who usually treat prostatic diseases. In order to address potential sources of bias, cluster sample methodology was retained. The participating clinicians were randomly selected from the overall population of urologists and GPs of every French region to rule out any geographic parameter and to take into account the distribution of the population in the country. The selected doctors had to note in a register all LUTS/BPE patients over 40 years old presenting two or more episodes of nocturia,

although they selected only a number of three patients who had poor sleep, possibly secondary to BPE. We believe that this design guaranteed the best representativity of the studied population.

This observational survey was approved by the national authority for epidemiological database studies (French National Commission for Data Protection and the Liberties) and abided by French regulatory requirements.

Data collection

During a patient’s visit, the investigator collected his age, the duration of BPE since the diagnosis (<1, 1–5, 6–10 and >10 years), the number of episodes of nocturia during the previous night and the 24 h diuresis (millilitre—if known). BPE diagnosis was confirmed by digital rectal exam performed by the clinician.

- ▶ If patients with BPE did not complain of regular sleep disorders, they were registered but were not included in the survey.
- ▶ If they complained of regular sleep disorders, insomnia and other sleep disorders, as well as the characteristics of LUTS/BPE, were assessed subjectively.

Instruments

Insomnia and other sleep disorders were assessed using a self-administered questionnaire, the ‘Sleep Disorders Questionnaire—French version’ (SDQFV). Excessive sleepiness was assessed using the ‘Epworth Sleepiness Scale’ (ESS).

The SDQFV is a 42-item questionnaire based on the “Stanford Sleep Questionnaire and Assessment of Wakefulness”.²⁰ The French version has been validated in several epidemiological studies.^{21 22} It covers sleep habits, sleep disorders, alertness during the daytime and psycho-behavioural items such as mood, memory and sexual behaviour.

All but one of the items are derived from questions and possible responses in the SDQFV. The selection of sleep disorders was based on two reference documents: the ‘International Classification of Sleep Disorders (ICSD-2)’¹⁷ and the ‘Diagnostic and Statistical Manual of Mental Disorders’, 4th revision (DSM-IV)¹⁶ (table 1).

The SDQFV also collected data on four specific sleep complaints: (1) difficulty falling asleep, (2) frequent nocturnal awakenings, (3) early awakenings and (4) non-restorative sleep.

A sleep log, a classic tool used in clinical practice and sleep clinics to assess sleep on the previous night (figure 1) was used to calculate sleep characteristics. It also enquired whether the patient used a sleep drug (occasionally, regularly or every day). The following sleep parameters were calculated based on sleep logs: total sleep period (TSP = final wake up time – bedtime), sleep latency (SL = period from lights off to sleep), wake after sleep onset (WASO = time of awakening during the sleep period), number of awakenings

Table 1 Definition of sleep disorders

<i>Items used to define sleep disorders</i>	<i>Criteria for defining sleep disorders</i>
Item A How many minutes does it take for you to fall asleep? (response: >30 min)	Criterion 0 At least one yes to the question, "Do you have sleep problems?"
Item B How many times do you wake up each night? (response: ≥2)	Criterion 1 (A or B) and (C and D)
Item C "Once I wake up, I cannot fall asleep" (response: every night/every week)	Criterion 2 Duration of sleep disorder longer than one month
Item D "After a normal night's sleep, I feel..." (response: a bit tired / very tired)	Criterion 3 E or F
Item E "I fall asleep during the day, during work, while listening to the radio or music, while travelling, in front of the TV." (response: every night/every week)	Criterion 4 Regular use of sedatives
Item F Does it seem that your memory has suddenly gotten worse? (response: yes)	Criterion 5 Hypersomnia: E or G
Item G Epworth Sleepiness Scale score >10	Criterion 6 Sleep apnoea syndrome: E and H and I
Item H Has anyone ever told you that you snore loudly? (response: yes)	Criterion 7 stop breathing for several seconds during sleep
Item I Do you snore? (response: often/almost every day)	Criterion 8 Insomnia: Criterion 0 and Criterion 1 and (Criterion 2 or 3)
	Criterion 9 Severe insomnia: (Criterion 0 and Criterion 1 and Criterion 2 and Criterion 3) or Criterion 4
	Criterion 10 Observed apnoea and sleepiness: Criterion 7 and E

Criteria for defining sleep disorders were based on the DSM-IV and International Classification of Sleep Disorders (ICSD) classification criteria. Items A to H were associated among these criteria to assess minimum criteria of the most common sleep disorders (ref^{15 16}). See for methodology ref.^{17 18}

during the sleep period and total sleep time (TST= TSP – (WASO + SL)). Sleep efficiency index was defined by the ratio TST:TSP (SEI = TST/TSP).

The ESS²³ was used to assess sleepiness. It is a well-known subjective scale used in epidemiology and clinical settings.

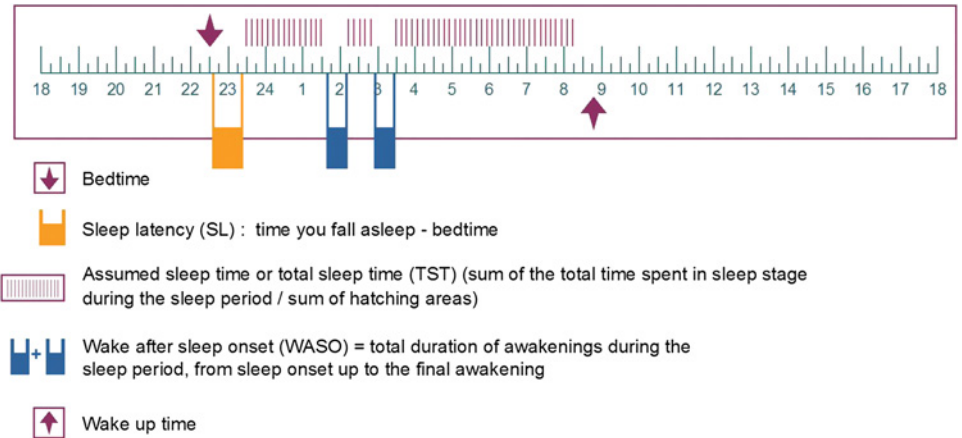
The subject scored his chances of dozing (0= would never doze, 1= slight chance of dozing, 2= moderate chance of dozing, 3= high chance of dozing) in eight ordinary daily situations (watching TV, as a passenger in a car for an hour without a break, sitting and talking to someone, etc). Based on the total score, patients can be classified in three subgroups of sleepiness: no =0–10, excessive sleepiness =10–16 or major sleepiness >16.

Insomnia was defined according to the DSM-IV and ICSD-2 definitions^{16 17}:

- ▶ Subjects first had to complain about difficulty initiating sleep, nocturnal awakenings, early awakenings or non-restorative sleep.
- ▶ Symptoms had to occur at least three nights per week and for at least 1 month and
- ▶ Symptoms had to be accompanied by daytime consequences: (1) fatigue or malaise; (2) attention, concentration or memory impairment; (3) social or vocational dysfunction or poor school performance; (4) mood disturbance or irritability; (5) daytime sleepiness; (6) motivation, energy or initiative reduction; (7) proneness to errors or accidents at work or while driving; (8) tension, headaches or

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Figure 1 Sleep diary/log.



gastrointestinal symptoms in response to sleep loss or (9) concerns or worries about sleep.

– *Severe insomnia* was defined as the presence of at least two sleep complaints according to the DSM-IV definition. In addition, the ICSID minimum criteria for insomnia, *idiopathic hypersomnia, snoring and sleep apnoea* were used. Information was also collected on duration of sleep disorders.

Assessing characteristics of LUTS/BPE

The International Prostate Symptom Score

This seven-item self-reporting questionnaire is the international reference tool used to assess the severity of LUTS/BPE (global score $S = 0-35$), with an additional item scoring separately the QoL impact of LUTS (6-grade scale from 0 to 5). Based on the obtained global score S , the patients could be classified as presenting mild ($S = 0-7$), moderate ($S = 8-19$) or severe ($S = 20-35$) LUTS.²⁴

The Nocturia-Specific Quality-of-Life Questionnaire

It assessing the impact of nocturia on patients' QoL. It includes sleep/energy and bother/concern subscales, and one global QoL item. Among the 13 items, six are related to sleep disturbances, measuring their consequences on daily activities (lack of sleep, difficulty concentrating, feeling low energy, needing to nap, decreased productivity and participation in activities). The different scores were determined by summing the answers of each corresponding question, the sum being then converted into a standardised scale from 0 to 100.²⁵

Statistical methods

Statistical analyses were performed using the SAS® software package (V.8.2, SAS Institute). Sleep parameters and disorders (WASO, SEI, SL, TSP and TST, ESS scores and the presence of insomnia, restless leg syndrome (RLS) and OSA) were described for the entire sample and according to the number of episodes of nocturia per night (non-linear correlation—Spearman test), and the severity of LUTS (International Prostate Symptom Score (I-PSS)) and the volume of 24 h diuresis ($>$ or <1500 ml). According to the analysed variables and their

distribution, used statistical tests were Student t test, paired t-test, McNemar test, Cochran—Mantel—Haenszel test, χ^2 test, Kruskal—Wallis or Wilcoxon tests. All statistical tests were two sided and significant at a 0.05 α -risk level and missing data were not replaced.

RESULTS

A total of 798 clinicians included 2299 patients. Because some of the questionnaires were not fully completed, we retained only 2179 of them. All the patients were males aged on average 67.5 ± 7.5 years.

Characteristics of LUTS/BPE are summarised in [table 2](#). Surveyed patients mostly had a moderate (69.9%) or a severe (24.1%) LUTS based on the I-PSS; 66.6% had three or more episodes of nocturia per night and 19% had more than four episodes. The 24 h diuresis was recorded for 1019 patients: 38% had a volume >1500 ml These LUTS deeply affect QoL based on I-PSS QoL score L: 46.4% scored themselves as mostly dissatisfied because of their troubles and 10.8% as unhappy/terrible. Sleep characteristics of patients with LUTS/BPE are presented in [table 3](#).

Impact of LUTS/BPE severity on sleep characteristics and sleepiness

- ▶ As expected, the number of reported nocturia episodes was associated with the number of awakenings ([figure 2](#)). However, a higher number of nocturia was also significantly associated with a higher WASO (from an average 70.5 min for one episode to 127.5 min for five or more episodes, $p < 0.001$), TSP ($p < 0.001$), a decreased sleep efficiency (from an average 79.0% for one episode to 69.2% for five or more episodes, $p < 0.001$) and an increased total sleep period (from an average 8.6 h for one episode to 9.4 h for five or more episodes, $p < 0.001$). Conversely, the sleep latency was not affected by the number of nocturia episodes and the TST also do not vary.
- ▶ Reporting a 24 h diuresis (≤ 1500 or > 1500 ml) was not associated with any of the sleep characteristics items: number of awakenings per night (2.8 ± 0.8 vs 2.9 ± 0.9 , $p = 0.260$), sleep latency (30.2 ± 36.9 vs

Table 2 Characteristics of LUTS/BPE

BPE duration (years) (n=2179) % patients (n)	<1 year 16.8 (365)	1–5 years 56.7 (236)	6–10 years 20.4 (444)	>10 years 6.1 (134)
24 h diuresis (n=1019) % patients (n)	≤1500 ml 62.0 (632)		>1500 ml 38.0 (387)	
Episodes of nocturia* (n=2129) *Previous night % patients (n)	Mean ± SD (min; median; max) 2 episodes 33.3 (726)		2.9±0.9 episodes (2; 3; 10) 3 episodes 47.6 (1037)	
I-PSS global score S (n=2096) Severity % patients (n)	Mean ± SD (min; median; max) Mild 6.3 (132)		15.9±5.7 (1; 16; 35) Moderate 69.6 (1459)	
I-PSS QoL score L (n=2129) QoL classes % patients (n)	Mean ± SD (min; median; max) Delighted 0.2 (4)		3.5±0.9 (0; 4; 5) Mixed 29.8 (635)	
N-QoL score	Mean ± SD		95% CI	
Total score (n=2091)	54.8±17.8		54.02 to 55.54	
Sleep/energy score (n=2091)	57.2±19.3		56.33 to 57.98	
Bother/concern score (n=2112)	52.5±19.9		51.60 to 53.30	
QoL score (n=2134)	50.1±18.8		49.32 to 50.92	
			Mostly dissatisfied 46.4 (988)	
			Unhappy terrible 10.8 (229)	
			Severe 24.1 (505)	
			Min; median; max 0.0; 54.2; 100.0	
			0.0; 58.3; 100.0	
			0.0; 50.0; 100.0	
			0.0; 50.0; 100.0	

BPE, benign prostatic hyperplasia; I-PSS, International Symptom Score Prostate; LUTS, lower urinary tract symptoms; N-QoL, Nocturia-Specific Quality-of-Life Questionnaire.

26.1±30.7 min, $p=0.147$), WASO (91±50 vs 88±44 min, $p=0.745$), TST (6.7±1.4 vs 6.8±1.3 h, $p=0.142$), TSP (8.9±1.1 vs 8.9±1.1 h, $p=0.751$) or SEI (74.9±14.0 vs 76.6±11.8%, $p=0.174$).

- ▶ However, the I-PSS classes had a significant effect on SEI (74.2±12.1% for severe, 76.3±12.7% for moderate and 80.7±10.6% for mild, $p<0.001$)

(table 4), WASO, TST and the number of awakenings per night ($p<0.001$ for each value) but none on sleep latency and TSP.

Impact of LUTS/BPE severity on insomnia and other sleep disorders

Among the 2179 patients with poor sleep who completed the HD-43 sleep questionnaire, 60.9% responded to the definition of insomnia according to the international classifications. Beside these insomniacs, an additional 7.9% responded to the subjective criteria for RLS and 6.4% to the minimum subjective criteria in favour of sleep apnoea (OSA). Sleepiness was high (ESS >10) in 32.3% of the patients and major in 3.1% of them ESS (>16).

- ▶ The number of reported nocturia episodes was significantly associated with the presence of insomnia: 95% of patients with five or more episodes of nocturia had insomnia versus 36.9% of those with two episodes ($p<0.001$). Conversely, insomniacs reported more nocturia episodes (3.1±0.9 (95% CI 3.0 to 3.1)) than non-insomniacs (2.6±0.9 (95% CI 2.5 to 2.7), $p<0.001$). Patients with LUTS/BPE complained more often of nocturnal awakenings than difficulty initiating sleep (48.9% vs 21.4%, $p<0.001$, 42.5% had both). Overall, 78.6% of subjects reported normal sleep latency <30 min, 16.2% between 30 and 60 min and only 5.2% above 60 min.

- ▶ Reporting a 24 h diuresis (≤1500 or >1500 ml) did not affect the frequency of insomnia (55.6% vs 62.7%) (NS).

- ▶ The I-PSS was higher in insomniacs than in subjects with no insomnia (17.5 (±5.4) vs 15.6 (±5.5), $p<0.001$), and insomnia was more prevalent in subjects with a severe I-PSS than in those with moderate or mild scores ($p<0.001$).

The number of nocturia episodes was significantly associated with more reported sleepiness and excessive sleepiness (ESS >16). The 24 h diuresis volume also

Table 3 Sleep characteristics of patients with lower urinary tract symptoms/benign prostatic hyperplasia

Number of awakenings* (n=2029)	2.8±0.9
Mean ± SD (min; median; max)	0; 3; 10
Sleep latency (n=2029)	27.2±31.3 min
Mean ± SD (min; median; max)	0; 30; 330
≤30 min, % patients (n)	78.6 (1517)
>30–≤60 min, % patients (n)	16.2 (313)
>60 min, % patients (n)	5.2 (100)
Wake after sleep onset (n=2010)	89.2±47.5 min
Mean ± SD (min; median; max)	0.; 90; 390
≤30 min, % patients (n)	10.1 (203)
>30–≤60 min, % patients (n)	28.6 (575)
>60 min, % patients (n)	61.3 (1232)
Total sleep period* (n=2047)	8.9±1.1 h
Mean ± SD (min; median; max)	5.1.; 9.0; 13.0
Total sleep time* (n=2007)	6.7±1.4 h
Mean ± SD (min; median; max)	0.3.; 6.8; 12.0
Sleep efficiency index* (n=2029)	76.0±12.8%
Mean ± SD (min; median; max)	9.; 78; 100
ESS (n=2059)	8.1±4.3
Mean ± SD (min; median; max)	0.; 8; 24
No sleepiness ESS ≤10, % patients (n)	64.6 (203)
Excessive sleepiness ESS 11–15, % patients (n)	32.3 (575)
Major sleepiness ESS ≥16, % patients (n)	3.1 (1232)

*Previous night.
Epworth Sleepiness Scale.

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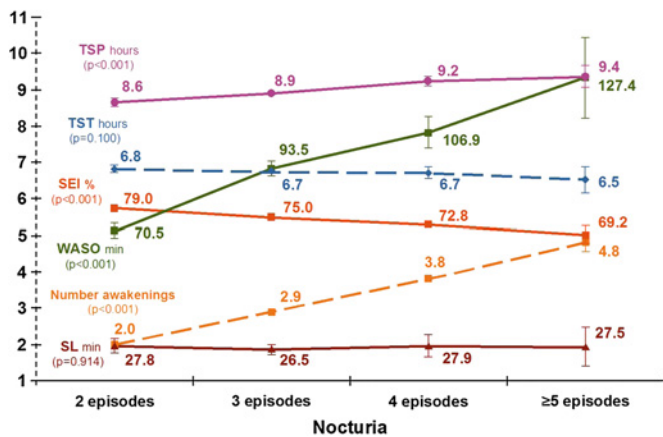


Figure 2 Impact of lower urinary tract symptoms/benign prostatic hyperplasia on sleep characteristics and sleepiness. SEI, sleep efficiency index; SL, sleep latency; TST, total sleep time; WASO, wake after sleep onset.

moderately affected sleepiness, but there was no association found between the I-PSS and ESS.

There was no significant association between RLS and sleep apnoea minimum criteria and any BPE symptom.

DISCUSSION

One major finding of this study is that older men complaining of LUTS related to BPE have poor sleep as reported by many studies^{4–8} and a high prevalence of insomnia, as assessed by well-validated tools. In a group of 2179 patients with LUTS and nocturia, visiting GPs and urologists, carefully representative of the clinicians who usually take care of BPE in France, found a high prevalence of insomnia (60.9%): more than three times greater than that observed (with the same tools) in the general population of France (ie, 19% in 12 778 subjects).²¹ Although these studies cannot be compared from a statistical point of view, we can suggest that insomnia is a major underestimated complaint in this group of LUTS patients. Ageing has a normal effect on sleep quality and quantity^{26–27}: sleep in older people is commonly shorter than in younger adults, with a lower percentage of slow wave sleep.²⁷ It is also common that, due to a phase advance of the biological clock, older people get to sleep earlier in the evening, with an earlier

awakening in the morning. Insomnia is also more prevalent in older subjects and is estimated to affect 30%–40% of them, mostly women.^{11 13–15 18 19 26} Facing this high prevalence of sleep disturbance, GPs and urologists may be tempted to consider poor sleep as an unavoidable consequence of ageing. Our study demonstrated that this is not only a question of ageing but it is also associated with the severity of nocturia. Based on these results, we firmly encourage GPs to investigate more deeply a possible link between the two disorders and to use well admitted sleep and LUTS/BPE instruments to assess the severity of illness.

This is the second issue highlighted by our study, which shows that some tools used to describe HGB may be significantly associated with the severity of insomnia:

- First, the I-PSS, which has been recommended to assess the impact of LUTS/BPE on QoL, was significantly associated with insomnia in our study. The I-PSS in insomniacs was higher than in subjects with no insomnia, and insomnia was more prevalent in subjects with a severe I-PSS than in those with moderate or mild scores. The severity of I-PSS also significantly correlates with SEI and excessive somnolence as measured by the ESS.

- Second, the number of nocturia episodes had a significant impact on the severity of insomnia. It may seem obvious that the more times one needs to void the bladder at night, the more awakenings result. Our study describes which sleep parameters were affected by the frequency of nocturia. As shown, it did not affect total sleep time, which means that patients with severe BPE did not sleep less than others in our survey. However, they had longer WASO and they compensated by staying in bed more with a longer total sleep period. Staying in bed is not recommended for insomniacs since it decreases sleep homeostatic power and may increase insomnia. It is possible that in these elderly subjects, staying in bed too much at night may decrease the quality of their sleep, driving them to be more sensitive to prostatic pressure, which may prompt them to go to the bathroom more often.

Interestingly, our study also allows us to better understand how sleep is disturbed and leads to insomnia in

Table 4 Characteristics of LUTS/BPE and sleep efficiency

SEI (%)	Number of episodes of nocturia				p Value
	2 (n=619)	3 (n=929)	4 (n=289)	≥5 (n=75)	
Mean ± SD	79.0±12.3	75.4±12.2	72.8±13.8	69.2±14.4	<0.001
95% CI	78.0 to 80.0	74.6 to 76.2	71.3 to 74.4	65.9 to 72.4	
24 h diuresis					
SEI (%)	≤1500 ml (n=619)		>1500 ml (n=619)		p Value
Mean ± SD	74.9±14.0		76.6±11.8		
95% CI	73.8 to 76.1		75.4 to 77.8		
Severity of LUTS/BPE (I-PSS—classes of global score S)					
SEI (%)	Mild (n=116)	Moderate (n=1309)	Severe (n=453)		p Value
Mean ± SD	80.7±10.6	76.3±12.7	74.2±12.1		
95% CI	78.8 to 82.6	75.6 to 77.0	73.1 to 75.3		

BPE, benign prostatic hyperplasia; I-PSS, International Symptom Score Prostate; LUTS, lower urinary tract symptoms; SEI, sleep efficiency index.

LUTS/BPE patients. In several previous studies,^{28 29} it was assessed that nocturia was strongly associated with insomnia. However, insomnia was just defined by a complaint of poor sleep with or without daytime consequences.

In more recent consensus or review papers, the impact of nocturia on sleep was mainly focused on QoL scales. However, it has been shown that insomnia has a significant impact on QoL,^{30–32} it seems difficult to think that the disturbed QoL in LUTS/BPE patients with poor sleep may be only associated with the disturbed sleep and not with other possible factors due to BPE such as pain, anxiety or depression.

In our study, we obtained additional interesting data to better understand insomnia in these patients.

- ▶ First, difficulty initiating sleep affected 21.4% of them versus 48.9% affected by nocturnal awakenings, 42.5% had both. This has not been previously described in other papers as difficulty initiating sleep does not fit with nocturia. We may hypothesise that nocturia may disturb sleep events at the beginning of the night with patients going to the toilet just after going to sleep to avoid future awakenings at night. Difficulty initiating sleep may also be associated with many other causes such as anxiety, environment or pain.
- ▶ Second, the patients in our group were not severely sleep deprived. Some authors have suggested that LUTS/BPE subjects may be severely sleep deprived and have associated risks due to sleepiness or fatigue.^{24 28}

Our study shows that the number of nocturia episodes did not affect total sleep time (**figure 2**); patients with frequent awakenings related to nocturia episodes spent more time in bed (TSP) to reach comparable effective sleep duration TST, with a significant increased WASO and decreased SEI. By being disruptive to sleep, the nocturia episodes affected sleep efficiency and quality, with no reduction of the quantity of sleep, which is within the limits of normal for this age group.²⁷ Similarly, the urine volume per day has no impact on TST.

We, however, showed that the number of nocturia episodes was associated with an increased sleepiness assessed by the ESS. The ESS score was above 10 for 24.5% of men with two nocturia versus 36.8% of those with more than five episodes (and an ESS score above 16 for 0.5 vs 4.8% $p<0.001$). Considering that total sleep time is not reduced in those patients, we may hypothesise that the quality of sleep is insufficient, which may explain excessive sleepiness during the day. The urge to void the bladder probably acts like other sleep disorders (sleep apnoea or RLS), resulting in sleep fragmentation and increased sleepiness the day after. We are aware that to confirm this hypothesis, polysomnography studies are needed as it is not possible to ascertain that the sleep quality of these patients is disturbed using subjective tools only. Moreover, we have made only one sleep assessment on the night before

clinician's visit. However, questionnaires are well accepted in the field as they have shown their consistency over time and across countries.

We also recognised several other limitations in this study. First, our study is a cross-sectional and observational study made in a group of patients who have sleep complaints and LUTS/BPE. It would have been more convincing to compare them to a similar group of older people with no LUTS/BPE. However, our study focused on the frequency of insomnia and on the correlates between LUTS/BPE and insomnia. The design of our study allowed us to answer more precisely to this second point.

It has been suggested that the frequency of nocturnal voids and the time the episodes occur may affect sleep quality. Deep, slow wave restorative sleep occurs during the first hours of the night, while in the second part, the lighter and less restorative sleep predominates. Such a decrease in deep sleep mainly contributes to daytime fatigue. Based on this, the concept of hours of undisturbed sleep was developed and broadly acknowledged as a potentially important parameter in assessing sleep disturbance due to nocturnal voids.^{4 24 33} Hours of undisturbed sleep was defined as the time from falling asleep to first waking to void, the limit considered as normal being 3–4 h. During this survey, the occurrence time of the first nocturnal void was not determined according to the time the patients fell asleep. Nevertheless, as assessed by the I-PSS item-2, 47.9% of the patients with chronic insomnia experienced the need to void <2 h after a miction in at least 1 of 2 cases compared with 28.9% and 26.7% of the patients, respectively, with or without sleep disorders ($p<0.001$). This could signify that patients with more severe sleep disorders were more likely to need to wake up to void during the first part of the night.

The results obtained in this French multicenter observational survey, conducted in routine practice in 2197 men with LUTS/BPE with associated sleep disorders for 1576 patients, showed that the most prevalent sleep disorder was chronic insomnia, mainly characterised by sleep disruption. The number of nocturia episodes appears to be the major driver of insomnia and subsequent decrease in daytime alertness.^{1 33 34} Thus, in patients consulting mainly their GP for LUTS, it is recommended to look for possible related sleep disorders and inversely. Tools such as the simplified SQHD—HD-43 that allows to determine the accurate type of sleep disorders and other possibly associated primary sleep disorders, as well as a patient's sleep log, I-PSS, ESS self-administered questionnaires that provide sensitive and reliable quantitative measurements for assessing the sleep disorders and their impact on the QoL—are easy to use in routine practice.

Contributors (1) EC-K, DL and DC made substantial contributions to conception and design. EC-K, DL, DC and FH contributed to the acquisition of data. MO and DL contributed to the analysis and interpretation of data; (2) all the authors have participated in the drafting of the article and critical revisions

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for important intellectual content and (3) all the authors have approved the final version of the submitted manuscript.

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Competing interests None.

Patient consent Obtained.

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