
Nocturia in the elderly in relation to thirst, dry mouth and dry eyes

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Objective: To assess the relationship between nocturia, thirst and the perception of dryness in the eyes and mouth in a group of elderly men and women.

Materials and methods: The study comprised 6103 elderly men and women recruited by a questionnaire from a group of pensioners (n=10216; response rate 61.3%). The age of the men and the women was 73.0 (6.0) and 72.6 (6.7) years, respectively. The questionnaire included questions on their health, diseases and symptoms, drugs, sleep habits and the number of nocturnal voiding episodes.

Results: Dryness of the eyes increased from 6.5% in men without nocturnal micturition to 15.8% ($p < 0.05$)

in those with $\geq$ three nocturnal voids, and correspondingly from 9.9% to 33.1% ($p < 0.0001$) in women. Dryness of the mouth increased similarly from 15.7% to 37.3% ($p < 0.001$) in the men and from 17.0% to 56.7% ($p < 0.0001$) in the women. Multiple logistic regression analyses revealed that dry eyes and dry mouth increased with increasing nocturnal micturition independently of the influence of age, sex, analgesics and the use of diuretics. **Conclusion:** Nocturia is associated with a significant increase in the occurrence of dry eyes and dry mouth among the elderly. The results may indicate that nocturnal polyuria is an overlooked pathogenetic mechanism in these symptoms.

Key Words: dry eyes, dry mouth, elderly, nocturia, nocturnal polyuria syndrome, thirst

Introduction

Nocturia is a common complaint in the elderly. It has a profound influence on sleep, and is associated with an increase in many sleep-disturbing symptoms, including thirst with a need for nocturnal drinking.¹

The prevalence of dry eyes increases in elderly persons with inflammatory diseases, especially in Sjögren's syndrome.² Dry mouth causes significant suffering in some elderly persons with a serious impact on the eating ability, chewing ability, swallowing and oral function in general, and consequently on the quality of life.^{3,4} In a study in hospitalized elderly men and women, dry mouth was found in more than half of the study group.⁵

Both dry eyes and dry mouth are common

complaints in the elderly. In a questionnaire survey in 2481 individuals, aged 65 to 84 years, Schein et al found that 27% of the study population reported that dry eye or dry mouth was present often or all the time and 4.4% reported the occurrence of both.² Although there is an increased prevalence of glandular hypofunction resulting in dryness of the mucous membranes in persons with inflammatory diseases, especially rheumatoid arthritis and Sjögren's syndrome, many persons with dry eyes and/or dry mouth show no atrophy in the salivary glands or the lacrimal glands.⁶

There seems to have been no study addressing the possible relationship between nocturia and dryness of mucous membrane in the elderly. The aim of the present study was to investigate the relation between nocturia, thirst and dryness of the eyes and mouth in a large group of elderly subjects.

Materials and methods

All 10216 members of the pensioners' association SPF

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TABLE 1. The distribution of nocturnal micturition episodes (%) in men and women of different ages

		Number of nocturnal micturition episodes			
	Age (years)	None	One	Two	≥ Three
Men	< 70	13.7	61.6	18.7	6.0
	70 - 79	7.9	54.8	27.7	9.6
	≥ 80	6.1	52.9	31.7	9.3
Women	< 70	13.7	61.3	18.7	6.3
	70 - 79	8.7	58.5	22.6	10.3
	≥ 80	6.2	54.9	25.9	13.0

men: $p < 0.0001$; women $p < 0.0001$

in the Swedish counties of Västerbotten and Norrbotten were asked to participate in a questionnaire survey. A further questionnaire was sent to those who did not respond within 1 month.

The questionnaire has been described previously.⁷ The questions concerned the general state of health, the occurrence of somatic diseases and symptoms, everyday habits and behavior, and the use of drugs. In addition, there was a question on the number of nocturnal voiding episodes. In the present report the relations between the reported number of nocturnal micturition episodes, on the one hand, and the responses to statements on thirst and drinking at night, thirst in the daytime and dryness of the eyes and mouth (with the alternative answers "often" versus "seldom or never") and on the use of diuretics and analgesics ("yes" versus "no"), on the other hand, were analyzed.

Statistical methods

Standard methods were used for calculating mean values and standard deviations (SD). Group comparisons of non-numerical data were made with the chi-square test. For comparing frequencies, odds ratios (OR) with a 95% confidence intervals (CI 95%) were calculated. For simultaneous evaluation of the

influence of more than one independent variable on a dependent variable, logistic regression analysis (StatView 5.0 for the Macintosh) was performed.

Results

The questionnaire was completed initially by 4544 persons. After a reminder, a further 1559 answers were received. Thus there were 6103 evaluable questionnaires, of which 39.5% were from men. The response rate was 61.3%. The ages of the male and female participants were 73.0 (SD 6.0) and 72.6 (6.7) years, respectively.

The numbers of nocturnal micturition episodes increased in parallel with increasing age in both men and women. There was no difference between men and women in the occurrence of nocturnal micturition episodes Table 1.

Thirst at night was reported by 13.7% of the men and 24.1% of the women ($p < 0.0001$) and 14.0% of the men and 24.1% of the women ($p < 0.0001$) stated that they needed to get up at night to drink. Both the occurrence of thirst at night and that of a the need to get up to drink at night were increased with increased nocturnal micturition, and this was more pronounced in women than in men Table 2. Thirst in the daytime

TABLE 2. The occurrence of thirst and the need to drink at night (%) in relation to the number of nocturnal micturition episodes in men and women

		Number of nocturnal micturition episodes				
		None	One	Two	≥ Three	p =
Thirst						
Men		1.5	11.1	22.1	22.7	< 0.001
Women		5.3	20.9	35.9	53.1	< 0.0001
Need to drink at night						
Men		2.3	11.6	22.7	24.2	< 0.0001
Women		6.4	20.2	37.3	55.3	< 0.0001

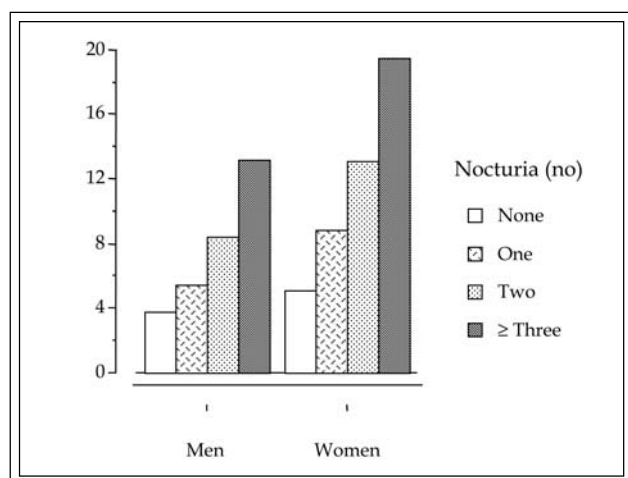


Figure 1. The occurrence of thirst in the daytime (%) in men and women with different numbers of nocturnal voiding episodes: men: $p < 0.05$; women $p < 0.001$.

was reported by 6.4% of the men and 9.9% of the women ($p < 0.001$). The occurrence of thirst in the daytime increased in parallel with the numbers of nocturnal micturition episodes in both men and women Figure 1.

Dryness of the eyes was reported by 14.3% of the men and 21.7% ($p < 0.0001$) of the women. Dryness of the mouth occurred in 25.1% of the men and 36.3% ($p < 0.0001$) of the women and showed an age-related increase in both sexes Table 3. Increased nocturnal micturition was associated with increased dryness of the eyes and the mouth in both men and women. Both dry eyes and dry mouth were more common in women than in men in the groups with different nocturnal micturition habits Figure 2 and Figure 3.

Diuretics were used by 12.5% of the men and 18.4% of the women ($p < 0.0001$). Dry eyes was 3.2 (1.6-3.4) times more common in men and 1.7 (1.3-2.2) times more common in women using diuretics than in those who were not being treated with these drugs. Dry

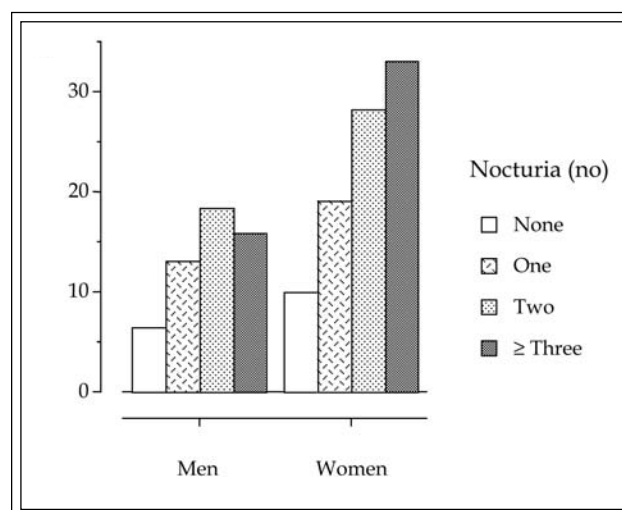


Figure 2. The occurrence of dry eyes (%) in men and women with different numbers of nocturnal voiding episodes: men: $p < 0.05$; women $p < 0.0001$.

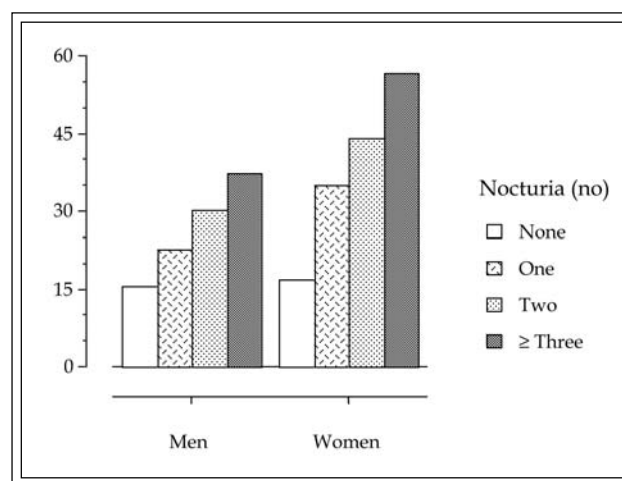


Figure 3. The occurrence of dry mouth (%) in men and women with different numbers of nocturnal voiding episodes: men: $p < 0.001$; women $p < 0.0001$.

TABLE 3. The percentage numbers of men and women of different ages with dry eyes and dry mouth and throat

		Dry eyes		Dry mouth	
	Age (years)	Men	Women	Men	Women
Men	< 70	10.0	18.4	19.6	30.6
	70 - 79	16.1	22.7	25.9	38.1
	≥ 80	17.4	26.7	35.8	43.5

dry eyes, men: $p < 0.01$; women $p < 0.05$. dry mouth, men: $p < 0.0001$; women $p < 0.001$

TABLE 4. The occurrence of dry eyes and dry mouth and throat in relation to age, sex, nocturnal micturition, and the use of diuretics and analgesics. Odds ratios (OR) and 95% confidence intervals (CI 95) for each of the variables included in the logistic model

Variables	Dry eyes		Dry mouth and throat	
	OR	(CI 95)	OR	(CI 95)
Sex (man = 1.0)				
Woman	1.6	(1.3 - 2.0)	1.5	(1.2 - 1.9)
Age (< 70 years = 1.0)				
70-79 years	1.3	(1.0 - 1.7)	1.3	(1.0 - 1.5)
≥ 80 years	1.3	(1.0 - 1.8)	1.5	(1.2 - 1.9)
Nocturnal micturition (none = 1.0)				
One	2.1	(1.3 - 3.3)	2.1	(1.5 - 3.0)
Two	3.1	(1.9 - 5.0)	2.9	(2.0 - 4.2)
≥ three	3.1	(1.9 - 5.6)	4.0	(2.6 - 6.0)
Analgesics (daily use vs. no use, no use = 1.0)				
Daily	1.4	(1.1 - 1.8)	1.6	(1.3 - 1.9)
Diuretics (no = 1.0)				
Yes	1.6	(1.2 - 2.0)	1.7	(1.4 - 2.1)

mouth was 2.5 (1.8-3.4) times more common in men and 2.0 (1.6-2.5) times more common in women receiving diuretics than in those who were not on diuretic treatment.

Analgesics were used by 14.8% of the men and 26.2% of the women ($p < 0.0001$). Daily use of analgesics was associated with a 2.5 (1.8-3.4) times increase in dry eyes in men and a 2.0 (1.6-2.5) times increase in women compared with no use of analgesics. Dry mouth was 2.5 (1.7-3.8) times more common in men and 1.9 (1.5-2.4) times more common in women using analgesics than in those who never used such medication.

In a multiple logistic regression analysis increased occurrence of dry eyes was associated with increased nocturia, female sex, increasing age, diuretic use and use of analgesics. Dry mouth was associated with increased nocturia, female sex, age ≥ 70 years versus < 70 years (but not ≥ 80 years versus < 70 years), diuretic use and the use of analgesics use Table 4.

Discussion

In the present study the occurrence of dry eyes and dry mouth increased in parallel with increased nocturia. This increase in mucosal symptoms occurred in both men and women and both in the daytime and at night. It is known from previous studies that nocturia in the elderly is associated with profound sleep deterioration and an increase in several nocturnal symptoms, such as feeling cold,

sweating, nightmares, increased thirst and drinking, leg tingling and muscle cramps.¹ However, nocturia does not seem to have been considered previously in connection with dryness of the mucous membranes in the eyes and the upper airways.

Could there be a link between nocturia and dryness of the mucous membranes? It is known that nocturia is often associated with increased nocturnal diuresis, and an increased number of nocturnal voids is associated with an increase in the nocturnal proportion of the 24-hour urine volume. In some nocturic elderly men and women the nocturnal urine output can constitute 85% of the 24-hour diuresis, resulting in a negative fluid balance.⁸ This condition is called the nocturnal polyuria syndrome.⁹

One important question in the interpretation of the results in the present study concerns the reliability of reports on nocturnal micturition. Nocturia recordings from self-administered questionnaires have shown an acceptable day-to-day variability during 3 consecutive nights in a large group of elderly men and women.¹⁰

Increased thirst, especially at night, and a need to get up at night for a drink are common consequences of nocturnal polyuria.¹ Thirst is perceived as dryness of the mouth and throat, and drinking reduces the unpleasant dry-mouth sensations that accompany thirst.¹¹ While in many elderly men and women the thirst mechanism is weakened by ageing, increased thirst, especially at night is common in elderly persons with nocturia.^{1,12} Nocturia, which is often caused by nocturnal polyuria, produces a negative fluid balance,

which needs to be corrected by drinking throughout the whole 24-hour period, but especially at night.¹ The dryness of the eyes and mouth seem to be largely consequences of this negative fluid balance.

Increased age was associated with increased dryness of the eyes and the mouth, after the influence of nocturia had been taken into account Table 4. Such an age-related decrease in the ability to keep the eyes moistened has been described previously and considered to be a result of impaired function of lachrymal gland.¹³ The salivary glands are also inclined to decrease their function at advanced ages.¹⁴ Both dry eyes and dry mouth were more common in women than in men, a finding in accordance with previous reports.^{13,14}

The use of diuretics was associated with a 40% increase in the occurrence of dry eyes and a 60% increase in the occurrence of dry mouth Table 4. This is in line with previous findings.^{2,15}

The use of analgesics was also associated with increased occurrence of dryness of the eyes and mouth. It has been suggested that dryness of the mucous membranes in association with the use of diuretics and analgesics may be caused both by direct influences on the salivary and lachrymal gland and by dehydration.^{2,16}

A possible limitation of the study was that the occurrence of anticholinergic medication was not addressed in the questionnaire. Dryness of the mucosal membranes is a well-known side-effect of such medication. On the other hand anticholinergic medication is common in the treatment of over-active bladder and the favorable effect of this medication on urinary urgency, frequency and nocturia is well established. Accordingly, a larger number of nocturnal micturition episodes is not expected in elderly persons on anticholinergic drugs compared to those without such medication. It thus seems reasonable to assume that the increase in dryness of the mucosal membranes in parallel with an increasing number of nocturnal micturition episodes can only be explained to a minor extent by the use of anticholinergic drugs.¹⁷

In summary, in this group of elderly men and women nocturia was associated with a significant increase in the occurrence of dry eyes and dry mouth. This increase persisted after adjustment in the analysis for sex and age, use of diuretics and use of analgesics. The results may indicate that nocturnal polyuria is an overlooked pathogenetic mechanism in the genesis of dry eyes and dry mouth in the elderly. □

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