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SMOKING IS INDEPENDENTLY ASSOCIATED WITH CERTAIN URINARY STORAGE SYMPTOMS: A POPULATION-BASED STUDY

Hypothesis / aims of study

There is a paucity of studies assessing the impact of smoking on urinary storage symptoms (overactive bladder symptoms and stress urinary incontinence). We evaluated the association of smoking with urinary storage symptoms among both sexes aged 18-79 years.

Study design, materials and methods

In 2003-2004, questionnaires were mailed to 3,000 men and 3,000 women randomly identified from the national population register. Subjects were classified as never smokers, former smokers and current smokers using questions: "Have you ever smoked?" (yes/no) and "Do you still smoke?" (yes/no). Information on urinary storage symptoms was collected using the DAN-PSS [1], with an additional nocturia question from the AUA-SI [2]. Urinary urgency, urinary urgency incontinence (UUI) and stress urinary incontinence (SUI) were defined as abnormal if reported often or always (in scale: never/seldom/often/always). Urinary frequency was defined as abnormal if longest interval between each urination was reported as <2 hours (in scale: >3 hours, 2-3 hours, 1-2 hours, <1 hour) and nocturia as ≥2 voids/night.

Information on self-reported physician diagnosed comorbidity (36 conditions), use of prescribed medication (27 groups using the ATC/DDD classification [3]), sociodemographic factors (marital status, education, employment, urbanity), body mass index (normal-weight, overweight, obese), coffee (cups/day) and alcohol (grams/week) consumption and female reproductive factors (parity, postpartum period, menopause, hormone replacement therapy,
hysterectomy) were treated as potential confounders. Confounder Scores (CSs) were calculated based on comorbidity and medication among subjects responding on all symptoms. For each comorbidity and medication factor, we calculated age-adjusted odds ratios (ORs) with confidence intervals. All factors respectively associated with symptoms were used to construct the CS formulas (where OR_{rf} is the odds ratio for a risk factor):

$$CS = \sum_{i=1}^{n} (OR_{rf} - 1)_n \qquad \text{AND} \qquad \text{only if } p < 0.05 \text{ for } OR_{rf}$$

Separately for both sexes and each symptom, logistic regression was used for analyses, with the presence of symptom as the outcome. First, we calculated odds ratios (OR) for each symptom with adjustment for age (Bivariate). Secondly, multivariate analyses with confounding factors were performed (Multivariate). All factors associated ($p<0.05$) with each symptom in the age-adjusted analyses were entered as potential confounders into multivariate models. Finally, backward elimination techniques were used to select variables for the final model of each symptom, separately, with likelihood ratio tests used to determine significance. At least 10% change in the estimate (OR), following elimination of a potential confounder was deemed confounding.

Results

Of the 6,000 subjects, 3,729 (62.4%) participated and 130 were excluded due to pregnancy, puerperium or urinary tract infection. Of the included subjects, 3,404 (95%) answered all urinary storage symptom and smoking questions. After age-standardization, 34.0% of men and 52.7% of women were regarded as never smokers; 37.2% of men and 24.1% of women as former smokers; and 28.8% of men and 23.2% of women as current smokers. Symptoms fulfilling the criteria of urinary urgency, UUI, frequency, nocturia and SUI was reported by 119, 15, 74, 186 and 7 men, and 153, 41, 113, 176 and 171 women, respectively. Age-standardized prevalence of these symptoms were reported by 7.8%, 0.9%, 5.2%, 12.3% and 0.4% of men and 9.7%, 3.1%, 7.1%, 12.6% and 11.2% of women, respectively.

Urinary urgency and frequency were related with current smoking in both sexes. Urgency was also related with former smoking among women whereas borderline association was found among men in the multivariate analysis. Nocturia was not associated with smoking in either sex. Among women, UUI and SUI were not associated with smoking in the multivariate analyses, whereas number of men with these symptoms was too small for reliable analyses. Numerous other statistically significant associations were found in bivariate analyses. (**Table**)

Table. Association of smoking (never, former, current) with urinary storage symptoms.

	Men				**Women**			
	Smoking status*				**Smoking status**			
	Former		**Current**		**Former**		**Current**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Urgency								
Bivariate†	1.69	1.05-2.73	1.89	1.10-3.27	1.78	1.15-2.75	2.73	1.81-4.13
Multivariate‡	1.59	0.97-2.59	**1.74**	**1.00-3.02**	**1.75**	**1.11-2.77**	**2.63**	**1.70-4.06**
UUI								
Bivariate	Not performed (small number of cases)				1.92	0.86-4.26	2.24	0.99-5.06
Multivariate					1.64	0.71-3.80	1.65	0.66-4.11

Frequency								
Bivariate	1.12	0.61-2.05	2.33	1.25-4.35	1.69	1.01-2.85	3.43	2.14-5.49
Multivariate	1.02	0.55-1.88	**1.97**	**1.04-3.74**	1.67	0.98-2.85	**3.27**	**2.02-5.27**
Nocturia								
Bivariate	1.14	0.77-1.69	0.93	0.56-1.53	1.06	0.70-1.62	1.34	0.88-2.05
Multivariate	1.04	0.69-1.57	0.82	0.49-1.39	0.96	0.62-1.49	1.22	0.79-1.89
SUI								
Bivariate	Not performed (small number of cases)				1.49	1.01-2.19	0.97	0.62-1.51
Multivariate					1.36	0.91-2.02	0.81	0.50-1.31

Bold font used for significance in multivariate analyses.
* Never smokers were regarded as referent.
† Adjusted for age.
‡ Adjusted for all confounding factors (factors in model differed by symptom and gender).

Interpretation of results

Current smoking was associated with urinary urgency and frequency in both sexes but not with nocturia or incontinence. Among women, former smoking was also related with urgency. Numerous significant associations for smoking with urinary storage symptoms were also found in age-adjusted analyses highlighting the importance of appropriate analysis including controlling for confounders. Validity of these results was strengthened by high response rate, representative study population, and adjustment for major confounding factors.

Concluding message

Urinary urgency and frequency are associated with smoking whereas nocturia and incontinence are not.

References

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Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**The Ethics Committee of the Pirkanmaa Hospital District (Tampere, Finland).**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**