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UNRAVELLING NOCTURNAL POLYURIA IN OLDER PATIENTS

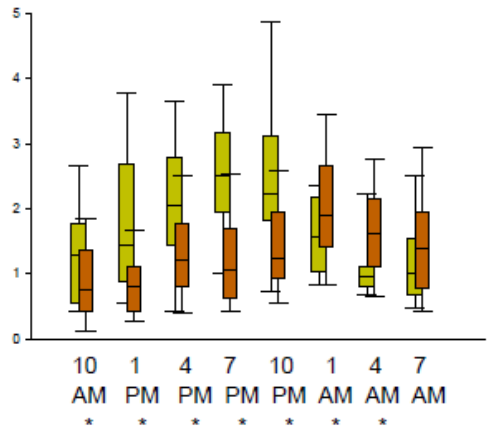
Hypothesis / aims of study

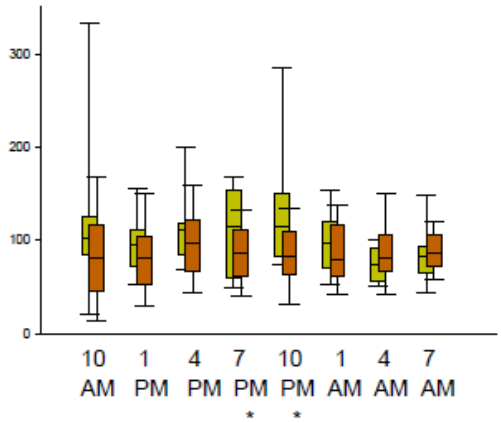
Nocturnal polyuria (NP) is a highly prevalent condition in older patients and a major cause of nocturnal lower urinary tract symptoms (LUTS), which affects quality of sleep, cognitive functions and overall health. Diagnosis of NP is based on a frequency volume charts (FVC). Moreover, addition of a renal function profile (RFP) to analyse concentrating and solute-conserving capacity allows differentiation of NP pathophysiology. The aim of this study was to map circadian rhythms of renal functions in order to explain NP in older patients.

Figure 1: Diuresis rate, creatinine clearance, free water clearance and sodium clearance in patients with NP (n=57) compared to patients without NP (n=19).
**p<0.05 between patients with and without NP*

Diuresis rate (ml/min)	NP (n=57)	No NP (n=19)	p-value
24h	1.4 (0.5-3.5)	1.8 (1.0-2.5)	**0.002**
daytime	1.1 (0.3-2.6)	2.1 (1.2-2.7)	**<0.001**
nighttime	1.7 (0.7-5.2)	1.1 (0.6-2.2)	**0.004**
p-value	**<0.001**	**<0.001**	

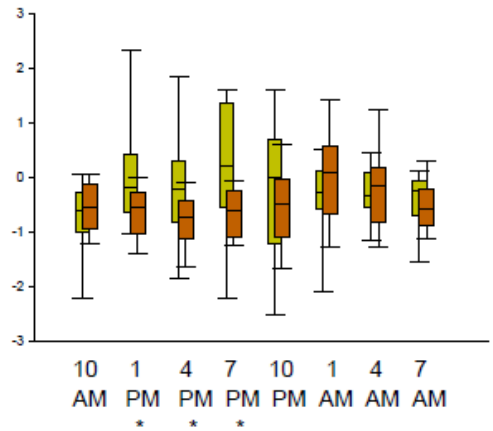
Creatinine clearance (ml/min)	NP (n=57)	No NP (n=19)	p-value
24h	85 (22-143)	99 (63-278)	0.091
daytime	86 (24-165)	113 (58-234)	**0.007**
nighttime	56 (19-166)	80 (50-337)	0.532
p-value	0.706	**0.007**	

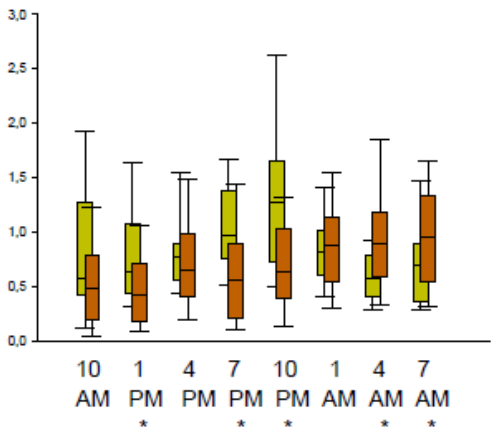




Free water clearance (ml/min)	NP (n=57)	No NP (n=19)	p-value
24h	-0.5 (-3.4;0.7)	-0.2 (-1.9;0.8)	0.129
daytime	-0.6 (-2.0;0.3)	-0.1 (-2.0;1.0)	**0.043**
nighttime	-0.2 (-7.0;2.4)	-0.3 (-1.9;0.6)	0.642
p-value	**<0.001**	0.286	

Sodium clearance (ml/min)	NP (n=57)	No NP (n=19)	p-value
24h	0.8 (0.03-1.4)	0.9 (0.5-1.6)	0.169
daytime	0.6 (0.03-1.4)	0.9 (0.6-1.9)	**<0.001**
nighttime	0.9 (0.04-1.8)	0.7 (0.3-1.3)	**0.016**
p-value	**<0.001**	**0.001**	





Study design, materials and methods

This prospective, observational study was conducted between February 2014 and 2016. Patients consulting the department of urology for complaints of urinary incontinence were invited to participate. Inclusion criteria were age ≥65 years and a normal cognitive screening. There were no specific exclusion criteria. Study protocol comprised a 24h-RFP (= 24h urinalysis based on a urine sample every 3h with analysis of diuresis rate, osmolality, sodium, and creatinine concentrations), and a sober blood sample to determine serum osmolality, sodium and creatinine to calculate renal clearance of each of these substances (U_{subst} x urine flow / P_{subst}). NP was defined as a nocturnal urine production (voided volume + incontinence weight) higher than 33% of total 24h urine production (NP index >33%). Descriptive parameters are represented as median, minimum and maximum. Non-parametric tests were used to compare unpaired (Mann-Whitney U test) and paired continuous variables (Wilcoxon test). A p-value <0.05 was considered statistically significant.

Results

A total of 66 women and 10 men, with a median age of 73 (65-91) years, were divided into patients with NP (n=57) and controls without NP (n=19) (Fig 1).

- *Diuresis rate*: Patients with NP showed a significant increase in nighttime diuresis rate compared to daytime (p<0.001), while controls without NP showed a significant decrease in nighttime diuresis rate (p<0.001). In addition, patient with NP showed a significantly lower 24h (p=0.002) and daytime (<0.001) diuresis rate compared to controls without NP.

- *Creatinine clearance*: Controls without NP show a significant decrease in nighttime creatinine clearance (p=0.007), while this circadian rhythm is lacking in patients with NP.

- *Free water clearance:* Patients with NP show a significant increase in nocturnal free water clearance (p<0.001), while controls show a tendency of nocturnal decrease in free water clearance (p=0.286).

- *Sodium clearance:* Patients with NP show a significant increase in nocturnal sodium clearance (p<0.001), especially at the end of the night (p<0.05 at 4am,7am), while controls show a significant decrease in nocturnal sodium clearance (p=0.001).

Interpretation of results

Patients with NP differ from controls without NP because of different circadian rhythms in diuresis rate, creatinine clearance, free water clearance and sodium clearance. We hypothesize that the difference in creatinine clearance and sodium clearance, which seems important at the end of the night, might be related to associated comorbidities; while changes in free water clearance, which seems more important in the beginning of the night, might be related to age.

Concluding message

This is the first study using RFPs to explore the underlying pathophysiology of NP in older patients. Compared to controls without NP, older patients with NP show an inverse circadian rhythm in diuresis rate, which can be explained by changes in circadian rhythms of creatinine clearance, free water clearance and sodium clearance. Further research has to describe the impact of ageing and comorbidities on NP and nocturnal LUTS.

Disclosures

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