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MOVING AT NIGHT, VOIDING AT NIGHT?

Hypothesis / aims of study

Nocturia is the major cause of sleep disturbance, leading to deficits in daily functioning and a higher risk of mortality for cardiovascular reasons. Nocturic patients void because they have urinary urgency, or out of convenience because they are awake. Also sleep disorders, such as obstructive sleep apnea or periodic limb movements during sleep (PLMS) have been described as causes of nocturnal polyuria (NP), enuresis and nocturia. Our hypothesis states that dopamine depletion and activation of the autonomic nervous system in patients with PLMS may reduce bladder capacity and increase urine production (1-3). The aim of this study was to explore the association between PLMS and nocturnal urine production.

Study design, materials and methods

This prospective study was conducted between May 2014 and November 2015. Polysomnographic studies of patients admitted to a multidisciplinary tertiary care referral centre for further clinical investigation of disabling, chronic fatigue were evaluated. Patients with a PLMS index >5 and an arousal index >30 were asked to participate before PLMS-treatment. Patients with major comorbidities or use of psychopharmaceutical drugs were excluded. Study protocol comprised a 24-72h frequency volume chart (FVC), a renal function profile (=24h urinalysis with collection of 1 urine sample every 3h to determine levels of osmolality, sodium and creatinine) and a sober blood sample. NP was defined as a nocturnal polyuria index (NPi) higher than 33%. Descriptive parameters are represented as median, minimum and maximum.

Results

Five women and 3 men, with a median age of 46 years (23-58) were included. Mean BMI was 25 (19-32) and mean NPi was 42% (13-57). Analysis of the FVCs showed a mean daytime frequency of 6 (4-10), a mean number of nocturia episodes of 0 (0-3), a mean functional bladder capacity of 260ml (68-351), a total 24h-diuresis of 1955ml (620-2540) and a 24h-fluid intake of 1647ml (907-2503). Figure 1 shows that 6 of the 8 patients have NP, which may be explained by abnormal circadian rhythms of free water and sodium clearance.

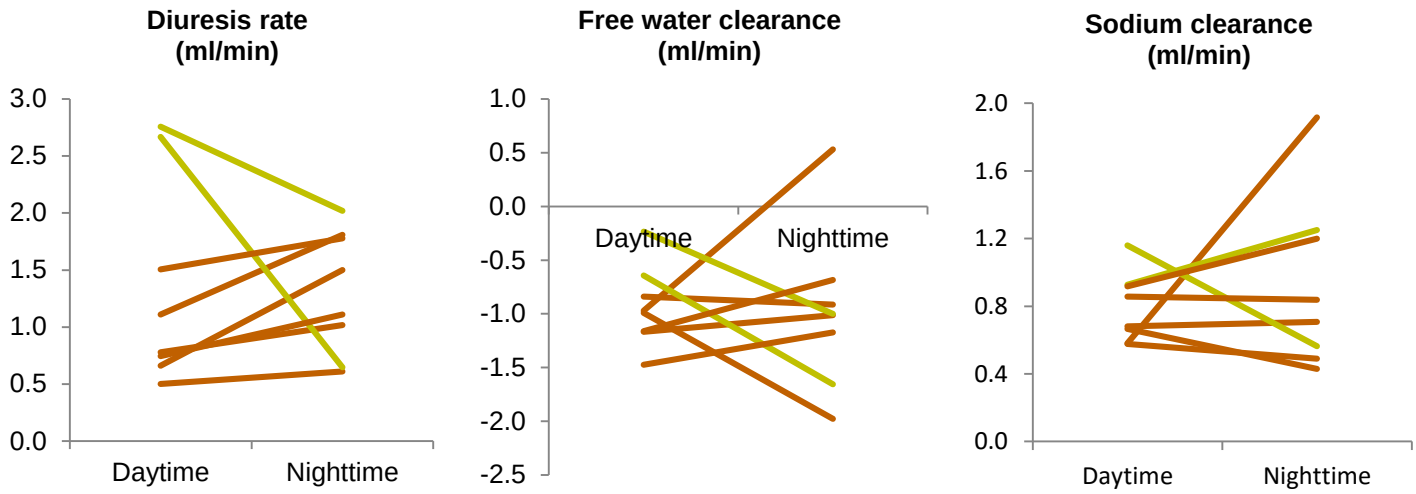
Interpretation of results

This prospective study used strict inclusion and exclusion criteria in order to include a relative healthy population without important comorbidities or medication use. A relatively young patients group was included and NP was found in 6 of the 8 included patients. This high prevalence of NP could be explained by the hypothesis that circadian rhythm are a crucial component in sleep physiology as well as in the regulation of many physiological parameters such as sodium and water handling. PLMS are caused by dopamine depletion and lead to dysregulation of cellular iron storage and inactivation of critical enzymes in dopaminergic neurons with consequent phenotypic effects on sleep. Moreover, the affected protein possibly interacts indirectly with the molecular mechanism in the central hypothalamic region. So, the observations of PLMS in nocturia might so far reflect a dopaminergic dysregulation with a possible central circadian defect (1-3). Of course, further research has to elucidate this hypothesis.

Concluding message

This is the first study evaluating the association between PLMS and nocturnal urine production, which may share a common pathophysiology with an important role for circadian disorders.
In patients with chronic fatigue and PLMS, we found that NP was present in 6 of the 8 participants, which could be explained by disorder in circadian rhythms of free water and sodium clearance.
Future research needs to be performed to evaluate the impact of sleep disorders on nocturnal urine production and nocturnal lower urinary tract symptoms.

Figure 1: Circadian rhythms in diuresis rate, free water clearance and sodium clearance in patients with NP (n=6) and without NP (n=2)



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Disclosures

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