

CIRCADIAN RHYTHMS OF RENAL FUNCTIONS IN AN ADULT NOCTURIC POPULATION

Hypothesis / aims of study

Adolescents and adults have a circadian rhythm with lower values for diuresis, glomerular filtration-rate, solute and sodium excretion associated with maximal concentrating capacity (>850mosmol/kg) overnight. Children with nocturnal enuresis or nocturia with nocturnal polyuria are characterised with low urinary osmolality related to low vasopressin levels overnight. A small subgroup of desmopressin resistant patients, however, have high osmotic excretion overnight and a deficient circadian glomerular and tubular function rhythm.

The aim of this study was to document the different circadian rhythms of renal functions in an adult population consulting for nocturia.

Study design, materials and methods

This prospective study was executed between October 2011 and March 2012; 26 patients with nocturia consulting a urologist in the University hospital of Ghent, were asked to collect 8 urine samples over 24 hours with a fixed interval of 3 hours between each sample; urinary volumes per interval were measured. Urine analysis of levels of sodium, creatinine and osmolality was performed. Creatinine and osmolality are used as parameters for the renal concentrating capacity. Diuresis-rate, solute excretion and sodium excretion were calculated.

Results

The mean age of this study population of nocturic patients is 56,58 (SD 14,67), with an age distribution from 21 to 77; sex ratio is 1/1.

Differences between daytime and nighttime values of the different variables are displayed in table 1.

Table 1: daytime and nighttime values for the outcome variables

Variable	Daytime	Nighttime	P-value
Diuresis (ml)	1460 (807)	716 (283)	0,000*
Osmolality (mosm/kg)	526 (162)	489 (144)	0,015*
Creatinine excretion (mg/dL)	13,33 (6,15)	12,92(4,82)	0,038*
Diuresis-rate (ml/min)	0,84 (0,44)	0,74 (0,37)	0,002*
Solute excretion (mosm/kg)/(mg/dL creatinine)	6,95 (1,66)	7,21 (2,63)	0,343
Sodium excretion (mmol/L)/(mg/dL creatinine)	1,31 (0,48)	1,54 (0,64)	0,256

Looking into the correlation between different variables, a strong positive correlation is found between solute and sodium excretion (R^2 78%). Osmolality and diuresis rate correlate negatively (R^2 41%). These results are shown in figure 1.

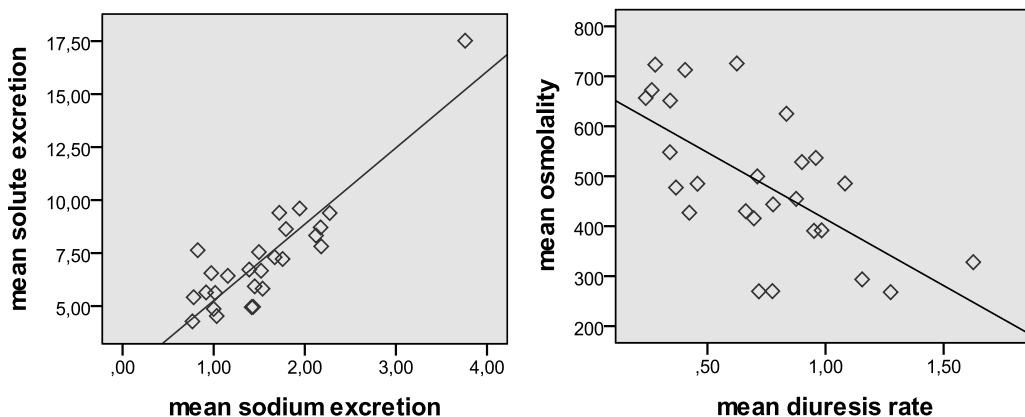


Figure 1: correlation between solute and sodium excretion, osmolality and diuresis rate

Interpretation of results

This study demonstrates a significant nocturnal polyuria among nocturic patients, with a night/day ratio of 110% (SD 78). This polyuria is accompanied not only by low urinary osmolality overnight, but even an almost absent circadian rhythm. Also an absent circadian rhythm is reported for creatinine excretion, diuresis-rate, solute excretion and sodium excretion, although the last two variables show no significant difference between daytime and nighttime. The strong correlation between urinary osmolality and diuresis-rate fits with polyuria related to deficient vasopressin levels overnight.

Concluding message

A significant percentage of patients with nocturia suffer from nocturnal polyuria with lower urinary osmolality, giving a rationale for a treatment with desmopressin. We have to admit that the large standard deviations certainly suggest heterogeneity of the population and that there might be a bias because of the tertiary centre population

Disclosures

Funding: unrestricted grant of Ferring **Clinical Trial:** Yes **Public Registry:** No **RCT:** No **Subjects:** HUMAN **Ethics Committee:** Ethics Committee of University Hospital Ghent **Helsinki:** Yes **Informed Consent:** Yes