

NOCTURNAL POLYURIA OR NOT? ROLE OF CIRCADIAN RHYTHM OF RENAL FUNCTIONS

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 overnight. In children with nocturnal polyuria often low urinary osmolality related to low vasopressin levels overnight can be found. A small subgroup of desmopressin resistant patients, however, have high osmotic excretion overnight and a deficient circadian glomerular function rhythm. The objective of this study was to document the different circadian rhythms of renal functions in an adult population with nocturnal polyuria compared to a control population.

Study design, materials and methods

Since October 2011, 119 volunteers were included, 80 nocturic patients and 39 controls. The study protocol comprised a general health questionnaire, a 72h frequency voiding chart and 24h urine collection in which 8 urine samples with an interval of 3 hours between each sample had to be collected. Urine analysis of levels of sodium, creatinine and osmolality was performed. Diuresis-rate, solute excretion and sodium excretion were calculated.

This study was approved by the ethics committee of the University Hospital of Ghent.

Results

With the criterion of a nocturnal volume >20-33% of the total 24h urine volume depending on age, we selected 15 participants in the control group without NP (38%) and 55 participants in the nocturia group with NP (69%). The results of the other participants are not discussed in this abstract.

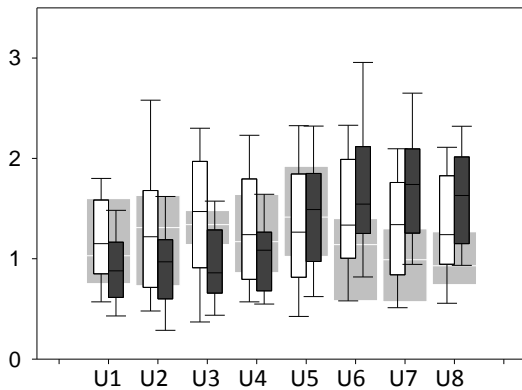
Mean age of the total group was 58±15, 34% is female, 66% male. A comparison between the nocturnal polyuria group and control group for volume, osmolality, solute and sodium excretion is represented in table 1.

Variable	Nocturnal polyuria group (N=55)			Control group (N=15)			P-value between groups	
	Day	Night	P-value within group	Day	Night	P-value within group	Day	night
Volume (ml)	266±13 2	270±12 3	0,426	275±11 8	207±76	0,033 *	0,768	0,035 *
Osmolality (mmol/l)	551±15 4	493±15 1	0,000 *	632±23 7	609±26 7	0,713	0,136	0,017 *
Solute excretion (mosm/kg)/(mg/dl creat)	6,5±1,3 7	6,9±1,5 1	0,023 *	6,8±1,3 4	5,6±1,3 5	0,014 *	0,450	0,003 *
Sodium excretion (mmol/l)/(mg/dl creat)	1,2±0,4 5	1,5±0,5 4	0,000 *	1,3±0,4 2	1,0±0,4 6	0,129	0,507	0,003 *

Comparing all variables within the nocturnal polyuria group according to age (younger than 65 years old versus 65 years or older), shows no significant differences for volume, osmolality and solute excretion – although there was a trend to significance for sample 7 for solute excretion (p<0,053). For sodium excretion, significant differences are found during daytime and nighttime between both age groups (fig. 1).

Sodium excretion (mmol/l)/(mg/dl creat)	Younger (N=29)	Older (N=26)	P-value
U1 (9-11 am)	1,2±0,49	0,9±0,41	0,015*
U2 (12-2 pm)	1,3±0,70	0,9±0,48	0,019*
U3 (3-5 pm)	1,4±0,71	1,0±0,47	0,007*
U4 (6-8 pm)	1,3±0,65	1,0±0,38	0,078
U5 (9-11 pm)	1,3±0,65	1,4±0,64	0,475
U6 (12-2 am)	1,4±0,65	1,7±0,70	0,144
U7 (3-5 am)	1,3±0,65	1,7±0,59	0,020*
U8 (6-8 am)	1,4±0,58	1,7±0,54	0,055

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Control group (N=15) Nocturia – NP <65 years old (N=29)
Nocturia – NP ≥ 65 years old (N=26)

No significant differences were found between the younger nocturnal polyuria group and the control group, for none of the variables. Whereas a significant difference was found in one or more nighttime samples of all variables between the older nocturnal polyuria group and the control group.

Interpretation of results

Comparing the mean values during daytime and nighttime within the nocturnal polyuria group and control group, shows no circadian rhythm for osmolality and sodium excretion within the latter group, whereas the nocturnal polyuria group has a significant decrease in osmolality, pleading for a vasopressin disturbance. However, also a clear increase in solute and more specifically sodium excretion are found, suggesting that a combination of different pathophysiologic mechanisms leads to nocturnal polyuria.

If we evaluate these differences according to age, we can conclude that a shift in sodium excretion from daytime to nighttime is seen in the older age group (65 years and older), whereas both the control group and younger have an absent circadian rhythm.

Both pathophysiologic mechanisms – vasopressin disturbance and increased nocturnal ANP secretion with consequent natriuresis – have been described, hence the suggestion to treat nocturnal polyuria with desmopressin or with furosemide, depending on the determinant factor [1,2]. However, if both mechanisms are as important in the older population, the shift in sodium excretion might be an explanation for the risk of hyponatremia in patients aged 65 years or older treated with desmopressin. A combination therapy of furosemide and desmopressin as suggested in desmopressin resistant children with nocturnal enuresis might be the solution.[3]

Concluding message

In a healthy adult population no distinct circadian rhythms are observed for osmolality and sodium excretion.

A vasopressin disturbance with a significant lower osmolality is a major contributing factor to the occurrence of nocturnal polyuria, however, in the population older than 65 years it is definitely not the only factor. A significant decrease in sodium excretion during daytime, which is compensated during nighttime is seen.

References

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3. Nevéus T, Johansson E, Hansson S. Diuretic treatment of nocturnal enuresis : preliminary results of an open pilot study. J Urol 2004; 171: 2584-2585

Disclosures

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