111

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CIRCADIAN RHYTHMS OF RENAL FUNCTIONS IN PATIENTS WITH PARAPLEGIA AND TETRAPLEGIA.

Hypothesis / aims of study

Although the problem of nocturnal polyuria has been recognized in para- and tetraplegics, the pathophysiological mechanisms remain unclear (1). First, it is considered that the circadian rhythmicity in the secretion of the anti-diuretic hormone, vasopressin, is inadequate or even absent, in the same way as in children with enuresis and aged persons with nocturnal polyuria. Second, it is known that these patients experience fluid retention in the lower extremities during daytime which leads to a higher nocturnal diuresis when changing to a recumbent position during the night (1,2).
The objective of this study was to document the different circadian rhythms of urine output, osmolality, solute, sodium and urea excretion in an adult para/tetraplegic population compared to a control population.

Study design, materials and methods

Since October 2011, 12 controls <65 years without nocturnal polyuria were included while 17 para/tetraplegic patients were included since June 2012. As part of the study protocol, all participants were requested to collect a urine sample every 3 hours during 24h to determine the urine volume and the levels of creatinin, urea, osmolality and sodium excretion. Subsequently, solute and sodium excretion was calculated. The last 3 urine samples (12-2am, 3-5am, 6-8am) were considered as nighttime samples in all subjects.

Results

The mean age in the 17 para/tetraplegics and 12 controls was respectively 44.06±14.1 and 45.3±13.6 years. Since the study is still ongoing, we currently report our preliminary findings, which will become more significant as the number of participants increase. A comparison between the para/tetraplegics (n=17) and control group (n=12) for the mean values of urine output and excretion of sodium, solute, osmolality and urea are represented in table 1.

Table 1: The 24h urinary osmolality profile in para/tetraplegics and controls

	Para/tetraplegic (n=17)			**Controls (n=12)**			**P-value**	
	Day (mean±SD)	Night (mean±SD)	P-value	Day (mean±SD)	Night (mean±SD)	P-value	Day	Night
Sodium excretion [(mmol/l)/(mg/dl creatinin)]	1,3±0,6	1,3±0,9	NS	1,3±0,5	1,0±0,5	NS	NS	NS
Solute excretion [(mosm/kg)/(mg/dl creatinin)]	6,8±2,5	6,5±3,0	NS	6,6±1,4	5,3±1,3	0,025*	NS	NS
Osmolality [mosm/kg]	475,1±186,5	435,8±187,8	NS	614,3±261,2	657,1±278,8	NS	NS	0,016
Urea excretion [(g/l)/(mg/dl creatinin)]	0,17±0,07	0,18±0,07	NS	0,17±0,03	0,16±0,03	NS	NS	NS
Urine output (ml)	1246,8±772,7	882,1±558,9	NS	1509,2±710,9	597,3±234,6	0,017*	NS	NS

* P-value<0,05

Differences in circadian rhythm of osmolality excretion between para/tetraplegics and controls are represented in figure 1. As the rate of osmolality excretion is a parameter for water diuresis, it is one of the contributing factors of urine output, as presented in figure 2.

Figure 3 shows differences in circadian rhythm of solute excretion between para/tetraplegics and the control group. A major contributing factor of solute diuresis is sodium excretion, which is represented in figure 4.

Figure 1: Osmolality excretion during day (A) and night (B)

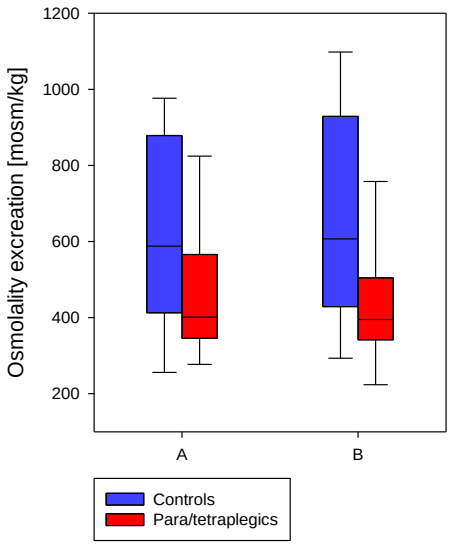


Figure 2: Urine output during day (A) and night (B)

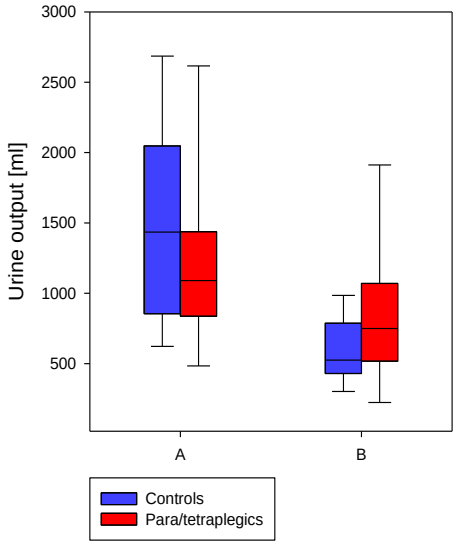


Figure 3: Solute excretion during day (A) and night (B)

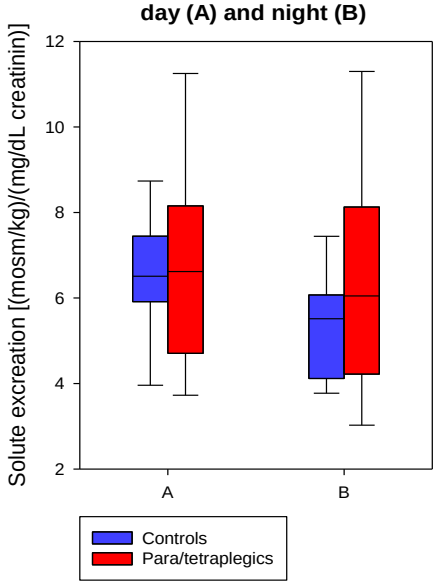
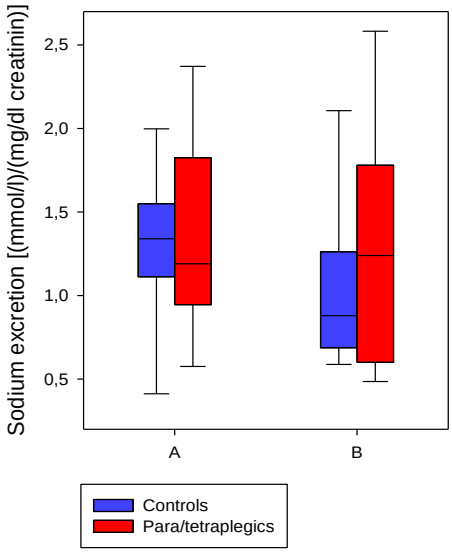


Figure 4: Sodium excretion during day (A) and night (B)



Interpretation of results

Both during day and night, para/tetraplegic patients had less concentrated urine compared to controls but this difference was only significant during the night (P=0,016), which was also reflected in the high nocturnal diuresis in para/tetraplegics. These results suggest that water diuresis due to an impaired nocturnal vasopressin secretion contributes to the high nocturnal urine volumes in para/tetraplegics (figure 1 and 2).

The para/tetraplegics had no circadian rhythm in solute and sodium excretion, while the control group showed a significant decrease in nocturnal solute excretion (P=0,025), which was reflected in the decreased nocturnal sodium excretion. These results suggest that also mechanisms involved in solute diuresis contribute to the development of nocturnal polyuria in para/tetraplegics (figure 3 and 4).

Concluding message

These results suggest that both increased water diuresis, due to an impaired circadian rhythm in vasopressin secretion and solute diuresis are contributing factors to the occurrence of nocturnal polyuria in para/tetraplegic patients.

References

1. Zahariou A, Karagiannis G, Papaioannou P, Stathi K, Michail X. The use of desmopressin in the management of nocturnal enuresis in patients with spinal cord injury. Eura Medicophys 2007 Sep;43(3):333-8.
2. Kilinc S, Akman MN, Levendoglu F, Ozker R. Diurnal variation of antidiuretic hormone and urinary output in spinal cord injury. Spinal Cord 1999 May;37(5):332-5.

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