



PATHOPHYSIOLOGY OF NOCTURNAL POLYURIA: CIRCADIAN RHYTHMS OF RENAL FUNCTIONS

Denys MA¹, Viaene A², Goessaert AS¹, Delanghe J³, Everaert K¹

¹Dept. of Urology, Ghent University Hospital, Ghent, Belgium

²Dept. of Physical Therapy and Motor Rehabilitation, Ghent University Hospital, Ghent, Belgium

³Dept. of Clinical chemistry, microbiology and immunology, Ghent University Hospital, Ghent, Belgium

ABSTRACT NO. SP139



BACKGROUND

Nocturnal polyuria (NP) is a highly prevalent condition, affecting up to 80% of nocturic patients. It can result in nocturia, which has an important impact on quality of life, morbidity and mortality. NP can also lead to overnight dilatation of the bladder in patients with a spinal cord injury (SCI) and neurogenic bladder, resulting in various complications.

OBJECTIVES

Evaluate circadian rhythms of renal functions in an adult population.

STUDY PROTOCOL

24h-urine collection

- 1 urine sample every 3h
- Determination of voided volumes, creatinine, sodium and osmolality
- Nighttime samples in the controls: last 3 samples (U6: 12-2am + U7: 3-5am + U8: 6-8am)
- Nighttime samples in the cases: last 4 samples (U5: 9-11pm + U6: 12-2am + U7: 3-5am + U8: 6-8am)
- NP: nocturnal urine production/24h urine production \geq 33%

1 blood sample

- During the 24h-urine collection
- Determination of creatinine, sodium and osmolality

RESULTS

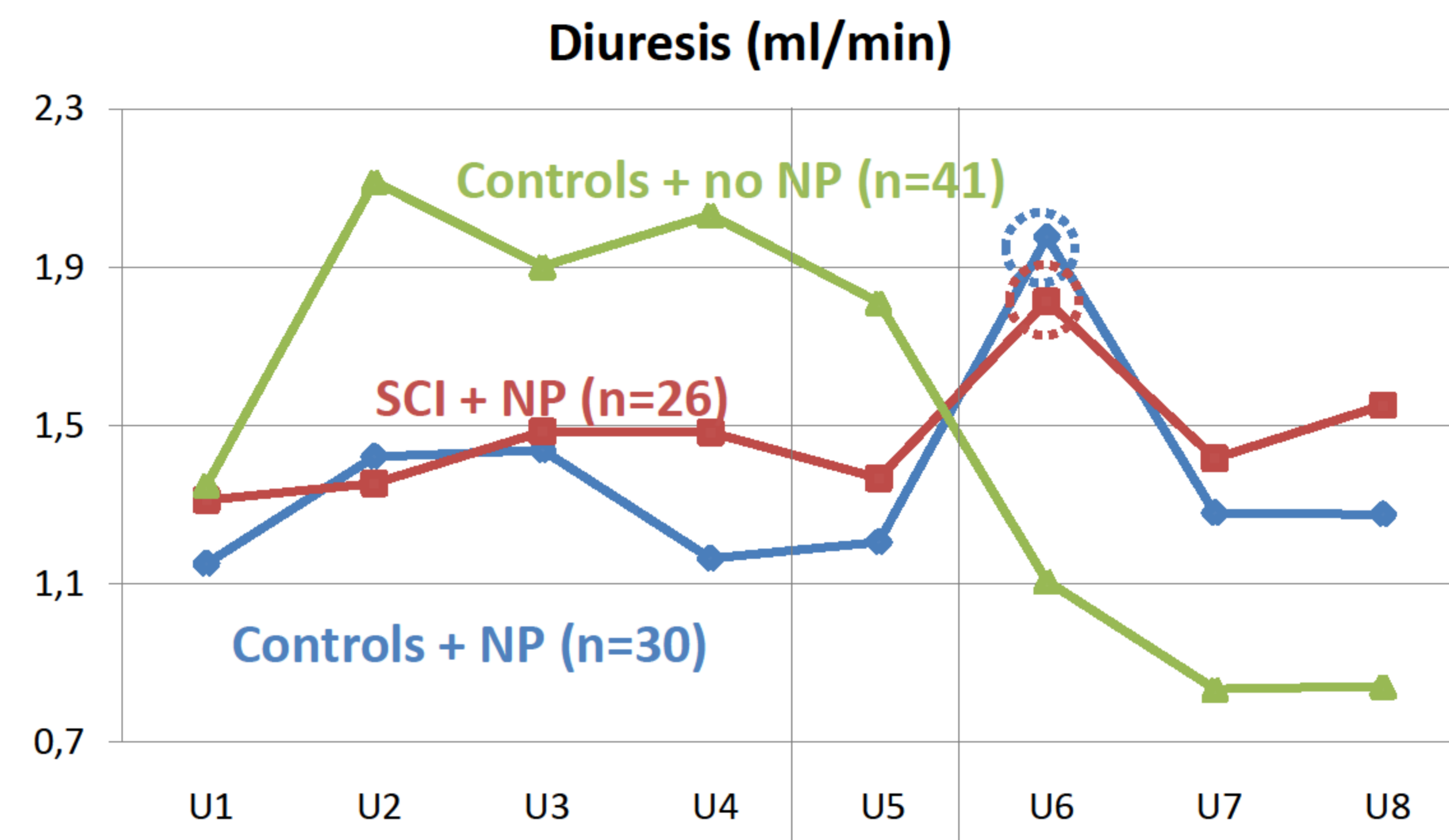
All included patients were <60 years.

	Cases: SCI + NP (n=26) Median [Min-Max]		Controls + NP (n=30) Median [Min-Max]		Controls + no NP (n=41) Median [Min-Max]		Cases vs. controls + NP (P-value)		Cases vs. controls + no NP (P-value)	
	☀	☾	☀	☾	☀	☾	☀	☾	☀	☾
Age (years)	46 [21-59]		51 [21-59]		42 [18-59]		NS		NS	
Gender (♂/♀)	16/10		17/13		10/31		NS		0,002	
Diuresis rate (ml/min)	1,3 [0,2-4,5]	1,4 [0,4-4,2]	1,2 [0,6-2,7]	1,3* [0,7-3,1]	1,8 [0,7-3,3]	0,8** [0,4-1,9]	NS	NS	NS	<0,001
Creatinine clearance (ml/min)	125 [32-276]	124 [56-398]	143 [51-216]*	130 [80-264]*	147 [70-275]*	118* [51-235]*	NS	NS	NS	NS
Free water clearance (ml/min)	-0,4 [-2,2-1,5]	-0,5 [-2,2-2,6]	-1,2 [-2,3-0,2]*	-0,7* [-2,4-1,2]*	-0,7 [-3,0-0,9]*	-0,8 [-2,6-0,1]*	0,002	NS	NS	0,016
Osmotic clearance (ml/min)	1,9 [0,3-3,4]	1,8 [0,5-3,7]	2,4 [1,3-4,0]*	2,1 [1,5-4,5]*	2,5 [1,2-4,4]*	1,7** [0,9-4,0]*	0,013	0,036	0,001	NS

Paired P-test between day and night: *p<0,05; **p<0,001. *1 missing value. NP = nocturnal polyuria; NS = not significant; SCI = spinal cord injury

RESULTS

Circadian rhythms of diuresis are can be explained by variations in glomerular filtration, water diuresis and osmotic diuresis:



Controls + NP

The peak in nocturnal diuresis can be explained by an increase in nocturnal free water clearance. This pleads for a disturbance in vasopressin secretion, which can be treated with desmopressin.

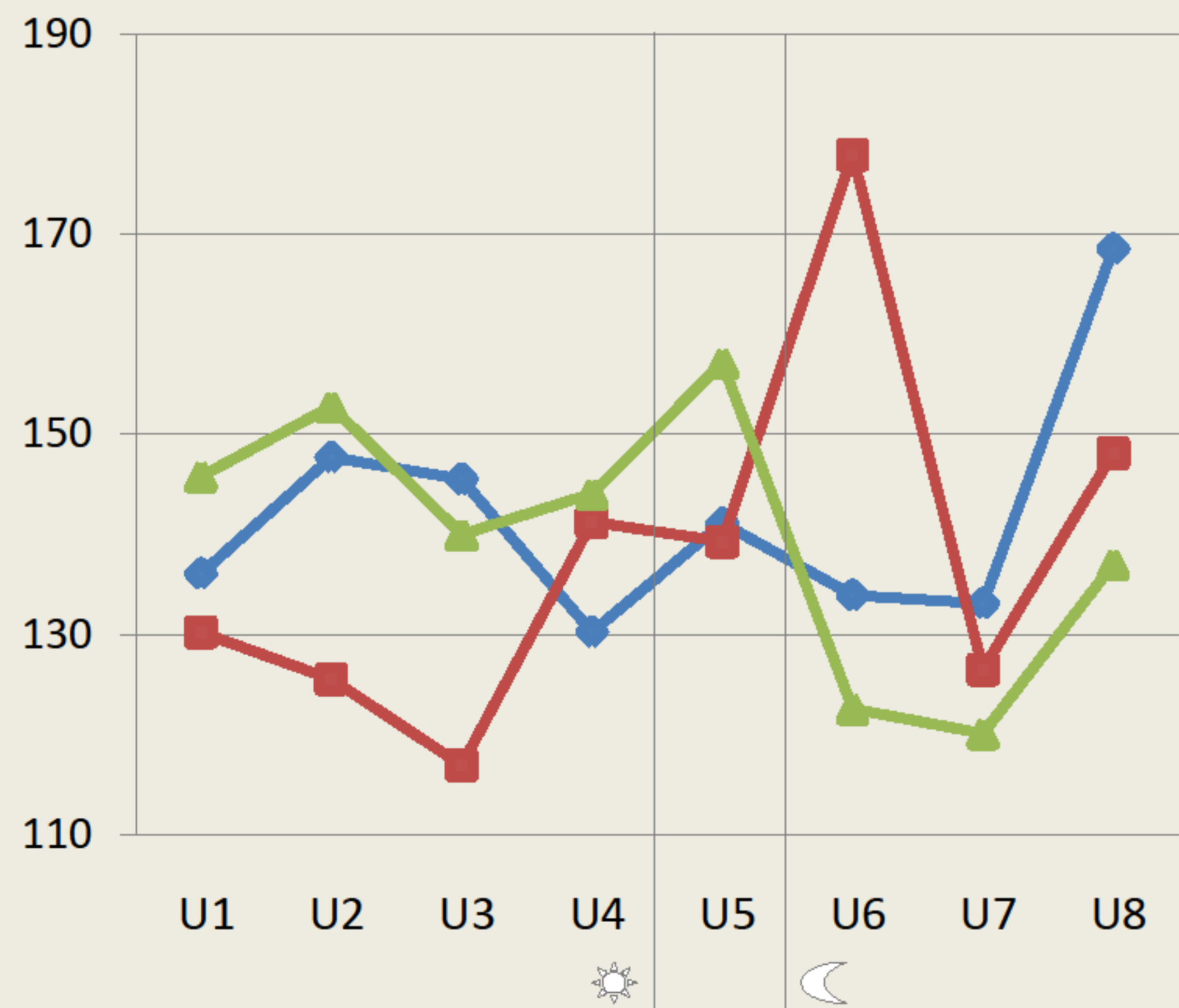
SCI + NP

The peak in nocturnal urine production can be explained by an absent circadian rhythm in both free water and osmotic clearance (e.g. sodium clearance). This suggests a role for desmopressin and diuretics in the treatment.

The peak in creatinine clearance in the beginning of the night can be the result of a glomerular hyperfiltration episode caused by the increased intravascular volume after lying down. This hypothesis can also explain the peak in nocturnal osmotic clearance, which can be caused by an increase in atrial natriuretic peptide and a decrease in aldosterone secretion.

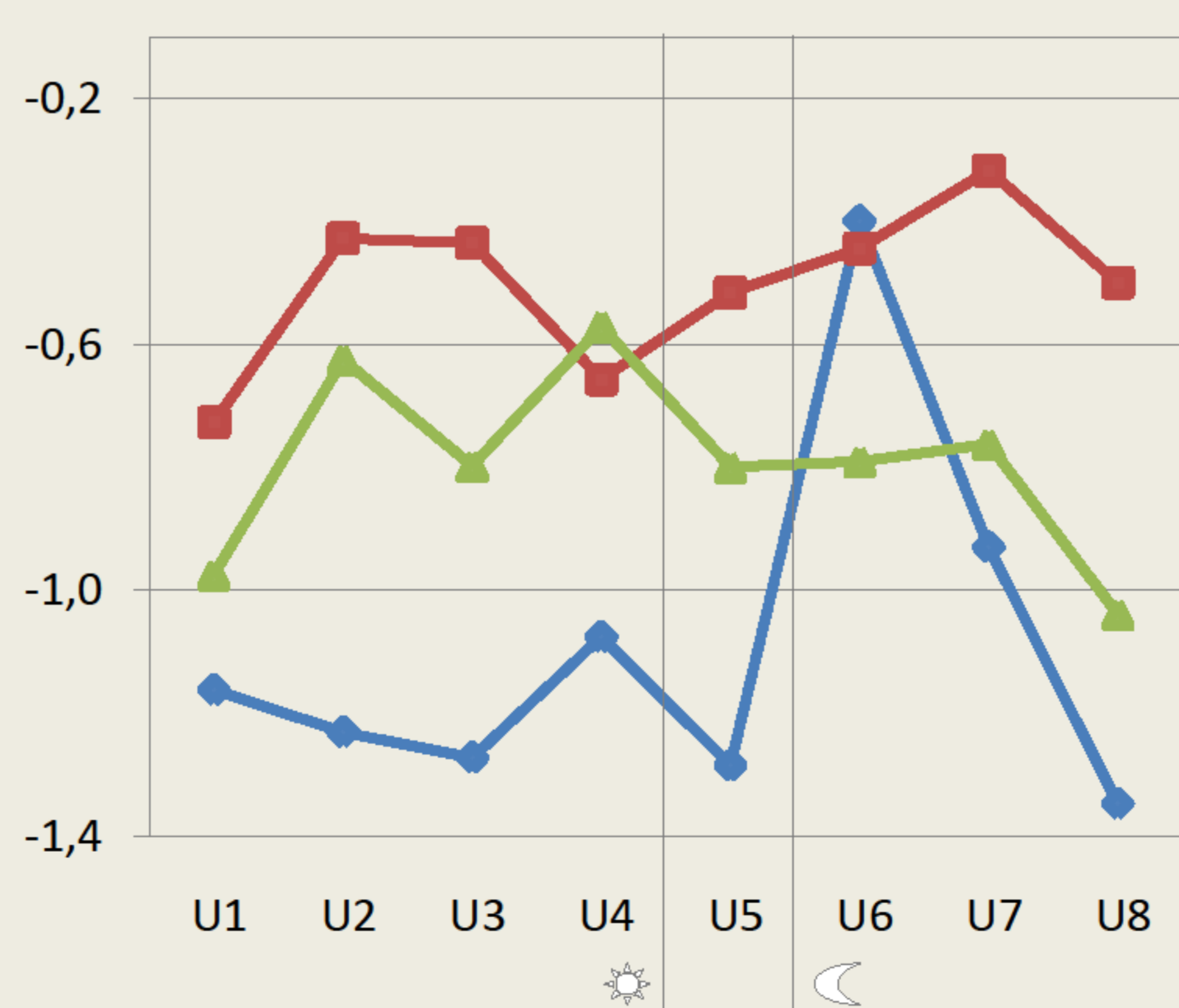
1. Glomerular filtration:

Creatinine clearance (ml/min)



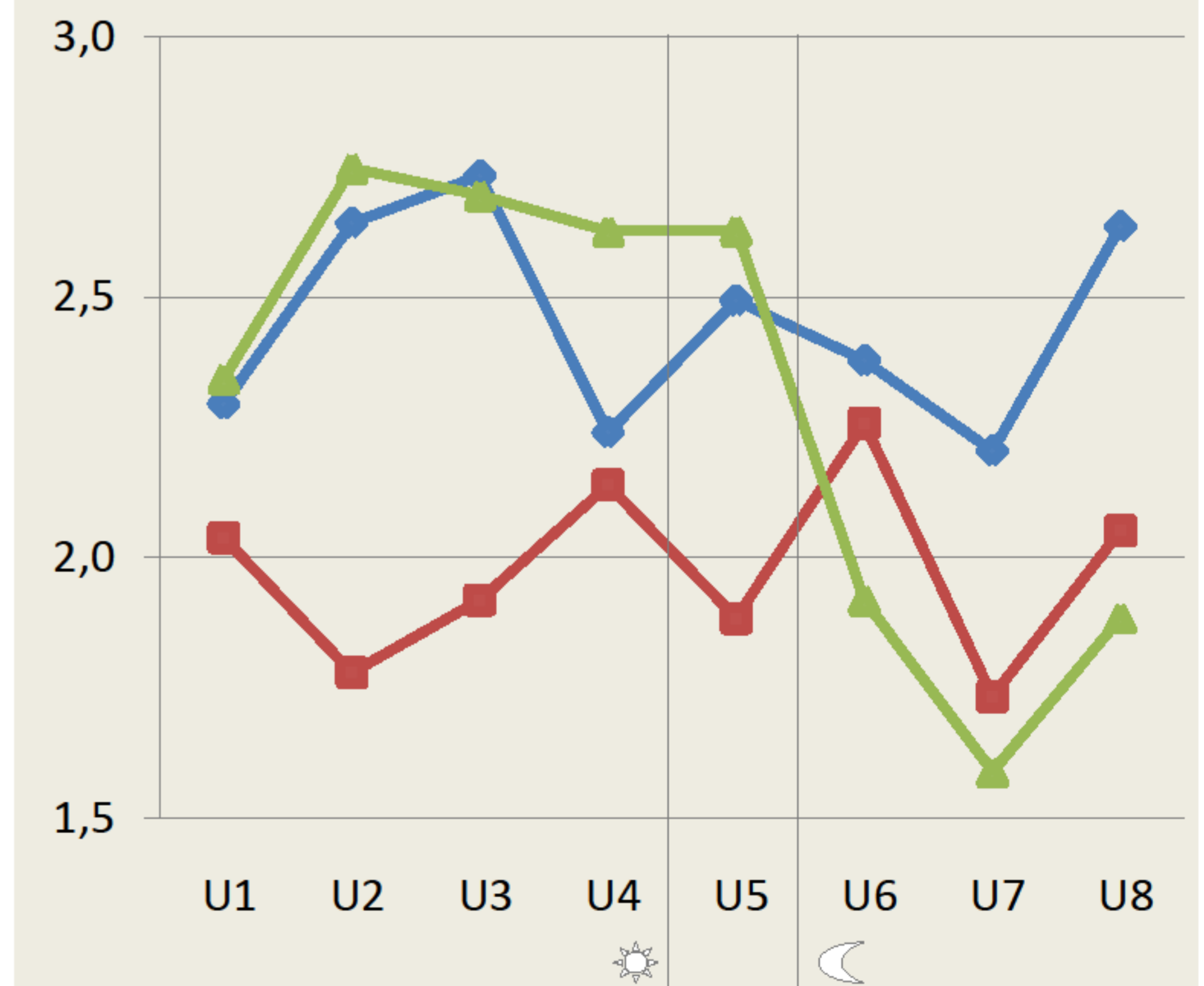
2. Water diuresis:

Free water clearance (ml/min)



3. Osmotic diuresis:

Osmotic clearance (ml/min)



CONCLUSION

Different pathophysiological mechanisms can contribute to the development of nocturnal polyuria: disturbances in water diuresis, osmotic diuresis and glomerular filtration. Consequently, treatment according to the underlying cause is required to avoid the symptoms and complications of nocturnal polyuria.

