



# Contributing factors for circadian rhythm variation of blood pressure in adult IgAN patients

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## Background

Blood pressure circadian rhythm variation occurs most frequently in patients with CKD, and also leads a subsequent deterioration of renal function as an independent risk factor. We aimed to determine the contributing factors for blood pressure rhythm variation in IgAN patients.

## Methods

341 adult IgAN patients, aged from 18 to 65 years, were recruited in this study. All patients were performed renal biopsy and ambulatory blood pressure monitoring. Patients were excluded if they were given antihypertensive therapy. 32 clinical parameters and 13 pathological data were analyzed. The pathological scores were evaluated by the IgAN Oxford criteria. Spearman correlation and logistic regression analysis were applied to determine the contributing factors of BP circadian rhythm variation.

## Results

### 1. Characteristics of circadian rhythm variation in IgAN patients

The incidence of non-dipper blood pressure was 73.0% (249/341) in IgAN patients, 72.1%(137/190) in the male, 74.2%(112/151) in the female, 73.8% patients (93/126) in hypertension and 72.6% (156/215) in normotension. The incidence of non-dipper in CKD 1-4 stage was 71.3%, 72.7%, 76.6% and 86.7% respectively.

### 2. Comparison of clinical parameter in the dipper and nondipper groups

	Total Patients (N=341)	Dippers (N=92)	Non-dippers (N=249)	P
BMI(kg/m <sup>2</sup> )	23.68±3.54	23.59±3.47	23.70±3.97	0.262
Smoker(n,%)	43(12.6)	11(11.9)	32(12.9)	0.825
24hSBP(mmHg)	123.18±12.69	121.94±12.84	120.97±15.28	0.586
24hDBP(mmHg)	74.81±10.76	74.96±10.71	74.62±10.87	0.797
CRP (mg/L)	1.71±0.53	1.64±0.51	1.77±0.47	0.351
CHOL(mmol/L)	5.62±2.39	5.33±1.73	5.50±2.43	0.553
TG(mmol/L)	1.65±0.68	1.61±0.42	1.70±0.64	0.578
HDL(mmol/L)	1.37±0.70	1.25±0.64	1.40±0.82	0.210
LDL(mmol/L)	2.99±1.79	2.82±1.70	3.21±1.93	0.087

(continued)

	Total Patients (N=341)	Dippers (N=92)	Non-dippers (N=249)	P
UA(μmol/L)	373.81±99.48	355.24±83.10	389.23±105.73	0.016
Cystatin C	1.25±0.69	1.16±0.55	1.28±0.75	0.187
eGFR(ml/min/1.73m <sup>2</sup> )	91.33±30.07	95.21±28.12	89.89±30.63	0.147
Urinary P/Cr(mg/mg)	2.37±1.06	2.04±0.82	2.60±1.28	0.000
24hUNa(mmol/L)	95.77±39.14	90.79±34.10	95.62±37.52	0.294
DU <sub>Na</sub> (mmol/L)	45.83±18.65	44.71±17.46	46.74±16.77	0.347
NU <sub>Na</sub> (mmol/L)	46.64±17.87	42.67±16.31	56.62±23.56	0.000
24hUCI(mmol/L)	73.19±31.15	70.51±28.35	74.22±30.60	0.179
DUCI(mmol/L)	39.04±19.87	38.63±16.37	39.42±19.41	0.347
NUCI(mmol/L)	39.38±20.14	36.14±14.76	43.45±21.67	0.034
urinaryNAG	26.88±18.83	29.01±21.53	24.53±15.92	0.174

### 3. Comparison of kidney tissue injury in the dipper and nondipper groups

	Dippers (N=92)	Non-dippers (N=249)	p 值
Mesangial hypercellularity	76(82.6)	211(84.7)	0.632
Endocapillary hypercellularity	30(32.6)	91(36.5)	0.500
segmental sclerosis	35(38.1)	114(45.8)	0.201
Glomerulosclerosis	32(34.4)	118(47.4)	0.037
Collapsed ischemic glomerulus	43(46.7)	200(80.3)	0.000
Tubular atrophy/interstitial fibrosis	45(48.9)	179(71.9)	0.000
Interstitial inflammation	42(45.7)	146(58.6)	0.032
Arcuate arteries Arteriosclerosis	34/82(41.5)	122/205(59.5)	0.006
Interlobular Arteriosclerosis	23(25.0)	116(46.6)	0.000
Arteriolar hyalinosis	30(32.6)	129(51.8)	0.002

### 4. Univariate analysis of risk factors for blood pressure circadian rhythm abnormality in the IgAN patients with hypertension

Parameter	β	S.E	Wals	Sig	OR	95%CI
Hyperuricemia	0.348	0.448	5.461	0.013	3.33	1.37-7.38
Cystatin C≥0.96mg/L	0.784	1.132	2.987	0.026	1.59	1.09-3.65
eGFR<60ml/min/1.73m <sup>2</sup>	0.647	1.247	2.324	0.030	1.38	0.98-3.49
NU <sub>Na</sub> >62.5mmol/L	0.438	1.179	3.502	0.021	2.70	1.34-4.76
Collapsed ischemic glomerulus	0.943	1.311	5.042	0.011	6.14	2.61-10.67
TIF≥25%	0.576	1.664	6.127	0.000	7.65	3.91-13.42
Arteriolar hyalinosis≥25%	0.365	0.081	3.018	0.028	2.38	1.06-4.59

### 5. Univariate analysis of risk factors for blood pressure circadian rhythm abnormality in the IgAN patients without hypertension

Parameter	β	S.E	Wals	Sig	OR	95%CI
Urinary P/C≥1.84mg/mg	0.584	0.947	2.987	0.026	2.61	1.54-6.00
NU <sub>Na</sub> >62.5mmol/L	0.475	1.134	3.425	0.021	2.70	1.26-4.74
Collapsed ischemic glomerulus	0.632	0.872	2.461	0.031	2.41	1.03-5.31
Tubular atrophy/interstitial fibrosis≥25%	0.541	0.695	5.419	0.000	3.65	1.91-8.27
Arteriosclerosis(Interlobular arteries)	0.497	1.047	4.388	0.017	2.76	1.05-5.68
C3 deposition>+ +	0.846	0.987	2.213	0.034	2.19	0.98-5.24

## Conclusion

Our data demonstrated that hyperuricemia, eGFR, urinary sodium, pathologic alteration including collapsed/ischemic glomerulus, interstitial inflammation, TIF, lesion of small arteries are associated with nondipper hypertension. Besides above factors, Proteinuria is an independent contributor for nondipper normotensive patients. The results imply that CKD is a pivotal cause of hypertension and circadian rhythm variation of BP.

