The Effects of Cardiac Autonomic Neuropathy in Early Non-diabetic Chronic Kidney Disease Patients

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Objectives:

Cardiac autonomic neuropathy (CAN) may be not uncommon early complication even in chronic kidney disease (CKD) 3,4 without diabetes mellitus. We explored the relationship of CAN in the view point of hydration status, vascular status, and renla function in non-diabetic early CKD patients.

Methods:

Thirty one CKD 3, 4 patients were enrolled. Hydration status (extracellular water [ECW]/total body water [TBW]) was determined by bioimpedance analysis. Brachial-ankle pulse wave velocity (baPWV) and neck ultrasonography for carotid plaque and intima-media thickness were conducted for checking up of vascular status. CAN was scored using Ewing's method and we also expressed the standard deviation of normal-to-normal interval (SDNN), low frequency/high frequency ratio (LF/HF ratio). Serial serum creatinine change over at least 12 months was used for assessment of renal function and expressed as reciprocal creatinine slope.

Results:

Table 1 Comparison between deteriorated group and preserved group of kidney function (Mean 1/creatinine slope: -0.002045)

	Deteriorated group(N=16)	Preserved group(N=15)	p-value
Age	58.0(47.5~65.5)	53.0(43.5~60.8)	0.2859
Male/Female	11/5	9/6	0.89
SBP	126.0(120.0~134.0)	120.0(107.8~137.0)	0.4428
DBP	78.5(74.0~88.5)	82.0(75.3~93.0)	0.5532
HR	73.8(72.5~76.5)	73.5(69.3~78.9)	1.0000
WHR	0.87(0.85~0.90)	0.86(0.80~0.89)	0.2410
ECW/TBW	0.384(0.380~0.393)	0.382(0.380~0.387)	0.3131
IMT	0.55(0.50~0.66)	0.56(0.47~0.71)	0.7220
Carotid plaque(Yes/No)	6/10	6/9	0.8211
PWV	1667.3(1444.3~1831.0)	1552.0(1306.0~1742.8)	0.3633
LF/HF ratio	1.31(0.82~1.75)	1.62(1.04~4.88)	0.1436
SDNN	**20.94(14.99~27.69)**	**35.52(26.35~43.14)**	**0.0064**
CAN score	1.5(0.75~2.25)	1.0(0.50~1.50)	0.1875
Hb	12.3(11.3~13.3)	12.6(11.8~12.7)	0.6211
TC	152.0(131.0~170.5)	160.0(146.8~188.8)	0.3230
LDL-C	92.0(72.5~123.0)	84.0(76.0~118.3)	0.8125
HDL-C	51.5(38.5~55.5)	50.0(38.8~57.8)	0.7820
TG	140.0(115.5~155.5)	136.0(88.8~183.3)	0.4287
Albumin	4.25(3.85~4.50)	4.40(4.13~4.65)	0.4287
Uric acid	7.75(7.25~8.20)	8.90(6.90~9.58)	0.0892
Proteinuria, %	**15/16(93.8)**	**7/15(46.7)**	**0.0128**
Proteinuria, dipstick +	**2.0(1.0~2.5)**	**0(0~1.0)**	**0.0011**

Table 2 Logistic regression analysis according to renal function status

	Coefficient	Std Error	p-value
Proteinuria	1.52933	0.61541	0.0130
SDNN	-0.0786	0.44584	0.0779

Table 3 Correlation among SDNN, ECW/TBW, mean PWV) and kidney function (1/creatinine slope)

	1/creatinine slope	SDNN	ECW/TBW	Mean PWV
1/creatinine slope		**r=0.598 p=0.0004**	r=-0.330 p=0.0698	r=-0.329 p=0.0711
SDNN	**r=0.598 p=0.0004**		**r=-0.488 p=0.0054**	r=-0.318 p=0.0811
ECW/TBW	r=-0.330 p=0.0698	**r=-0.488 p=0.0054**		**r=0.401 p=0.0254**
Mean PWV	r=-0.329 p=0.0711	r=-0.318 p=0.0811	**r=0.401 p=0.0254**	

1. Of the 31 patients, nine (9/31, 29%) have suffered with CAN.
2. SDNN was correlated with 1/creatinine slope (r= 0.598, P = 0.0004), ECW/TBW (r=-0.488, P =0.0054).
3. ECW/TBW was correlated with mean PWV (p= 0.401, P= 0.0254).
4. Mean 1/creatinine slope was -0.002045 and used for marker of the deterioration of renal function over one year. Deteriorated group (N=16) had a lower SDNN [20.94 (14.99~27.69), vs. 35.52 (26.35~43.14)] and more patients had a proteinuria (93.8% vs. 46.7).
5. After logistic regression analysis according to renal function status, proteinuria had a good relationship with the decline of renal function and SDNN as marker of CAN only had marginal relationship

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Conclusion:

We found that 29% of early CKD patients had CAN and there were interrelationships among renal function, CAN, hydration status, and arteriosclerosis.

Abbreviations:
SDNN- standard deviation of the normal-to-normal interval
LF/HF ratio- low frequency/high frequency ratio
PWV-pulse wave velocity
CAN-cardiac autonomic neuropathy

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