Plasma N-Terminal pro B-Type Natriuretic Peptide Predicts Renal Function Decline in Patients with High Cardiovascular Risks

NEPHROLOGY
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Background:

N-terminal pro-B-type natriuretic peptide (NT-proBNP) is a marker of ventricular stretch and is an established marker for prediction of cardiovascular (CV) events. We designed the study to determine associations of plasma NT-proBNP level and glomerular filtration rate (GFR) decline in patients with high CV risk.

Methods:

This was a cohort study with 1-year follow up in patients with high CV risk. Plasma NT-proBNP was measured at baseline. Estimated GFR was estimated using the CKD-EPI equation and rapid decline in GFR was defined with decrease GFR ≥ 25% mL/min/1.73 m2 per year.

Results:

Among 356 patients with mean aged 72.6±13.0 years were included, 103 patients (28.9%) had ischemic heart disease and 132 patients (37.1%) had GFR <60 mL/min/1.73m2. At baseline, median NT-proBNP level was 1954 (IQR 558 to 5402.5) pg/L.

Table 1. Baseline patient characteristics

Group	GFR ≥ 90 ml/min/1.73 m² (Stage I)	GFR 60-89 ml/min/1.73 m² (Stage II)	GFR 30-59 ml/min/1.73 m² (Stage III)	GFR ‹ 30 ml/min/1.73 m² (Stage IV)	All patients	p-value
n	**73**	**151**	**107**	**25**	**356**	
Mean age, years (range)	61.42 ± 15.17	74.86 ± 10.36	76.36 ± 10.06	74.84 ± 14.73	72.55 ± 13.01	<0.001*
Male	37 (50.7%)	83 (55%)	49 (45.8%)	10 (40%)	179 (50.3%)	0.355
Underlying disease, n (%)						
Diabetic mellitus	20 (27.4%)	49 (32.5%)	47 (43.9%)	10 (40%)	126 (35.4%)	0.100
Hypertension	51 (69.9%)	119 (78.8%)	92 (86%)	24 (96%)	286 (80.3%)	0.010
Prior stroke	9 (12.3%)	16 (10.6%)	9 (8.4%)	4 (16%)	38 (10.7%)	0.676
Ischemic heart disease	13 (17.8%)	46 (30.5%)	34 (31.8%)	10 (40%)	103 (28.9%)	0.091
Current drug use, n (%)						
Diuretics	18 (24.7%)	58 (38.4%)	49 (45.8%)	12 (48%)	137 (38.5%)	0.026
ACEI/ARBs	22 (30.1%)	53 (35.1%)	31 (29%)	4 (16%)	110 (30.9%)	0.256
Calcium channel blockers	22 (30.1%)	51 (33.8%)	41 (38.3%)	12 (48%)	126 (35.4%)	0.363
B-blockers	27 (37%)	69 (45.7%)	54 (50.5%)	12 (48%)	162 (45.5%)	0.353
Systolic blood pressure, mmHg	126.79 ± 17.9	130.2 ± 16.49	131.98 ± 16.56	132.4 ± 23.28	130.2 ± 17.38	0.233
Diastolic blood pressure, mmHg	74.14 ± 11.52	71.47 ± 10.36	69.15 ± 9.89	70.4 ± 16.45	71.24 ± 11.09	0.030
Serum creatinine, mg/dl	0.65 ± 0.16	0.9 ± 0.18	1.32 ± 0.24	2.24 ± 0.43	1.07 ± 0.46	<0.001*
Serum calcium, mg/dl	9.04 ± 0.56	9.05 ± 0.51	9.15 ± 0.59	9.08 ± 0.57	9.08 ± 0.55	0.466
Serum phosphate, mg/dl	3.26 ± 0.76	3.25 ± 0.64	3.38 ± 0.71	3.32 ± 0.87	3.3 ± 0.7	0.582
Serum albumin, g/dl	3.71 ± 0.69	3.72 ± 0.59	3.7 ± 0.54	3.6 ± 0.48	3.71 ± 0.59	0.804
Hemoglobin, g/dl	12.12 ± 2.13	11.87 ± 1.59	11.38 ± 1.555363	11.06 ± 1.38	11.72 ± 1.72	0.004
Median serum NT-proBNP, pg/ml (IQR)	946 (310, 2400)	2020 (608, 4904)	2550 (940, 7560)	4618 (3068, 12135)	1954 (558, 5402.5)	<0.001*
Mean LVEF, %	59.28 ± 13.77	52.75 ± 18.64	55.97 ± 16.98	57.25 ± 18.8	55.31 ± 17.33	0.241

There was significant difference of NT-proBNP level in each stage of CKD (P<0.001). Subjects with an NT-proBNP above the median had a greater percentage of GFR decline per year than others with an NT-proBNP levels below the median (34.2±16.8% vs. 14.8±12.6%, P<0.001)

Table 2. Factors predict rapid GFR decline

	Univariate		Multivariate	
Variables	**Crude OR (95%CI.)**	**p-value**	**Adjusted OR (95%CI)**	**p-value**
Age	1.01 (0.99, 1.03)	0.228		
Male	0.75 (0.49, 1.13)	0.17		
DM	1.94 (1.25, 3.02)	0.003		
HT	1.88 (1.08, 3.26)	0.025		
Stroke	0.69 (0.34, 1.38)	0.29		
IHD	1.1 (0.69, 1.74)	0.688		
Diuretic	2.83 (1.82, 4.41)	<0.001*	1.82 (1.03,	0.04*
ACEI/ARB	1.34 (0.86, 2.11)	0.2		
Calcium channel blocker	1.07 (0.69, 1.66)	0.76		
B-Blocker	1.52 (1, 2.32)	0.05		
Systolic blood pressure	1 (0.99, 1.02)	0.505		
Diastolic blood pressure	0.99 (0.97, 1.01)	0.32		
Albuminuria	2.88 (2, 4.13)	<0.001*	3.47 (2.16,	<0.001*
Calcium (mg/dl)	0.85 (0.57, 1.27)	0.439		
Phosphate (mg/dl)	1.07 (0.78, 1.46)	0.678		
Albumin (g/dl)	0.64 (0.44, 0.92)	0.016*	1.27 (0.78,	0.339
Hb (g/dl)	0.78 (0.68, 0.89)	<0.001*	0.81 (0.68,	0.016*
Serum albumin, g/dl	3.71 ± 0.69	3.72 ± 0.59	3.7 ± 0.54	3.6 ± 0.48
Hemoglobin, g/dl	12.12 ± 2.13	11.87 ± 1.59	11.38 ±	11.06 ± 1.38
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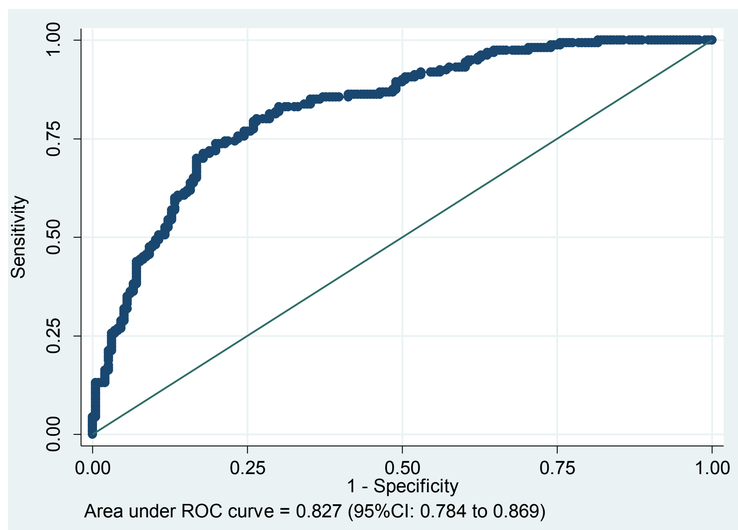

Plasma NT-proBNP › median value (1954 pg/mL) predicted renal outcome with ROC = 0.827; 95% CI 0.874-0.869.

Multivariable analysis showed that NT-proBNP levels >1954 pg/ml and albuminuria were associated with 12.77-fold (95% CI, 6.92-23.58; P<0.001) and 3.47-fold (95% CI, 2.16-5.57; P<0.001) increased risk of rapid GFR decline >25% per year, respectively.

Figure 1. Graph ROC curves showing Area under the Curve (AUC) of plasma NT-proBNP › median (1954 pg/mL) to predict rapid GFR decline

Conclusion:

In high risk of CVS patients, high plasma NT-proBNP levels predicted accelerated renal progression, suggesting that ventricular dysfunction might have a synergistic association of adverse renal outcomes.