Association between E/e´ ratio and Volume Overload in Patients with Predialysis Chronic Kidney Disease

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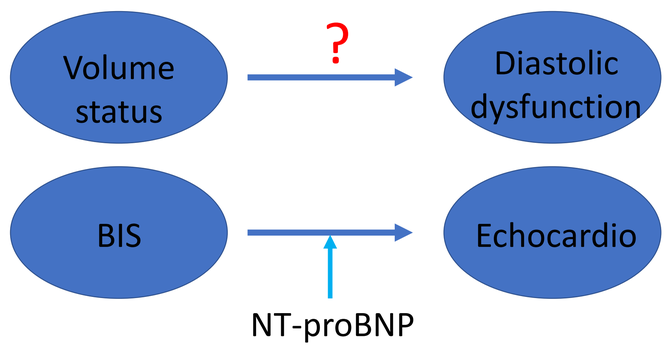
Introduction :

- Chronic kidney disease (CKD) : increases cardiovascular (CV) risk
- modifiable variables : blood pressure, diabetes, anemia, and volume status
- accurate assessment of volume status appears to be crucial.
- Diastolic dysfunction : frequently found in patients with CKD.

Objectives : role of NT-proBNP and bioimpedance spectroscopy (BIS) in early detection of diastolic dysfunction prior to echocardiographic assessment in patients with CKD



Materials and Methods

- BIS, echocardiography, and NT-proBNP were simultaneously performed prior to dialysis (stage 5 CKD, not yet dialysis, N=84)
- Bioimpedance spectroscopy (BIS) : BCM™
- Exclusion : acute kidney injury, malignancy, infection, liver cirrhosis, mitral regurgitation, atrial fibrillation, valvular heart disease, or abnormal LV segmental wall motion

Statistical analysis

- IBM SPSS version 23.0 (IBM Corporation, Armonk, NY, USA)
- Pearson's correlation analysis
- ANOVA
- multiple linear regression analysis
- receiver operating characteristic (ROC) curve
- Statistical significance was defined as $P < 0.05$

Results

Table 1. Baseline characteristics of the patients

variables		distribution
Age, years		60.32±10.34
Gender (%)	Men	46 (54.76%)
	Women	38 (45.24%)
Diabetes (%)	Yes	50 (59.52%)
	No	34 (40.48%)
BP medication (%)	Yes	78 (92.86%)
	No	6 (7.14%)
Diuretics (%)	Yes	58 (69.05%)
	No	26 (30.95%)
BPsys (mmHg)		143.24±18.72
BPdia (mmHg)		78.50±11.68
eGFR (ml/min per 1.73 m²)		6.29±2.28

Table 3. Univariate analysis of serum laboratory tests, blood pressure, and BIS parameters in association with E/e´

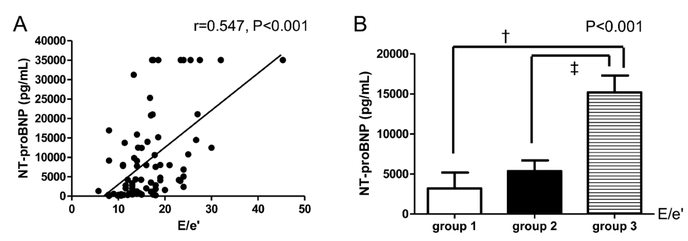
Variables	E/e´ ratio	
	Corr. coefficient	P-value
BPsys, mmHg	0.280	0.011
BPdia, mmHG	0.097	0.386
NT-proBNP, pg/mL	0.547	<.001
eGFR, mL/min/1.73 m²	-0.132	0.232
Total Protein, g/dL	-0.117	0.287
Albumin, g/dL	-0.259	0.018
Uric acid, mg/dL	0.242	0.032
LDH, U/L	0.276	0.015
OH, liter	0.405	<.001
OH/ECW	0.435	<.001
TBW, liter	0.083	0.455
ECW, liter	0.266	0.014
ICW, liter	-0.153	0.165
ECW/TBW	0.482	<.0001

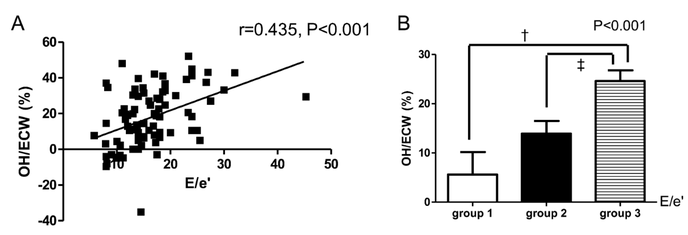
Table 2. Comparison of blood pressure, serum chemistry, NT-proBNP, BIS parameters, and echocardiographic study parameters according to E/e´

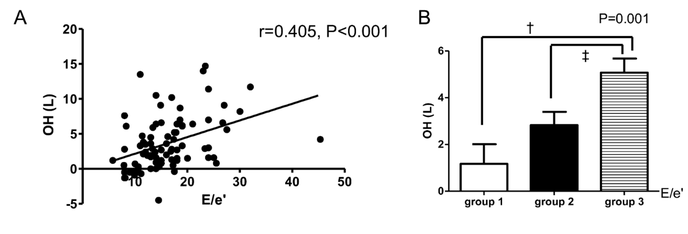
Variables	E/e´ ratio			P-value
	Group 1 (≤10)	Group 2 (10–15)	Group 3 (>15)	
Age, year	56.1±10.2	61.2±9.4	60.9±11.2	0.310
LA dimension, cm	4.54±0.38	4.75±0.25	4.92±0.45†	0.006
LAVI, ml/m²	29.2±5.94	35.41±7.77	45.71±12.56†‡	<.001
LVEDD, cm	5.17±0.57	5.32±0.54	5.62±0.53†	0.015
LVEDV, ml	129.3±32.5	140.4±24.00	156.0±34.95†	0.016
LVMI, g/m²	97.42±22.82	120.4±23.22	138.3±38.88†	<.001
Fractional shortening, %	34.83±5.18	36.18±4.54	34.16±5.33	0.234
LVEF, %	63.25±6.76	65.35±5.49	62.00±7.44	0.105
BPsys, mmHg	143.67±23.05	136.39±17.21	149.22±16.83‡	0.015
BPdia, mmHG	79.50±14.29	77.55±11.75	79.03±10.98	0.829
NT-proBNP, pg/mL	2690.3±5408.4	4781.8±6523.8	14649.6±13020.9†‡	<.001
eGFR, mL/min/1.73 m²	6.22±2.30	6.65±2.41	6.04±2.19	0.517
Total Protein, g/dL	6.24±0.65	6.24±0.86	5.97±0.72	0.296
Albumin, g/dL	3.78±0.50	3.52±0.67	3.24±0.51†	0.010
Uric acid, mg/dL	7.36±2.56	8.07±2.12	8.72±2.69	0.228
OH, liter	1.17±2.92	2.84±3.42	5.13±3.78†‡	0.001
OH/ECW, %	5.61±15.75	14.01±15.38	24.75±13.79†‡	<.001
ECW/TBW	0.50±0.05	0.479±0.05	0.514±0.05†‡	<.001
ECW, liter	15.86±3.19	17.02±4.31	19.05±4.96	0.051
ICW, liter	19.19±4.21	17.90±3.64	17.07±4.04	0.249
TBW, liter	35.04±6.65	34.93±7.21	36.11±8.36	0.789

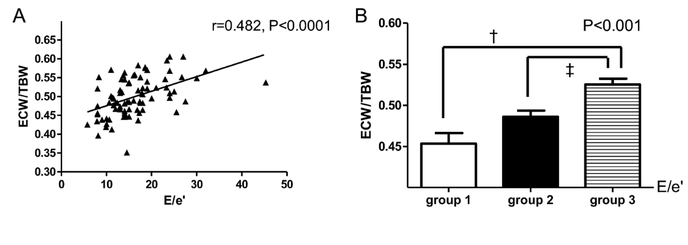
Table 4. Multiple linear regression analysis of variables influencing E/e´ ratio

	Unstandardized Coefficients		Standardized Coefficients	P-value
	B	Standard Error	Beta	
BPsys, mmHg	0.061	0.028	0.204	0.029
NT-proBNP, pg/mL	0.000	0.000	0.292	0.006
Albumin, g/dL	-0.174	1.026	-0.018	0.866
Uric acid, mg/dL	0.342	0.218	0.146	0.122
LDH, U/L	0.004	0.005	0.074	0.434
OH/ECW	-0.039	0.076	-0.110	0.609
ECW/TBW	49.610	22.118	0.454	0.028









Discussion :

- In multiple linear regression analysis, BPsys, NT-proBNP, and ECW/TBW showed significant p-value.
- ROC curve : predicting E/e' ratio greater than 15.

  NT-proBNP : AUC 0.73 ± 0.05 ($P < 0.001$), cut-off value 2,797 pg/mL (sensitivity 82.05%, specificity 63.04%)

  ECW/TBW : AUC 0.77 ± 0.05 ($P < 0.001$), cut-off value 0.486 (sensitivity 82.05%, specificity 66.96%)

  OH/ECW : AUC 0.73 ± 0.05 ($P < 0.001$), cut-off value 17.28% (sensitivity 71.79%, specificity 68.09%)

  OH : AUC 0.73 ± 0.05 ($P < 0.001$), cut-off value 2.45 liter (sensitivity 74.36%, specificity 63.83%)

Conclusion : In addition to decrease in GFR, nephrologists should be aware of cardiac function evaluation and preservation, and BIS may act as a bridge between cardiologists and nephrologists in achieving cardiorenal protection

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