Clinical Significance of the Interval Change of Plasma Neutrophil Gelatinase-Associated Lipocalin in Acute Kidney Injury and Acute Kidney Injury Superimposed on Chronic Kidney Disease

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Early detection of acute kidney injury (AKI) is crucial for patients with chronic kidney disease (CKD) because the staging of AKI is associated with in-hospital mortality and CKD is a risk factor for the development of AKI.¹ The definition of AKI is primarily based on serum creatinine (sCr) as a surrogate marker for glomerular filtration rate (GFR). However, sCr level may not reflect an acute decline of GFR, and it may be affected by several factors including age, sex, muscle mass, and chronic illness.² The present study investigated the clinical significance of plasma neutrophil gelatinase-associated lipocalin (pNGAL) as a biomarker in the diagnosis of AKI and AKI superimposed on CKD. This retrospective observational study included 343 patients with AKI. The patients were classified into two groups; AKI (n=90) and AKI superimposed on CKD (n=253). AKI and CKD were defined by the 2012 Kidney Disease: Improving

Global Outcomes Clinical Practice Guideline. The cut-off value of pNGAL was 200 ng/mL. The levels of sCr and pNGAL obtained at baseline and at 48 hr after the onset of AKI were analyzed. The interval change of sCr, estimated GFR (eGFR) and pNGAL during the first 48 hr (a value at baseline-a value at 48 hr) was described as Δ sCr, Δ eGFR and Δ pNGAL, respectively. In the present study, the level of pNGAL was inversely correlated with eGFR calculated by the CKD-EPI equation ($r = -0.376$, $p < 0.001$), and positively correlated with sCr ($r = 0.421$, $p < 0.001$). The levels of sCr at baseline and at 48 hr were higher, and those of eGFR were lower in the AKI superimposed on CKD group than the AKI group. In addition, pNGAL levels at baseline and at 48 hr were higher in the AKI superimposed on CKD group as compared with the AKI group. However, the value of the Δ pNGAL was higher in the AKI group as compared

TABLE 1. Clinical characteristics of the enrolled patients

	AKI (n=90)	AKI on CKD (n=253)	p-value
Age (years)	57±17	61±16	0.028
Male sex, n (%)	59 (65.6)	161 (63.6)	0.744
Diabetes, n (%)	25 (36.2)	86 (52.8)	0.002
sCr at baseline (mg/dL)	3.3±2.9	6.0±3.4	<0.001
sCr at 48 hr (mg/dL)	2.2±1.8	4.8±2.8	<0.001
Δ sCr (mg/dL)	1.0±2.4	1.1±2.0	0.738
eGFR at baseline (mL/min/1.73 m ²)	49.5±74.4	12.8±11.4	<0.001
eGFR at 48 hr (mL/min/1.73 m ²)	61.9±60.3	17.1±13.6	<0.001
Δ eGFR (mL/min/1.73 m ²)	-12.4±54.2	-4.1±7.9	0.153
pNGAL at baseline (ng/mL)	556.9±449.9	873.8±386.1	<0.001
pNGAL at 48 hr (ng/mL)	394.7±373.0	780.8±361.7	<0.001
Δ pNGAL (ng/mL)	159.5±261.5	10.1±229.7	0.001

Values are expressed as mean±standard deviation of the mean. AKI: acute kidney injury, CKD: chronic kidney disease, sCr: serum creatinine, eGFR: estimated glomerular filtration rate, pNGAL: plasma neutrophil gelatinase-associated lipocalin. The interval change of sCr, eGFR and pNGAL during the first 48 hr (a value at baseline-a value at 48 hr) was described as Δ sCr, Δ eGFR and Δ pNGAL, respectively.

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Article History:

Received December 31, 2018

Revised January 9, 2019

Accepted January 15, 2019

with the AKI superimposed on CKD group (159.5 ± 261.5 in the AKI group vs. 10.1 ± 229.7 in the AKI on CKD group, $p=0.001$) although the values of the Δ ScCr and Δ eGFR did not differ between the both groups (Table 1). Many clinical studies have demonstrated the clinical value of pNGAL for the diagnosis and prognosis of AKI.³ However, the clinical significance of pNGAL in differentiating AKI and AKI superimposed on CKD have not yet been established.⁴ Our results suggest that pNGAL may be a useful marker of GFR and the analysis of Δ pNGAL may be helpful to differentiate AKI from AKI superimposed on CKD.

ACKNOWLEDGEMENTS

This study was financially supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2014R1A1A2058250).

CONFLICT OF INTEREST STATEMENT

None declared.

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