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Associations of plasma neutrophil gelatinase-associated lipocalin, anemia, and renal scarring in children with febrile urinary tract infections

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Objectives: Neutrophil gelatinase-associated lipocalin (NGAL), a bacteriostatic agent, is known to inhibit erythropoiesis leading to anemia. NGAL has also been shown to predict acute pyelonephritis (APN) in children with febrile urinary tract infections (UTIs). In this study, we aimed to investigate the association between plasma NGAL and anemia in pediatric patients with febrile UTIs. We further investigated the utility of plasma NGAL as a diagnostic predictor for renal scarring in children with febrile UTIs.

Methods: In 261 children with febrile UTI, the relationship between plasma NGAL with anemia was investigated. NGAL performance in comparison with serum C-reactive protein (CRP) for the prediction of anemia and renal scarring was also evaluated.

Results: Plasma NGAL levels were significantly elevated in patients with anemia compared with those without anemia ($P < 0.001$). Both NGAL and CRP levels were inversely correlated with indices of anemia including red blood cell count, hemoglobin, and hematocrit in children with febrile UTIs (all $P < 0.001$). Increased NGAL level, but not CRP, was independently associated with the presence of anemia [odds ratio: 2.37 (95% CI: 1.07-5.27), $P < 0.05$]. While both NGAL and CRP were favorable for the detection of anemia in receiver operating characteristic curve analyses, only NGAL levels before and after antibiotic treatment showed good diagnostic profiles for identifying renal scarring (all $P < 0.05$). In multivariable analysis, elevated plasma NGAL level (> 150 ng/mL) at admission and the presence of anemia independently predicted the presence of renal scarring in children with febrile UTIs (all $P < 0.05$). In the presence of anemia, NGAL concentration increased consecutively in febrile UTI without renal involvement, APN without scar, and APN with subsequent renal scarring ($P < 0.05$).

Conclusions: Increased plasma NGAL levels may be associated with the presence of anemia and renal scarring in children with febrile UTIs.

Figure 1

Fig. 1. ROC curves showing the diagnostic ability of plasma NGAL and CRP for anemia and renal scarring. AUC values of NGAL and CRP before antibiotic treatment are not different to detect anemia (a) or renal scarring (b) in children with febrile UTIs. However, the AUC of NGAL after treatment is higher than that of CRP for diagnosing renal scarring ($P < 0.05$) (c).

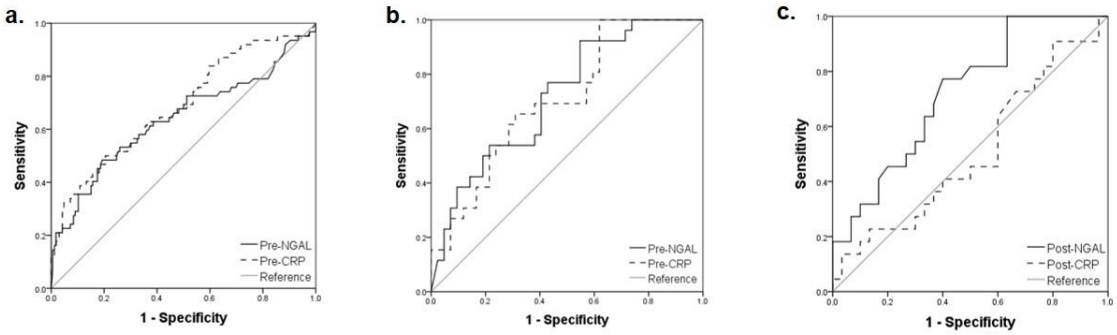

Figure 2

Fig. 2. Plasma NGAL levels at admission in febrile UTI without renal involvement (black bar), APN without renal scarring (white bar), and APN with scar development (grey bar) ($^{*}P < 0.05$, febrile UTI without renal involvement vs. APN without scar and APN with scar; $^{\dagger}P < 0.05$, APN without scar vs. APN with scar; Kruskal–Wallis test).