Research Brief

Prognostic utility of neutrophil gelatinase associated lipocalin in cardiac ICU: A prospective study

Anubhuti Bhardwaj a,*, Upma Narain b, Arvind Gupta c

a Department of Medicine, MLN Medical College, Prayagraj, India
b Tejas Microdiagnostics, Prayagraj, India
c Professor in Nephrology, PG Department of Medicine, MLN Medical College, Prayagraj, India

Abstract

Our study aims to evaluate the role of neutrophil gelatinase associated lipocalin (NGAL) as an early surrogate marker in predicting acute kidney injury (AKI) and mortality in cardiac ICU patients. The study was conducted at SRN Hospital, excluding those with known renal diseases. Out of 152 patients, 56 developed AKI (cases) and 96 were our controls. Higher NGAL was associated with increased mortality rates (P = 0.0201 and 0.0255 for serum and urinary NGAL respectively). Our study concluded that NGAL measurement at admission may be a boon in improving the outcome of cardiac ICU patients.

© 2022 Cardiological Society of India. Published by Elsevier, a division of RELX India, Pvt. Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

The epidemiology of acute kidney injury (AKI) in cardiac ICU has been reported up to 50% in few studies, which was also associated with increased mortality. In the recent years, Neutrophil gelatinase associated lipocalin (NGAL) has been shown to be a potential marker and has been compared to be as important as troponin in cardiac diseases. It has been studied to be a potential biomarker in various diseases such as-after cardiac surgery, post Cardiopulmonary Bypass, contrast induced nephropathy, following ECMO (Extra Corporeal Membrane Oxygenation).

The aim of this study is to evaluate the role of NGAL as a surrogate marker for predicting AKI and mortality in cardiac ICU patients, earlier than traditional indicators.

2. Materials and methods

This study was designed as a prospective cohort analysis in patients admitted to cardiac ICU from 1st August 2020 to 15th March, 2021 at a tertiary care hospital in India. The patients were followed during the hospital stay and their outcomes were noted.

Inclusion criteria comprised of age >18 years (male or female), patients of cardiac disease, while patients with eGFR (estimated glomerular filtration rate) < 90 mL/min, CKD (Chronic kidney disease) were excluded.

Samples for NGAL were collected within 8 h of admission to ICU and tested by ELISA kit- ELABSCIENCE® (USA). Laboratory parameters were measured for the duration of hospital stay. The primary outcome (AKI) and secondary outcome (mortality) were noted. AKI was defined using the KDIGO criteria (Increase in S. Creatinine /C21 0.3 mg/dL within 48 h or /C21 1.5 times baseline within 7 days or urine volume <0.5 mL/kg/h for 6 h).

SPSS 23 was used for statistical analyses.

3. Results

A total of 165 patients admitted in cardiac ICU were enrolled, out of which 13 patients were excluded owing to the exclusion criteria. Table 1 shows the demographic profile and outcomes of the patients. 56 patients (36.84%) developed AKI.

Fig. 1 A shows ROC curves which demonstrate role of NGAL in predicting AKI. AUC for serum and urinary NGAL was 0.869 (95% CI -0.720 - 0.956; p value < 0.001) and 0.899 (95% CI -0.757 to 0.973; p value < 0.001) respectively. The cutoffs for serum and urinary NGAL for predicting AKI were >42.5 ng/mL and >40.5 ng/mL respectively. Kaplan–Meier survival curves (Fig. 1B and C) portray that patients with lower NGAL (less than median) had better prognosis.
4. Discussion

In our study, a total of 56 patients (36.84%) developed AKI. We observed that patients of ACS (42.8%) had the highest development of AKI. Ghonemy et al.7 found similar results in his study (45%).

Our data revealed that NGAL values were significantly higher in patients who developed AKI than in those without AKI. Mosa8 did a similar study in patients of open heart surgery and found that baseline serum NGAL values were higher in the AKI group compared to the non-AKI group ($p<0.01$). Haase-Fielitz et al.9 found similar performance of NGAL in patients of cardiac surgery. Our study clearly demonstrated that raised NGAL was significantly associated with a poorer prognosis and increased mortality, which was irrespective of development of AKI. Van Deursen et al.10 found that raised NGAL was associated with increased mortality in HF ($P=0.023$).

This is a pilot study evaluating the performance of NGAL in cardiac ICU (Intensive care unit) patients. The study was ended prematurely due to the havoc caused by the COVID-19 pandemic. Hence, further studies with larger sample sizes are recommended.

5. Conclusion

It is a well established fact that NGAL correlates with development of AKI and we have reinstated this in our study. Furthermore, mortality was found to be associated with development of AKI and raised NGAL, irrespective of AKI. Thus, judicious use of NGAL can be used to decrease morbidity and mortality in patients admitted in cardiac ICU.

References

1. Jentzer J, Breen T, Sidhu M, et al. Epidemiology and outcomes of acute kidney injury in cardiac intensive care unit patients. J Crit Care. 2020;60:127–134.
2. McIlroy DR, Wagener G, Lee HT. Neutrophil gelatinase-associated lipocalin and acute kidney injury after cardiac surgery: the effect of baseline renal function on diagnostic performance. Clin J Am Soc Nephrol. 2010 Feb;5(2):211–219.
3. Tuladhar SM, Puntmann VO, Soni M, et al. Rapid detection of acute kidney injury by plasma and urinary neutrophil gelatinase-associated lipocalin after cardiopulmonary bypass. J Cardiovasc Pharmacol. 2009;53:261–266.
4. Hirsch R, Dent C, Pilsner H, et al. NGAL is an early predictive biomarker of contrast-induced nephropathy in children. Pediatr Nephrol. 2007;22:2089–2095.
5. Zwiers AJ, Cransberg K, de Rijke YB, et al. Urinary neutrophil gelatinase-associated lipocalin predicts renal injury following extracorporeal Membrane oxygenation. Pediatr Crit Care Med. 2015 Sep;16(7):663–670.
6. KDIGO clinical practice guideline for acute kidney injury. Kidney Int Suppl. 2012;2:8.
7. Ghonemy T, Allam H, Elokely A, et al. Prevalence of acute kidney injury in Egyptian ICU patients after open heart surgery: a pilot study. Kidney Dis. 2018;4(4):246–254.
8. Mosa O. Prognostic significance of serum NGAL and troponin I against acute kidney injury in Egyptian ICU patients after open heart surgery: a pilot study. Crit Care Med. 2009;37(2):553–560.
9. Haase-Fielitz A, Bellomo R, Devarajan P, et al. Novel and conventional serum biomarkers predicting acute kidney injury in adult cardiac surgery—a prospective cohort study. Crit Care Med. 2009;37(2):553–560.
10. Van Deursen V, Dammann K, Voors A, et al. Prognostic value of plasma neutrophil gelatinase–associated lipocalin for mortality in patients with heart failure. Circ. Heart Fail. 2014;7(1):35–42.