International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 11, November 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.11.2024.79

ORIGINAL RESEARCH

Efficacy of Neutrophil Gelatinase Associated Lipocalin as a biomarker for acute kidney injury

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Received date: 16 August, 2024 Acceptance date: 21 October, 2024

ABSTRACT

Background: The term "acute coronary syndrome" (ACS) refers to a group of cardiovascular disorders characterized by abrupt, decreased blood flow to the heart muscle. The present study was conducted to assess efficacy of Neutrophil Gelatinase Associated Lipocalin as a biomarker for acute kidney injury. **Materials & Methods:** 80 patients with acute coronary syndrome of both genders underwent a comprehensive history and examination. A sample of urine was taken. A standardized clinical platform was used to measure urine NGAL assays. The baseline, 24-hour, and 48-hour serum creatinine levels were also measured. **Results:** Out of 80 patients, males were 48 and females were 32. The mean serum creatinine level at baseline was 1.09 mg/dl, after 24 hours was 1.20 mg/dl and after 48 hours was 1.56 mg/dl. The difference was significant (P< 0.05). The mean urinary NGAL level was 78.5 in non- AKI and 415.2 in AKI group. The difference was significant (P< 0.05). There was a correlation between Urinary NGAL and AKI. This correlation was statistically significant (P<0.05). **Conclusion:** In individuals with acute coronary syndrome, urine Neutrophil Gelatinase Associated Lipocalin has demonstrated potential as a biomarker for acute kidney injury (AKI).

Key words: Acute Coronary Syndrome, Acute kidney injury, Neutrophil Gelatinase Associated Lipocalin

INTRODUCTION

The term "acute coronary syndrome" (ACS) refers to a group of cardiovascular disorders characterized by abrupt, decreased blood flow to the heart muscle. Usually, it covers ailments like myocardial infarction (heart attack) and unstable angina. ACS is a medical emergency that needs to be treated right now.[1,2] The rupture of an atherosclerotic plaque in one of the coronary arteries, which might result in the formation of a blood clot, is typically the underlying cause of ACS.[3] Ischemia, or a lack of oxygen, in the heart muscle can result from this clot's partial or total blockage of blood flow via the artery. The degree of blockage and the extent of cardiac muscle damage determine how severe the problem is.[4]

Acute kidney injury (AKI) is a common illness that can affect 10.0% to 30% of people who are hospitalized after suffering an acute myocardial infarction (AMI). AKI is more common in high-risk patients (10.0% to 25.0%), such as those receiving treatment in hospitals for congestive heart failure, sepsis, or following heart surgery.[5] Urine Neutrophil Gelatinase Associated Lipocalin (NGAL) levels have been proven to be an early predictor of acute renal damage. Newer devices are now available for early bedside detection of NGAL. Given that serum creatinine is a poor and delayed indication of acute kidney injury (AKI), NGAL may soon take its place as an early test for the illness.[6] Recent studies suggest that it could be a biomarker for several other renal and non-renal conditions. NGAL messenger RNA and protein expression are highly boosted in the damaged kidney's tubules, which raises the amount of NGAL in the blood and urine.[7] The present study was conducted to assess efficacy of Neutrophil Gelatinase Associated Lipocalin as a biomarker for acute kidney injury.

MATERIALS & METHODS

The present study consisted of 80 patients with acute coronary syndrome of both genders. Patients' relatives gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. A comprehensive history and examination were conducted. A sample of urine was taken. A

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standardized clinical platform was used to measure urine NGAL assays. The baseline, 24-hour, and 48-hour serum creatinine levels were also measured. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 80		
Gender	**Male**	**Female**
Number	48	32

Table I shows that out of 80 patients, males were 48 and females were 32.

Table II Assessment of serum creatinine level

Serum creatinine level	Mean	P value
Baseline	1.09	0.02
After 24 hours	1.20	
After 48 hours	1.56	

Table II shows that mean serum creatinine level at baseline was 1.09 mg/dl, after 24 hours was 1.20 mg/dl and after 48 hours was 1.56 mg/dl. The difference was significant (P< 0.05).

Graph I Assessment of serum creatinine level

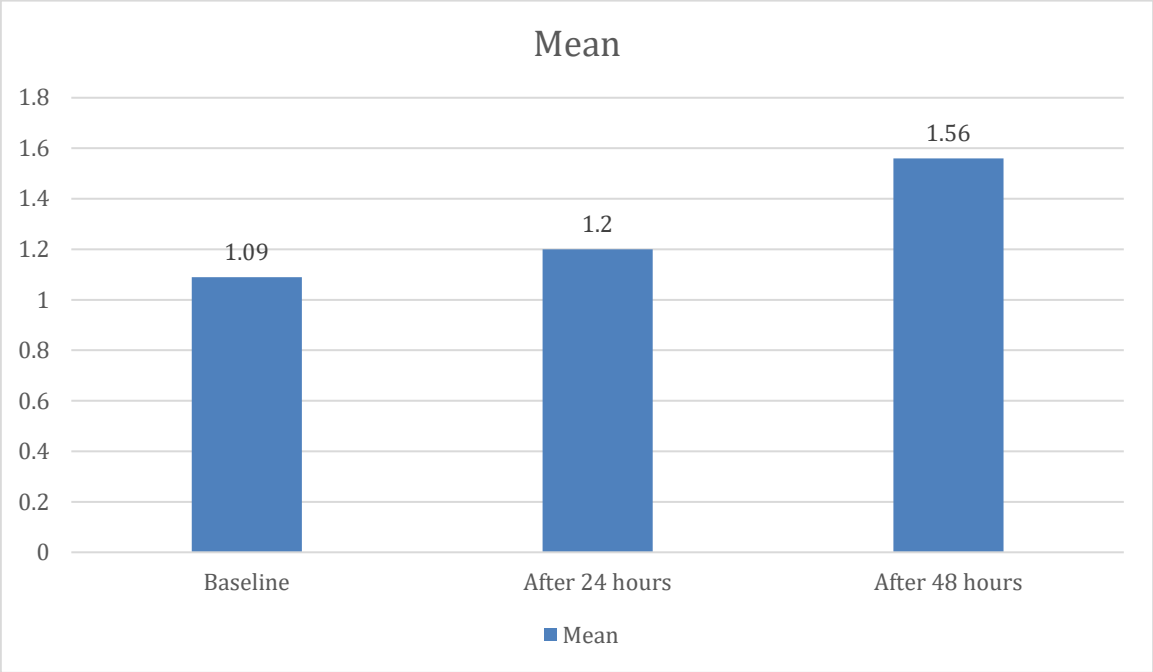

Table III Estimation of urinary Neutrophil Gelatinase Associated Lipocalin level

Groups	Mean	P value
Non AKI	78.5	0.01
AKI	415.2	

Table III shows that mean urinary NGAL level was 78.5 in non- AKI and 415.2 in AKI group. The difference was significant (P< 0.05).

Table IV Correlation between urinary Neutrophil Gelatinase Associated Lipocalin and AKI

Variable	Value
Pearson Correlation value (r)	0.75
P value	0.05

Table IV shows the correlation between Urinary NGAL and AKI. This correlation was statistically significant (P<0.05).

DISCUSSION

Chest pain or discomfort that happens at rest or with little effort is a sign of unstable angina. The discomfort may be excruciating and persist for a few minutes.[8] The heart muscle is not irreversibly damaged by unstable angina, in contrast to a heart

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attack. Reduced blood supply to a section of the heart muscle results from a partial blockage of a coronary artery in non-ST segment elevation myocardial infarction (NSTEMI).[9] Although not to the same degree as in a full-blown heart attack, this causes damage to the heart muscle. A more severe form of ACS known as ST segment elevation myocardial infarction (STEMI) occurs when a coronary artery is completely blocked, leaving a sizable section of the heart muscle completely.[10]

We found that out of 80 patients, males were 48 and females were 32. We observed that mean serum creatinine level at baseline was 1.09 mg/dl, after 24 hours was 1.20 mg/dl and after 48 hours was 1.56 mg/dl. According to Petrova et al[11], plasma NGAL was measured at baseline and four and twenty-four hours after the administration of contrast in patients with a high-risk profile who were scheduled for coronary angiography and/or angioplasty. NGAL rose considerably in the CI-AKI group at the 4th and 24th hours (Me 109.3 (IQR 92.1–148.7) ng/mL versus 97.6 (IQR 69.4–127.0) ng/mL, p = 0.006). At the fourth hour, NGAL also rose considerably in patients with subclinical CI-AKI (Me 94.0 (IQR 75.5–148.2) ng/mL, p = 0.002) and approached values comparable to those in patients with CI-AKI. However, there was no discernible change in serum creatinine in this group, in contrast to the novel biomarker. NGAL has a very high diagnostic power (AUC 0.847 in CI-AKI and AUC 0.731 in subclinical CI-AKI). NGA Following contrast angiographic tests, NGAL may be a trustworthy biomarker for the early detection of both clinical and subclinical forms of renal damage.

We found that mean urinary NGAL level was 78.5 in non- AKI and 415.2 in AKI group. Serum NGAL is a biomarker with a "narrow diagnostic window," according to Padhy et al[12], where peak values can be attained within 4 hours of a contrast angiography scan and stay noticeably elevated for up to 24 hours before fully normalizing by 48 hours. At six hours after contrast examination, the area under the curve (AUC) was 0.81 (p = 0.03), with a sensitivity of 97.64% and a specificity of 67.78% at a cut-off point of 96.35 ng/mL; at the twenty-fourth hour, the AUC was 0.89 (p < 0.01), with sensitivity 96.63% and specificity 68.72% at the established reference level of 97.57 ng/mL, according to Liao et al13's study of 240 patients.

We observed a correlation between Urinary NGAL and AKI. This correlation was statistically significant (P<0.05). Amin et al[13] discovered that the largest proportion of patients were between the ages of 40 and 60 (49, or 61.3%), followed by those over 60 (26.3%) and those between the ages of 20 and 40 (10.5%), respectively. The patients' ages ranged from 32 to 80 years old, with a mean age of 55.33±11.710. Males accounted for 54 (67.5%) and females for 26 (32.5%) of the study's cases, respectively. There were 2.1 times as many men as women. Urinary NGAL levels were typically below 131.7 ng/mL. The normal and abnormal urine NGAL groups had respective means and SDs of 68.83±44.10 ng/mL and 505.89±305.92 ng/mL. There was a slight positive correlation between the development of AKI and urine UNGAL.

The limitation of the study is small sample size.

CONCLUSION

Authors found that in individuals with acute coronary syndrome, urine Neutrophil Gelatinase Associated Lipocalin has demonstrated potential as a biomarker for acute kidney injury (AKI).

REFERENCES

1. Mody P, Wang T, McNamara R, et al. Association of in hospital acute kidney injury with long-term outcomes in survivors of acute myocardial infarction: insight from the NCDR. Circulation. 2015;132:A13975.
2. Kümpers P, Hafer C, David S, Hecker H, Lukasz A, Fliser D, Haller H, Kielstein JT, Faulhaber-Walter R. Angiopoietin-2 in patients requiring renal replacement therapy in the ICU: relation to acute kidney injury, multiple organ dysfunction syndrome and outcome. Intensive care medicine. 2010;36(3):462-70.
3. Prabhu A, Sujatha D, Ninan B, Vijayalakshmi M et al. Neutrophil gelatinase associated lipocalin as a biomarker for acute kidney injury in patients undergoing coronary artery bypass grafting with cardiopulmonary bypass', Ann Vasc Surg 2010;525-31
4. Kim JD, Chee HK, Shin JK, Kim JS, Lee SA, Kim YH et al. Novel Early Predictor of Acute Kidney Injury after Open Heart Surgery under Cadiopulmonary Bypass Using Plasma Neutrophil Gelatinase-Associated Lipocalin', Korean J Thorac Cardiovasc Surg, 2014; 240-248.
5. James MT, Samuel SM, Manning MA, Tonelli M, Ghali WA, Faris P, Knudtson ML, Pannu N, Hemmelgarn BR. Contrast induced acute kidney injury and risk of adverse clinical outcomes after coronary angiography: a systematic review and meta-analysis. Circulation: Cardiovascular Interventions. 2013;6(1):37-43
6. Ronco C, Lullo LD. Cardiorenal syndrome. Heart Fail Clin. 2014;10:251–80.
7. Moriyama N, Ishihara M, Noguchi T, et al. Early development of acute kidney injury is an independent predictor of in hospital mortality in patients with acute myocardial infarction. J Cardiol. 2017;69:79–83.
8. Tung YC, Chang CH, Chen YC, Chu PH. Combined biomarker analysis for risk of acute kidney injury in patients with ST-segment elevation myocardial infarction. PLoS one 2015 Apr 8; 10(4):0125282.
9. Parikh CR, Coca SG, Thiessen-Philbrook H, Shlipak MG, Koyner JL, Wang Z et al. Postoperative Biomarkers Predict Acute Kidney Injury and Poor Outcomes after Adult Cardiac Surgery. J Am Soc Nephrol 2011; 1748–1757.
10. Liao, B.; Nian, W.; Xi, A.; Zheng, M. Evaluation of a Diagnostic Test of Serum Neutrophil Gelatinase-Associated Lipocalin (NGAL) and Urine KIM-1 in Contrast-Induced Nephropathy (CIN). Experiment 2019, 25, 565–570.
11. Petrova I, Alexandrov A, Vladimirov G, Mateev H, Bogov I, Paskaleva I, Gotcheva N. NGAL as

DOI: 10.69605/ijlbpr_13.11.2024.79

Biomarker of Clinical and Subclinical Damage of Kidney Function after Coronary Angiography. Diagnostics. 2023 Mar 20;13(6):1180.

12. Padhy, M.; Kaushik, S.; Girish, M.; Mohapatra, S.; Shah, S.; Koner, B.C. Serum neutrophil gelatinase associated lipocalin (NGAL) and cystatin C as early predictors of contrast-induced acute kidney injury in patients undergoing percutaneous coronary intervention. Clin. Chim. Acta 2014;435: 48–52.
13. Amin MR, Hasan GMS, Haque M, Razzak MA, Kabir MFI, Alam MS, Saha S. Acute Coronary Syndrome: The Efficacy of NGAL as a Biomarker for Acute Kidney Injury (AKI). Ann. Int. Med. Den. Res. 2021; 7(2):9-12.