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Original Article

Efficacy of serum blood urea nitrogen, creatinine and electrolytes in the diagnosis and mortality risk assessment of patients with acute coronary syndrome

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ABSTRACT

Background: Although blood urea nitrogen (BUN), creatinine (Cr) and electrolytes are not the mainstay of diagnosis in acute coronary syndrome (ACS) patients but they may have a role in providing a more detailed view of the complications and mortality rates. The aim of this study was to determine the efficacy of these parameters in the diagnosis and mortality risk-assessment of patients with ACS.
Methodology: A total of 200 patients with ACS were recruited in this prospective study. The relationship of serum BUN, Cr and electrolytes with cardiac enzymes, Global Registry of Acute Coronary Events (GRACE) and mortality was assessed during a 6-months follow-up. Statistical test like multivariate linear regression and binary logistic regression analysis were applied.
Results: On multivariate linear regression analysis, serum potassium (K) (Unstandardized Coefficient B = −3.77; p = 0.04) showed significant negative association with Creatine Kinase and serum BUN (Unstandardized Coefficient B = 0.52; p = 0.001) showed significant positive association with Troponin I. The patients with GRACE > 105 had significantly higher levels of serum BUN and Cr. Receiver operating characteristic curves showed that area under curve (AUC) of BUN (0.7) was higher than AUC of Cr (0.5). Multiple adjusted model showed that patients with BUN > 32.5 mg/dl were almost 20 times more likely to be associated with mortality as compared to reference group.
Conclusion: In addition to cardiac enzymes, K along with BUN and Cr may serve as important aid in diagnosis of ACS. BUN and Cr may also serve as important tools in mortality-risk assessment of ACS patients.

1. Introduction

Acute coronary syndrome (ACS) is one of the major causes of mortality and morbidity worldwide.[1] The severity and type of ACS varies considerably among individuals.[2] Thus, it becomes important to effectively diagnose and determine the prognosis and mortality risk. The use of serum blood urea nitrogen (BUN), creatinine (Cr) and electrolytes' levels for these purposes is a prospective area for exploration. Even though the mainstay of diagnoses remains the cardiac bio-markers such as troponins, Creatine Kinase-MB and electrocardiography (ECG),[3] electrolyte levels along with renal dysfunction markers can aid in providing a better picture of the patient, and identify those patients that are at a greater risk.[4]

BUN is a powerful predictor and is a sensitive marker for hemodynamic changes and kidney perfusion,[5] but the data for the prognostic value of serum BUN in ACS patients independent to rise in Glomerular Filtration Rate (GFR) is scarce. Although serum Cr, being a gold standard test for GFR, has a good prognostic significance among ACS patients,[6] it is not as accurate for normal or mildly reduced kidney function as serum BUN. In such cases, serum BUN may rise independent to changes in GFR under the influence of sympathetic, arginine-vasopressin, and renin-angiotensin-aldosterone systems, which are activated in ACS and

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increase the renal tubular reabsorption of urea,[7] thus making it a better prognosis predictor than Cr in ACS patients.

While criteria such as Thrombolysis in Myocardial Infarction (TIMI) score, Global Registry of Acute Coronary Events (GRACE) score and HEART score are clinically used to work out the prognosis of patients with ACS, the employment of BUN along side in predicting outcome may prove favorable as well.

Even though electrolytes have a significant role in maintaining the integrity of the cardiovascular system, their role in the diagnosis and prognosis of ACS has not been given considerable significance, albeit a few researches on this topic show the relationship of serum levels of sodium (Na) and potassium (K) with long term mortality risk in ACS patients.[8–11] Magnesium (Mg) serves as a beta-adrenoreceptor blocker and also has an anti-platelet action.[11] Calcium (Ca) plays an electrophysiological role in the cardiac muscle and nodal cells,[12] as do Na and potassium K. Therefore, it is highly likely that any derangement in their levels or their relative ratios may hint at an underlying pathology. Our study

Table 1
Comparison of baseline demographical, clinical, laboratory and follow-up data between the two groups, A (GRACE score ≤ 105) and B (GRACE score > 105)

Variables	GRACE score ≤ 105 (GROUP A) n = 103	GRACE score > 105 (GROUP B) n = 97	[a]p-value
Age [years]	56.26 ± 10.46	55.59 ± 11.26	0.661
Male, n (%)	69 (67)	72 (74)	0.262
Previous History			
Smoking, n (%)	28 (27)	33 (34)	0.294
Diabetes Mellitus, n (%)	31 (30)	33 (34)	0.552
Hypertension, n (%)	80 (78)	60 (62)	0.015
Family History Of CAD, n (%)	41 (40)	37 (38)	0.810
MI or CAD, n (%)	69 (67)	61 (63)	0.543
PCI, n (%)	12 (12)	11 (11)	0.945
CABG, n (%)	2 (2)	3 (3)	[d]0.675
Admission heart rate [bpm]	83.28 ± 13.57	82.73 ± 16.49	[b]0.797
Admission SBP [mmHg]	139.58 ± 26.83	116.20 ± 26.37	[b]<0.001
Admission DBP [mmHg]	85.94 ± 15.06	74.84 ± 17.21	[b]<0.001
LVEF [%]	48.12 ± 10.69	43.56 ± 12.16	[b]0.005
Killip class on presentation, n (%)			
≤I	77 (75)	47 (48)	<0.001
>I	26 (25)	50 (52)	
NYHA classification, n (%)			
≤I	36 (35)	12 (12)	<0.001
>I	67 (65)	85 (88)	
Number of diseased vessels			
1 vessel, n (%)	39 (38)	26 (27)	0.095
> 1 vessel, n (%)	64 (62)	71 (73)	
Duration of Hospitalization, [days]	7 (5)	7 (5.5)	[c]0.757
CBC profile			
Hemoglobin [g/dl]	12.61 ± 2.03	12.88 ± 2.09	[b]0.360
Platelet count [x10^3/ul]	288.52 ± 87.04	281.54 ± 114.62	[b]0.630
White blood cell count [x10^3/ul]	10.64 ± 3.30	10.74 ± 3.24	[b]0.830
Red blood cell count [x10^6/ul]	4.77 ± 0.75	4.61 ± 0.76	[b]0.126
Hematocrit [%]	38.31 ± 5.99	38.44 ± 5.84	[b]0.874
Cardiac Enzymes			
CK [IU/L]	150 (258)	192 (417.5)	[c]0.150
CK-MB[IU/L]	41 (39)	48 (31.5)	[c]0.122
Troponin-I [ng/ml]	1.0 (3.2)	4.2 (22.9)	[c]<0.001
Follow up			
Rehospitalization, n (%)	17 (17)	21 (22)	0.354
MI, n (%)	16 (16)	20 (21)	0.350
Cardiogenic shock, n (%)	8 (8)	13 (13)	0.194
Stroke, n (%)	5 (5)	7 (7)	0.482
Dialysis, n (%)	0 (0)	3 (3)	[d]0.112
GI Bleeding, n (%)	7 (7)	7 (7)	0.907
Tranfusion, n (%)	8 (8)	12 (12)	0.278
CABG, n (%)	8 (8)	13 (13)	0.194
Acute stent thrombosis, n (%)	35 (34)	24 (25)	0.152
Mortality, n (%)	2 (2)	20 (21)	<0.001
GRACE score	85.59 ± 15.88	134.36 ± 24.48	[b]<0.001

BP: blood pressure; LVEF: left ventricular ejection fraction; CK-MB: creatine kinase MB isoenzyme; MI—myocardial infarction; NYHA—New York Heart Association; CABG: coronary artery bypass grafting GI: gastrointestinal bleeding; PCI: percutaneous coronary intervention; CAD: coronary artery disease: RDW: red distribution width; MPV: mean platelet volume.

[a] p value < 0.05 were considered statistically significant.
[b] Student's *t*-test.
[c] Mann Whitney *U* test was used to compare quantitative data without normal distribution.
[d] Fisher's exact test and x^2 test (Pearson's chi-square test) were used to compare categorical variables.Data presented as mean±standard deviation, median (IQR) and frequency (percentages).

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