

## Original Research Article

# Blood urea nitrogen as an early predictor of severity in acute pancreatitis

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### ABSTRACT

**Background:** Acute pancreatitis presents as acute abdominal pain and is usually associated with raised pancreatic enzyme levels in the blood or urine. Aims and objectives of the study was to evaluate the role of serial BUN measurement as an early prognostic marker of acute pancreatitis.

**Methods:** From each patient detailed history was taken, general and systemic examination were done and relevant investigations were conducted. BUN was repeated after 24 hours and the change in the level of BUN was noted. Imaging in the form of CT after 72 hours of admission were performed in each patient. The severity of acute pancreatitis was gauged by modified CTSI and the same was compared to the change in BUN values over first 24 hours of admission.

**Results:** Mean BUN values at '0' hour in severe acute pancreatitis and non-severe acute pancreatitis were  $31.91 \pm 6.79$  and  $15.44 \pm 5.95$  mg/dl, respectively. The difference between the two groups was statistically significant with p value of  $<0.001$ . Similarly, the difference in BUN values at '24' hours between the two groups was statistically significant. BUN value  $\geq 23$  mg/dl at '0' hour was found to be the optimal cut off for determining the severity of pancreatitis with sensitivity of 91.3%. BUN  $\geq 25$  mg/dl at 24 hours was found to be the optimal cut-off for determining the severity of acute pancreatitis with sensitivity of 95.7%.

**Conclusions:** BUN as a single marker for acute pancreatitis can be useful as it is easy to perform and cheap marker to predict severity without the need for complex calculations.

**Keywords:** Acute pancreatitis, Blood urea nitrogen, Mortality, Resuscitation

### INTRODUCTION

Acute pancreatitis is defined as an acute inflammatory process of the pancreas with variable involvement of the pancreas, regional tissues around the pancreas, or remote organ systems. The condition presents as acute abdominal pain and is usually associated with raised pancreatic

enzyme levels in the blood or urine.<sup>1-3</sup> The prevalence of acute pancreatitis is estimated between 6 and 45 per 100,000 adults per year.<sup>4</sup> Although most patients experience only mild, self-limited disease, up to 20% experience a more severe form of illness that can be lifethreatening.<sup>5-8</sup> Early diagnosis and staging are main objectives in the initial evaluation, to differentiate those

with severe disease and to establish proper treatment.<sup>9</sup> Recent critical care data have indicated that the median length of stay for patients with acute pancreatitis before transferring to intensive care was 1 day.<sup>10</sup> Therefore, the first 24 hours of hospitalization represents a critical “therapeutic window” during which efforts should be made to identify patients at increased risk of severe disease to provide optimal therapy. Current practice guidelines recommend vigorous fluid resuscitation in the early treatment of acute pancreatitis.<sup>5,11-14</sup>

Simple, routine, and widespread laboratory tests, specifically tests for evaluating serum blood urea nitrogen (BUN), haematocrit, and creatinine, have also been proposed as markers of disease severity. Such laboratory parameters have great potential, because they are readily available, inexpensive, and have standardized reference ranges. Aims and objectives of the study was to evaluate the role of serial BUN measurement as an early prognostic marker of acute pancreatitis.

**METHODS**

The study was a prospective observational study conducted in the Postgraduate Department of General Surgery, Government Medical College Srinagar. It was conducted over a period of 2 years from November 2018 to November 2020. 100 patients were included after obtaining ethical clearance from Ethical committee, GMC, Srinagar. The study included all the patients with diagnosis of acute pancreatitis, onset of symptoms of ≤24 hours, and age ≥18 years. Patients with onset of symptoms >24 hours, age <18 years, chronic pancreatitis, CKD, were excluded from the study.

From each patient detailed history was taken, general and systemic examination were done and relevant investigations were conducted. Investigations that were sent at the time of admission (‘0’hours) in all cases

Haemoglobin, TLC, DLC, Platelet count, Haematocrit, RDW, serum amylase/ Serum lipase, BUN, Serum Urea, Serum Creatinine, LFT, Serum Sodium, Serum Potassium and Serum Calcium levels, Arterial blood gases (ABG), Random blood sugar (RBS), Chest X-ray and X-ray Abdomen, Electrocardiogram (ECG), USG Abdomen BUN was repeated after 24 hours and the change in the level of BUN was noted. Imaging in the form of USG and CT after 72 hours of admission were performed in each patient. The severity of acute pancreatitis was gauged by modified CTSI and the same was compared to the change in BUN values over first 24 hours of admission.

**Statistical methods**

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean±SD and categorical variables were summarized as frequencies and percentages. Student’s independent t-test was employed for comparing continuous variables. Chi-square test or Fisher’s exact test, whichever appropriate, was applied for comparing categorical variables. Sensitivity, specificity, positive and negative predictive values (PPV, NPV) were calculated for individual criteria. ROC curves were plotted and a cut-off value was determined for the variable of interest. A p-value of less than 0.05 was considered statistically significant. All p values were two tailed.

**RESULTS**

Table 1 shows the demographic characters as per the severity of pancreatitis. The difference in age, gender and BMI between the two groups (severe and non-severe pancreatitis) was statistically insignificant with p values of 0.389, 0.478 and 0.386, respectively.

**Table 1: Demographic characteristics as per severity of acute pancreatitis.**

Characteristic	Severe acute pancreatitis		Non-severe acute pancreatitis		P value	
	N	%	N	%		
<b>Age (Years)</b>	<30	2	8.7	4	5.2	0.389
	30-39	5	21.7	22	28.6	
	40-49	6	26.1	29	37.7	
	50-59	8	34.8	21	27.3	
	≥60	2	8.7	1	1.3	
	Mean±SD	45.2±11.17		43.3±8.89		
<b>Gender</b>	Male	9	39.1	38	49.4	0.478
	Female	14	60.9	39	50.6	
<b>BMI</b>	<18.5	0	0.0	0	0.0	0.386
	18.5-24.9	8	34.8	23	29.9	
	25-29.9	11	47.8	32	41.6	
	≥30	4	17.4	22	28.6	
	Mean±SD	25.96±3.98		26.71±3.57		

P value by Student’s Independent t-test for age and BMI; Chi-square test for gender

**Table 2: Blood urea nitrogen (BUN) as per severity of acute pancreatitis.**

	Severe acute pancreatitis		Non severe acute pancreatitis		P value
	Mean	SD	Mean	SD	
<b>BUN at 0 hour (mg/dl)</b>	31.91	6.79	15.44	5.95	<0.001*
<b>BUN at 24 hours (mg/dl)</b>	39.74	10.18	14.31	6.08	<0.001*

\*Statistically Significant Difference (P value<0.05); P-value by Student’s Independent t-test

Table 2 shows the BUN values as per severity of acute pancreatitis. There was statistically significant difference in the BUN values at ‘0’ hour and at ‘24’ hours between the two groups (severe and non-severe pancreatitis). Mean BUN values at ‘0’ hour in severe acute pancreatitis and non-severe acute pancreatitis were 31.91±6.79 and 15.44±5.95 mg/dl, respectively. The difference between the two groups was statistically significant with p-value of <0.001. Similarly, the difference in BUN values at ‘24’ hours between the two groups was statistically significant.

**Table 3: Diagnostic accuracy of BUN at 0 hour for prediction of severe acute pancreatitis.**

Variable	Value	95% CI
<b>Optimal cutoff</b>	≥23	-
<b>Sensitivity</b>	91.3	73.20-97.58
<b>Specificity</b>	92.2	84.02-96.38
<b>Accuracy</b>	92.0	85.0-95.89
<b>PPV</b>	77.8	59.24-89.39
<b>NPV</b>	97.3	90.55-99.25
<b>AUC</b>	0.966	0.909-0.992

Table 3 shows the diagnostic accuracy of BUN at ‘0’ hour for prediction of severe acute pancreatitis. BUN value ≥23 mg/dl at ‘0’ hour was found to be the optimal cut off for determining the severity of pancreatitis with sensitivity and specificity of 91.3% and 92.2%, respectively.

**Table 4: Diagnostic accuracy of BUN at 24 hours for prediction of severe acute pancreatitis (SAP).**

Variable	Value	95% CI
<b>Optimal cut-off</b>	≥25	-
<b>Sensitivity</b>	95.7	79.01-99.23
<b>Specificity</b>	97.4	91.02-99.28
<b>Accuracy</b>	97.0	91.55-98.97
<b>PPV</b>	91.7	74.15-97.68
<b>NPV</b>	98.6	92.93-99.77
<b>AUC</b>	0.989	0.945-0.999

Table 4 shows the diagnostic accuracy of BUN at 24 hours for prediction of severity of acute pancreatitis. BUN ≥25 mg/dl at 24 hours was found to be the optimal cut-off for determining the severity of acute pancreatitis with sensitivity and specificity of 95.7% and 97.4%, respectively.

**Table 5: Diagnostic accuracy of change in BUN levels for prediction of severe acute pancreatitis**

Variable	Value	95% CI
<b>Optimal cut-off</b>	≥4	-
<b>Sensitivity</b>	86.9	67.87-95.46
<b>Specificity</b>	83.1	73.23-89.86
<b>Accuracy</b>	84.0	75.58-89.91
<b>PPV</b>	60.6	43.68-75.32
<b>NPV</b>	95.5	87.64-98.47
<b>AUC</b>	0.915	0.842-0.961

Table 5 shows diagnostic accuracy of change in BUN levels for prediction of severe acute pancreatitis. It was found that change in BUN >4 mg/dl over 24 hours was found to predict the severity of pancreatitis with accuracy of 84%.

**DISCUSSION**

Several predictive scoring systems have been developed, including the acute physiology and chronic health evaluation-II (APACHE-II) score, systemic inflammatory response syndrome (SIRS), the bedside index for the severity in acute pancreatitis (BISAP), and CT severity index (CTSI). One major limitation of the available scoring systems is that they are complex and frequently cumbersome to calculate in clinical practice.<sup>15</sup> Simple, routine, and widespread laboratory tests, specifically tests for evaluating serum blood urea nitrogen (BUN), haematocrit, and creatinine, have also been proposed as markers of disease severity.

In our study, the difference in age, gender and BMI between the two groups was statistically insignificant (Table 1). A study was conducted by Pallegu et al who also didn’t have statistically significant difference in age between the two groups (p value 0.55).<sup>16</sup> Similarly, there was statistically insignificant difference (p-value 0.14) in age between the two groups in a study conducted by Lin et al.<sup>17</sup> Also, the gender distribution between the two groups was equal in our study with p-value of 0.478. Our results were consistent with Lin et al.<sup>17</sup> In their study, there was equal distribution of gender between the two groups (p value.0.127).

In our study, the mean BUN value at ‘0’ hour in the severe acute pancreatitis group was significantly higher (31.91±6.79 mg/dl) than that of the non-severe acute pancreatitis group (15.44±5.95 mg/dl), the difference

between the two groups being statistically significant (p value <0.001) (Table 2). Similarly, the BUN value at '24' hour was significantly higher (39.74±10.18 mg/dl) in severe acute pancreatitis group than in non-severe acute pancreatitis group (14.31±6.08 mg/dl). The difference between the two groups was again statistically significant (p value <0.001). Lin et al also found significantly higher BUN value in severe acute pancreatitis group than non-severe acute pancreatitis group at '0' hour and at '24' hours. P-value in their study was <0.001 both at '0' hour and at '24' hours.<sup>17</sup>

In our study, BUN value  $\geq 23$  mg/dl at '0' hour was found to be the optimal cut off for determining the severity of pancreatitis with sensitivity, specificity and accuracy of 91.3%, 92.2% and 92%, respectively (Table 3). Similarly, BUN  $\geq 25$  mg/dl at '24' hours was found to be the optimal cut-off for determining the severity of acute pancreatitis with sensitivity, specificity and accuracy of 95.7%, 97.4% and 97%, respectively (Table 4). Similar results were found by Pallegu et al.<sup>16</sup> In their study, it was found that BUN  $\geq 20$  mg/dl was the critical value for determining the severity of acute pancreatitis with sensitivity, specificity and accuracy of 89%, 93% and 91.66%, respectively. Also, they found that BUN at '24' hours  $\geq 25$  mg/dl was the critical value for determining severity of acute pancreatitis with sensitivity, specificity and accuracy of 89%, 100% and 100%, respectively.

In our study, it was found that change in BUN >4 mg/dl over 24 hours was found to predict the severity of pancreatitis with sensitivity of 86.9%, specificity of 83.1% and accuracy of 84% (Table 5). Our results were consistent with Pallpagu et al., who in their study found that rise in BUN value of >5 mg/dl over 24 hours was predictive of severity of acute pancreatitis with sensitivity of 88.8%, specificity of 96.3% and accuracy of 88.8%.<sup>16</sup>

## CONCLUSION

From the study, we concluded that BUN serves as a simple and accurate predictor of severity and mortality in acute pancreatitis. BUN value  $\geq 23$  mg/dl at '0' hour is found to be the optimal cut-off for determining the severity of pancreatitis with sensitivity, specificity and accuracy of 91.3%, 92.2% and 92%, respectively. Similarly, BUN  $\geq 25$  mg/dl at '24' hours is found to be the optimal cut-off for determining the severity of acute pancreatitis with sensitivity, specificity and accuracy of 95.7%, 97.4% and 97%, respectively.

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