

Original Research Article

EVALUATION AND COMPARISON OF SCORING SYSTEM IN PREDICTING SEVERE ACUTE PANCREATITIS

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ABSTRACT

Background: Early prediction of severe acute pancreatitis (AP) is crucial for effective triage. This study evaluates the predictive accuracy of APACHE II, BISAP, Ranson's's criteria, the Modified Computed Tomography Severity Index (MCTSI), and C-Reactive Protein (CRP) against the Revised Atlanta Classification.

Materials and Methods: A prospective observational study of 204 adult AP patients was conducted. Predictive performance for severe AP (persistent organ failure >48 hours) was analyzed using sensitivity, specificity, predictive values, and Receiver Operating Characteristic (ROC) curves.

Results: Severe AP occurred in 18.1% of patients. CRP exhibited the highest overall discriminative accuracy (AUC = 0.933), closely followed by BISAP and APACHE II (both AUC = 0.927). APACHE II demonstrated the highest sensitivity (89.2%) and negative predictive value (97.0%) for excluding severe disease. Conversely, Ranson's and BISAP offered the highest specificities (98.8% and 97.6%) and positive predictive values (87.5% and 85.7%). All scores were significantly elevated in severe cases ($p < 0.001$).

Conclusion: CRP, BISAP, and APACHE II are highly accurate predictors of severe AP. APACHE II is optimal for early exclusion of severe disease, BISAP is highly specific for confirming high risk, and CRP serves as a highly accurate, easily accessible standalone biomarker.

Keywords: Severe, Acute Pancreatitis, APACHEII, Ranson's, BISAP, MCTSI, Scoring system

INTRODUCTION

Acute pancreatitis (AP) is a common acute gastrointestinal condition ranging from self-limited disease to life-threatening illness. It has become more common in recent decades, with population-based studies reporting an increase of about 3% per year.^[1] Global Burden of Disease (GBD) analyses indicate a substantial and increasing burden worldwide.^[2] In India, GBD 2021 estimated 523,074 incident cases, with an age-standardised incidence rate of 36.76 per 100,000 population.^[3] However, population-based data from Tamil Nadu remain limited.

The clinical course of AP is variable, and early identification of patients at risk of severe disease is essential for appropriate triage, monitoring and timely escalation of care. While most patients have

mild disease, some develop persistent organ failure, pancreatic necrosis and local or systemic complications.^[4,5] The Revised Atlanta Classification provides the accepted framework for severity assessment, categorising AP as mild, moderately severe or severe according to organ failure and local or systemic complications; severe AP is defined by persistent organ failure lasting >48 hours.^[6] As severity may evolve after presentation, this classification primarily defines clinical severity rather than providing early prognostic prediction. Several scoring systems have been developed for early risk stratification. APACHE II can be calculated at admission, BISAP within 24 hours, and Ranson's criteria at admission and 48 hours, whereas the Modified Computed Tomography Severity Index (MCTSI) assesses anatomical severity following CT.^[7-10] These systems differ in timing, complexity

and the domains assessed, with MCTSI also influenced by the timing of imaging because early CT may underestimate evolving necrosis.^[6,11] Comparative evidence has not demonstrated consistent superiority of any single system across all clinically relevant outcomes. A meta-analysis of 30 studies involving 5,988 patients found broadly comparable performance of APACHE II, BISAP, Ranson's criteria and MCTSI for predicting AP severity, although performance varied according to the outcome assessed.^[12] Other comparative studies have similarly highlighted the complementary roles of clinical and imaging-based scores.^[13] Therefore, comparative evaluation of these systems against the Revised Atlanta Classification may help clarify their utility for risk stratification. The present study compares APACHE II at admission, BISAP within 24 hours, Ranson's criteria at admission and 48 hours, and MCTSI following CT, using the Revised Atlanta Classification as the reference framework for severity assessment.

MATERIALS AND METHODS

Study Design and Setting: A prospective observational study was conducted among patients presenting with acute pancreatitis to the Department of General Surgery and General Medicine, Government Medical College Tiruppur, during the study period from April 2026 to July 2026. 204 consecutive patients who fulfilled the diagnostic criteria were included.

Study population

Patients aged ≥ 18 years presenting to the Surgery Outpatient Department with clinical suspicion of acute pancreatitis were evaluated. The diagnosis of acute pancreatitis was established when at least two of the following three criteria were present:

1. Abdominal pain
2. Serum amylase and/or lipase levels ≥ 3 times the upper limit of normal.
3. Imaging findings characteristic of acute pancreatitis

Patients fulfilling the diagnostic criteria were enrolled after obtaining written informed consent.

Inclusion criteria

- Patients aged ≥ 18 years.
- Patients presenting to the Surgery OPD with a diagnosis of acute pancreatitis based on the above criteria.
- Patients who consented to participate in the study.

Exclusion criteria

- Patients with chronic pancreatitis or acute-on-chronic pancreatitis, pancreatic malignancy
- Patients with incomplete clinical, biochemical or radiological data required for severity assessment.
- Pregnant women

Clinical and biochemical assessment was done at admission and followed through hospitalisation.

According to the Revised Atlanta Classification, Severe acute pancreatitis (SAP) was defined as acute pancreatitis associated with persistent organ failure (>48 hours) involving the respiratory, cardiovascular, and/or renal system.^[6] Disease severity was assessed using four established scoring systems at predefined time points: APACHE II on admission, BISAP within 24 hours, Ranson's score at admission and at 48 hours, and Modified CT Severity Index (MCTSI) following contrast-enhanced CT. APACHE II incorporated acute physiological variables, age and chronic health status; BISAP included BUN, impaired mental status, SIRS, age and pleural effusion; Ranson's score was calculated using the standard admission and 48-hour parameters; and CTSI was determined from the extent of pancreatic inflammation and necrosis on CT.

Ethical considerations

Approval from the Institutional Ethics Committee was obtained. Participants were enrolled after obtaining written informed consent and confidentiality was maintained throughout the study.

Statistical analysis

Data were entered and analysed using SPSS version 25. Continuous variables were expressed as mean $\pm$ standard deviation. Categorical variables were expressed as frequencies and percentages. The association between scoring, laboratory parameters and severe acute pancreatitis was assessed using Mann whitney test as the distribution was not normal. The predictive performance of **APACHE II, BISAP, Ranson's and MCTSI** for severe acute pancreatitis was evaluated using sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV). Receiver operating characteristic (ROC) curves were constructed, and the area under the curve (AUC) was calculated for each scoring system. A two-sided **p-value** <0.05 was considered statistically significant.

RESULTS

Among 204 study subjects, 18.1% (n=37) of the patients had a severe disease presentation. According to Ranson's Criteria, the majority of patients (66.2%, n=135) fell into the lower risk category. However, 26.0% (n=53) showed an increased risk of severe disease, 7.4% (n=15) were at high risk, and 0.5% (n=1) were at very high risk. As per BISAP score 86.3% (n=176) of the patients were lower risk and 13.7% (n=28) in higher risk. According to the APACHE II scoring, 66.2% (n=135) of the patients were categorized as lower risk, and 33.8% (n=69) were higher risk. Radiological assessment using the Modified CT Severity Index (MCTSI) identified 51.5% (n=105) of cases as mild, 43.1% (n=88) as moderate, and 5.4% (n=11) as severe. C-Reactive Protein (CRP) levels indicated a lower risk profile for 78.9%

(n=161) of the patients, while 21.1% (n=43) were in the higher risk. [Table 1,2]

Table 1: Severe acute pancreatitis among study subjects

Severity	Frequency (n)	Percentage (%)
No	167	81.9%
Yes	37	18.1%
Total	204	

Table 2: Severity score among study subjects

Variable	Category	Frequency (n)	Percentage (%)
Severity	No	167	81.9%
	Severe	37	18.1%
Ranson's	Lower risk	135	66.2%
	Severe risk increases	53	26.0%
	High risk	15	7.4%
	Very high risk	1	0.5%
BISAP	Lower risk	176	86.3%
	Higher risk	28	13.7%
APACHE II	Lower risk	135	66.2%
	Higher risk	69	33.8%
MCTSI	Mild	105	51.5%
	Moderate	88	43.1%
	Severe	11	5.4%
CRP	Lower risk	161	78.9%
	Higher risk	43	21.1%

Mann-Whitney U test was conducted to evaluate differences in continuous prognostic scores and inflammatory markers between patients who developed severe disease (n=37) and those who did not (n=167). The distributions of all evaluated parameters were significantly higher in the severe group compared to the non-severe group. Ranson's total scores were significantly elevated in severe cases (U = 723.50, Z = -7.442, p < 0.001). Similar

highly significant differences were observed for BISAP scores (U = 454.00, Z = -8.427, p < 0.001), APACHE II scores (U = 453.00, Z = -8.150, p < 0.001), and MCTSI scores (U = 601.50, Z = -7.754, p < 0.001). Furthermore, C-reactive protein (CRP) levels were significantly higher among patients with severe disease (U = 414.00, Z = -8.241, p < 0.001). [Table 3]

Table 3: Comparison of continuous prognostic scores and CRP levels between severity groups (Mann-Whitney U Test)

Variable	No Severity (n=167) Mean Rank	Severe AP (n=37) Mean Rank	Mann-Whitney U	Z-score	p-value
Ranson's Total Score	88.33	166.45	723.500	-7.442	<0.001
BISAP Total Score	86.72	173.73	454.000	-8.427	<0.001
APACHE II Total Score	86.71	173.76	453.000	-8.150	<0.001
MCTSI Total Score	87.60	169.74	601.500	-7.754	<0.001
CRP (mg/L)	86.48	174.81	414.000	-8.241	<0.001

APACHE II had the highest sensitivity (89.2%) for predicting severe cases, followed by MCTSI (86.5%, with moderate/severe grades as the positive predictor) and CRP (75.7%). Ranson's criteria and BISAP had sensitivities of 37.8% and 64.9%, respectively, and specificities of 98.8% and 97.6%. The highest PPV (87.5% and 85.7% respectively) were observed with both Ranson's criteria and BISAP, which implies that the high-risk score in

these systems is highly related to the actual occurrence of severe pancreatitis. In contrast, APACHE II and MCTSI had lower PPVs (47.8% and 32.3%) and higher false positives. All tested scoring systems had good NPVs (>87%) particularly for exclusion of severe disease in low-risk patients with APACHE II (97.0%) and MCTSI (95.2%). [Table 4]

Table 4: Characteristics of scoring system in predicting severity

Scoring System	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BISAP	64.9	97.6	85.7	92.6
APACHE II	89.2	78.4	47.8	97.0
MCTSI	86.5	59.9	32.3	95.2
Ranson's	37.8	98.8	87.5	87.8
CRP	75.7	91.0	65.1	94.4

Receiver Operating Characteristic (ROC) curve analyses were conducted to evaluate the predictive performance of multiple clinical scoring systems and biomarkers. C-reactive protein (CRP) showed the highest overall discriminative accuracy with an Area Under Curve (AUC) of 0.933 and an optimal diagnostic threshold of ≥ 118.5 mg/L with a sensitivity of 94.6% and specificity of 79.6%. The AUC for BISAP and APACHE II Total Scores were 0.927 indicating good predictive power. BISAP > 1.5 had a sensitivity of 94.6% and a specificity of 72.5%. APACHE II ≥ 7.5 had a sensitivity of 83.8% and a specificity of 86.2%. The total score of MCTSI (AUC=0.903) had excellent specificity (92.8%) and sensitivity (78.4%) at an optimal cutoff ≥ 4.5 . The Ranson's Total Score (AUC = 0.883) had a sensitivity of 86.5% and a specificity of 77.8% at a cut-off point of ≥ 2.5 . All optimal diagnostic thresholds were determined via maximum Youden index. [Figure 1-5]

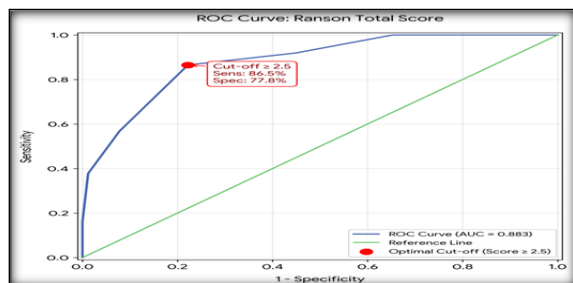


Figure 1: ROC Curve demonstrating the performance of the Ranson's Total Score

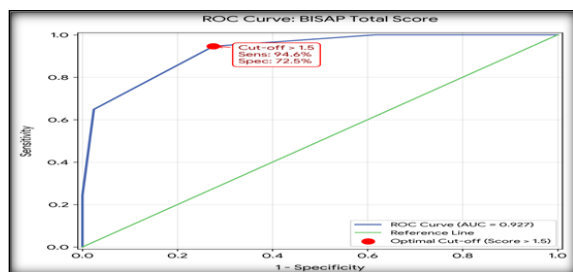


Figure 2: ROC Curve demonstrating the performance of the BISAP Total Score

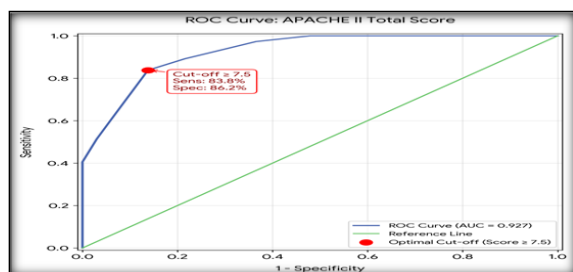


Figure 3: ROC Curve demonstrating the performance of the APACHE II Total Score

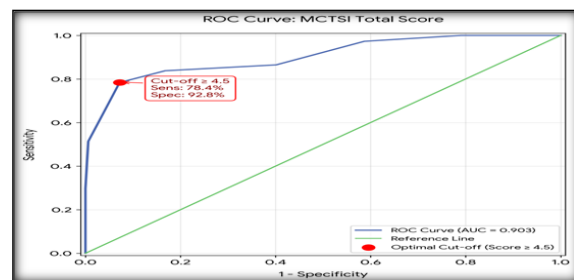


Figure 4: ROC Curve demonstrating the performance of the MCTSI Total Score

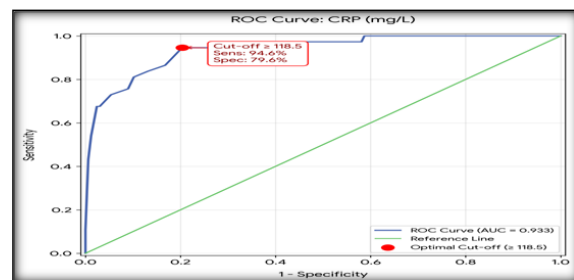


Figure 5: ROC Curve demonstrating the performance of CRP Value

DISCUSSION

Early recognition of severe acute pancreatitis (SAP) is essential for triage to intensive care and for reducing mortality. In our study, 18.1% of patients presented with severe disease, which is comparable to incidence rates in Indian population.^[13] We analysed the prognostic accuracy of different scoring systems (APACHE II, BISAP, MCTSI, Ranson's) and of the serum biomarker C-reactive protein (CRP). Our results show that CRP, APACHE II and BISAP have an excellent discriminatory capacity and surpass the performance of the traditional Ranson's criteria.

C-reactive protein turned out to be the best gauge for severity in our study, with an AUC of 0.933. While studies refer to CRP cutoff of 150 mg/L for predicting severity - highly specificity with poor sensitivity,^[14] With a satisfactory specificity of 79.6% and an excellent sensitivity of 94.6%, we discovered an ideal cutoff of > 118.5 mg/L. These findings find good support in prominent Indian studies.^[15]

APACHE II and BISAP had similar, high AUCs of 0.927.^[14] intricate physiological indicators must be evaluated for the APACHE II score, which can be difficult and frequently lacking at first. However, Kumar et al. discovered that APACHE II showed a little higher statistical accuracy to predict late organ failure than BISAP in a similar North Indian group.^[13] While we found overall equal AUCs, BISAP (cutoff > 1.5) had a great positive predictive value (85.7%) and high specificity (97.6%), while APACHE II (cutoff ≥ 7.5) was more sensitive to late organ failures but had a lower PPV (47.8%). BISAP provides the best predictive performance and bedside practicality, according to similar

comparative research conducted in Indian cohorts.^[16]

An MCTSI score of ≥ 4.5 had the highest specificity (92.8%) of the imaging criteria in our analysis. The MCTSI is a more straightforward and accurate scoring tool than the conventional CTSI, according to regional studies conducted by Banday et al. and others.^[13,17] However, in order to distinguish pancreatic necrosis, imaging is typically not advised until 48 to 72 hours following the onset of symptoms. Hence it can best be used to identify local complications later in the course of the condition, rather than as an early severity triage tool.

Lastly, Ranson's criteria showed the lowest overall accuracy in our cohort with an extremely low sensitivity of 37.8%. Combined with a need for a 48-hour observation period to complete scoring, its utility is extremely limited. Our results find good agreement with multiple Indian cohorts which have found Ranson's criteria to be prone to false positivity.^[15,16]

Limitations

The small sample size of the current single-center investigation is a drawback, and bigger multi-center trials are required to prospectively validate the diagnostic cutoffs. Additionally, there was no comparison of novel inflammatory biomarkers.

CONCLUSION

The most reliable and useful methods for determining the severity of acute pancreatitis in patients are the BISAP score and C-reactive protein. Although it uses fewer variables and is favoured for quick bedside assessment, the BISAP score seems to be comparable to APACHE II in terms of outcome prediction.

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