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Original Article

Comparison of Scoring System (Ranson's vs BISAP) for Prediction of Morbidity and Mortality in Patients of Acute Pancreatitis

Hassan Javed[1], Manzoor Qader[1], Ahmed Bilal[1], Muhammad Uzair[1], Ayesha Saddiqua[1], Muhammad Arslan Javaid[1]

[1] Pak Emirates Military Hospital, Rawalpindi, Pakistan

***Corresponding author: Hassan Javed, megamind9211@gmail.com**

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ABSTRACT

Background: Early risk stratification in acute pancreatitis is essential for identifying patients at risk of severe disease, organ failure, intensive care admission, and mortality. Ranson's criteria are comprehensive but require 48 hours for completion, whereas the Bedside Index of Severity in Acute Pancreatitis (BISAP) is simpler and available within the first 24 hours. Objective: To compare the diagnostic performance of Ranson's criteria and BISAP score for predicting severe acute pancreatitis, composite morbidity, and in-hospital mortality. Methods: This prospective observational diagnostic and prognostic accuracy study was conducted at the Department of Gastroenterology, Pak Emirates Military Hospital, Rawalpindi, from July 2023 to June 2024. A total of 120 adult patients with acute pancreatitis were enrolled consecutively. BISAP was calculated within 24 hours and Ranson's criteria at 48 hours. Severe acute pancreatitis was classified according to the Revised Atlanta Classification. Diagnostic accuracy measures, receiver operating characteristic analysis, and morbidity associations were assessed at a cutoff score of ≥3. Results: Severe acute pancreatitis occurred in 40 patients (33.3%), and in-hospital mortality occurred in 10 patients (8.3%). For severity prediction, Ranson's criteria showed sensitivity of 100.0%, specificity of 81.2%, PPV of 72.7%, NPV of 100.0%, and AUC of 0.942, while BISAP showed sensitivity of 60.0%, specificity of 96.2%, PPV of 88.9%, NPV of 82.8%, and AUC of 0.896. The AUC difference was not statistically significant. For mortality prediction, Ranson's criteria were more sensitive, while BISAP was more specific. Conclusion: Ranson's criteria provided superior sensitivity and rule-out value after 48 hours, whereas BISAP offered superior specificity and earlier rule-in value within 24 hours. Sequential use of BISAP followed by Ranson's criteria may offer a pragmatic approach to risk stratification, although further multicenter validation is required. Keywords: Acute pancreatitis, BISAP score, Ranson's criteria, Severity prediction, Morbidity, Mortality.

INTRODUCTION

Acute pancreatitis is one of the most common gastrointestinal emergencies requiring hospital admission and is associated with a wide clinical spectrum ranging from mild interstitial inflammation to severe necrotizing disease complicated by persistent organ failure, systemic inflammatory response, prolonged hospitalization, intensive care admission, and death. Its global incidence has increased over recent decades, contributing substantially to emergency and inpatient gastroenterology workload across both high-income and resource-limited healthcare systems (1). Although most patients experience a mild and self-limiting course, a clinically important proportion progress to moderately severe or severe acute pancreatitis, in which mortality rises markedly, particularly when persistent organ failure, infected

necrosis, or multiorgan dysfunction develops (2,3). This heterogeneity in clinical course makes early risk stratification a central component of acute pancreatitis management.

Early identification of patients at risk of severe disease has direct clinical implications because timely triage can guide the intensity of monitoring, fluid resuscitation, analgesia, nutritional support, imaging decisions, intensive care referral, and multidisciplinary involvement. Conversely, delayed recognition of high-risk patients may result in missed opportunities for early escalation of care, whereas overestimation of severity may expose low-risk patients to unnecessary investigations, prolonged admission, and avoidable resource utilization. Several clinical, biochemical, radiological, and composite scoring systems have therefore been developed to predict disease severity and adverse outcomes in acute pancreatitis, but their performance varies according to timing of assessment, population characteristics, disease etiology, available investigations, and the reference standard used for severity classification (4,5).

Ranson's criteria remain among the earliest and most widely recognized prognostic tools for acute pancreatitis. The system incorporates eleven clinical and laboratory variables, five assessed at admission and six reassessed at forty-eight hours, including age, white blood cell count, blood glucose, serum lactate dehydrogenase, aspartate aminotransferase, hematocrit fall, blood urea nitrogen change, serum calcium, arterial oxygen tension, base deficit, and estimated fluid sequestration. A score of three or more has traditionally been used to identify patients at increased risk of severe disease and adverse outcomes (6). Despite its long-standing clinical use, the principal limitation of Ranson's criteria is that complete scoring requires forty-eight hours, which may delay definitive risk classification during the early therapeutic window when escalation decisions are often most critical (7).

The Bedside Index of Severity in Acute Pancreatitis, commonly known as the BISAP score, was introduced as a simpler and earlier prognostic alternative. BISAP uses five parameters available within the first twenty-four hours of presentation: blood urea nitrogen greater than 25 mg/dL, impaired mental status, systemic inflammatory response syndrome, age above sixty years, and pleural effusion. A BISAP score of three or more has been associated with increased risk of severe acute pancreatitis and mortality (8). Its practical appeal lies in its simplicity, early availability, and reliance on routinely accessible bedside and laboratory variables. However, because BISAP uses fewer variables and is calculated earlier in the disease course, its sensitivity for later severe disease may differ from more comprehensive delayed systems such as Ranson's criteria.

The Revised Atlanta Classification provides a standardized framework for defining acute pancreatitis severity as mild, moderately severe, or severe, based on the presence of local or systemic complications and the duration of organ failure. Under this classification, severe acute pancreatitis is defined by persistent organ failure lasting more than forty-eight hours, while moderately severe disease includes transient organ failure, local complications, or exacerbation of comorbid disease without persistent organ failure (9). This classification has become an accepted reference standard for evaluating prognostic tools and is incorporated into contemporary clinical guidance for acute pancreatitis management (10). Accurate comparison of scoring systems should therefore clearly define the reference standard, timing of index test assessment, cutoff thresholds, and outcome categories.

Previous comparative studies and meta-analyses have reported variable findings regarding the relative diagnostic performance of Ranson's criteria and BISAP. Some studies suggest that both systems have broadly comparable discriminatory performance, while others report that Ranson's criteria may be more sensitive and BISAP more specific for identifying severe disease (11–13). These differences may reflect variation in case mix, etiological patterns, timing of hospital presentation, availability of imaging, and baseline probability of severe pancreatitis. In South Asian settings, where gallstone-related, metabolic, idiopathic, and procedure-related pancreatitis are commonly encountered and where advanced prognostic systems such as APACHE-II or CT-based scoring may not always be feasible at first contact, a pragmatic comparison between Ranson's criteria and BISAP remains clinically relevant (14).

Local evidence from Pakistan has produced useful but not fully consistent conclusions, and further institution-specific data are needed to clarify how these scoring systems perform in tertiary-care populations with different referral patterns and resource constraints (15,16). In this context, the relevant clinical question is whether an early, simple bedside score such as BISAP can provide sufficiently reliable prognostic information compared with the more comprehensive but delayed Ranson's criteria. Therefore, this study aimed to compare the diagnostic performance of Ranson's criteria and BISAP score at a cutoff of three or more for predicting severe acute pancreatitis according to the Revised Atlanta Classification, and for assessing their association with composite morbidity and in-hospital mortality among adult patients admitted with acute pancreatitis at a tertiary care military hospital.

MATERIALS AND METHODS

This prospective observational diagnostic and prognostic accuracy study was conducted in the Department of Gastroenterology, Pak Emirates Military Hospital, Rawalpindi, Pakistan, over a twelve-month period from 1 July 2023 to 30 June 2024. The study was designed to compare two index prognostic tools, Ranson's criteria and the BISAP score, for predicting severe acute pancreatitis and adverse in-hospital outcomes among adult patients presenting with acute pancreatitis. Disease severity classified according to the Revised Atlanta Classification was used as the clinical reference standard for severity assessment (9).

Adult patients of either sex aged eighteen years or older were eligible for inclusion if they presented with a confirmed diagnosis of acute pancreatitis during the study period. Acute pancreatitis was diagnosed when at least two of the following three criteria were present: characteristic acute upper abdominal pain suggestive of pancreatitis, serum amylase or lipase level at least three times the upper limit of normal, and imaging findings consistent with acute pancreatitis on abdominal ultrasonography, computed tomography, or other clinically indicated cross-sectional imaging. Patients were excluded if they were younger than eighteen years, presented more than seventy-two hours after symptom onset, had known chronic pancreatitis or pancreatic malignancy, were pregnant, or had incomplete laboratory or clinical records required for calculation of either scoring system or outcome classification.

Participants were enrolled by non-probability consecutive sampling to minimize selection bias among eligible patients admitted during the study period. Written informed consent was obtained from each participant or from the next of kin when the patient was clinically unable to provide consent at presentation. All patients underwent initial clinical assessment at admission, including demographic documentation, presenting symptoms, comorbidities, relevant etiological risk factors, physical examination findings, and baseline disease characteristics. Etiology was categorized using available clinical, laboratory, imaging, and procedural information, including gallstone-related pancreatitis, hypertriglyceridemia-associated pancreatitis, post-endoscopic retrograde cholangiopancreatography pancreatitis, and idiopathic pancreatitis where no definite cause was identified.

Baseline investigations were obtained within the first twenty-four hours of admission and included complete blood count, serum amylase, serum lipase, liver function tests, serum calcium, renal function tests, blood glucose, C-reactive protein, arterial blood gases, and serum lactate dehydrogenase. Abdominal ultrasonography was performed at admission where feasible, and contrast-enhanced computed tomography was obtained when clinically indicated for diagnostic confirmation, assessment of complications, or evaluation of disease progression. Follow-up clinical and laboratory parameters were recorded at forty-eight hours to complete Ranson's criteria. Data were collected using a structured study proforma to ensure uniform documentation of scoring variables, severity classification, morbidity outcomes, and mortality status.

The BISAP score was calculated within the first twenty-four hours of admission using five variables: blood urea nitrogen greater than 25 mg/dL, impaired mental status defined as Glasgow Coma Scale score below 15, presence of systemic inflammatory response syndrome, age greater than sixty years, and

pleural effusion on chest imaging or computed tomography. One point was assigned for each variable, producing a total score ranging from zero to five. Ranson's criteria were calculated using the standard eleven-variable model, with five variables assessed at admission and six variables reassessed at forty-eight hours. For both scoring systems, a cutoff score of three or more was used to classify patients as predicted high risk for severe acute pancreatitis.

The primary outcome was severe acute pancreatitis according to the Revised Atlanta Classification. Severity was determined independently from the scoring systems using clinical course, organ failure status, imaging findings, and systemic or local complications. Severe acute pancreatitis was defined by persistent organ failure lasting longer than forty-eight hours. Mild acute pancreatitis was defined by absence of organ failure and absence of local or systemic complications. Patients with transient organ failure, local complications, or systemic complications without persistent organ failure were assessed under the moderately severe category according to the Revised Atlanta framework; for diagnostic accuracy analysis, severity was dichotomized as severe versus non-severe acute pancreatitis to enable calculation of sensitivity, specificity, predictive values, and accuracy. The secondary outcomes were composite in-hospital morbidity and in-hospital mortality. Composite morbidity was defined as the occurrence of at least one of the following during admission: organ failure, pancreatic necrosis, or intensive care unit admission. Because these morbidity components can overlap, each component was recorded separately and not treated as mutually exclusive.

To reduce classification bias, scoring variables were recorded according to predefined operational definitions, and severity was assessed using the Revised Atlanta Classification rather than subjective clinical impression alone. The timing of index test assessment was standardized, with BISAP calculated within twenty-four hours and Ranson's criteria completed at forty-eight hours. Patients presenting after seventy-two hours of symptom onset were excluded to reduce heterogeneity caused by delayed presentation and incomplete early physiological data. Consecutive enrolment was used to reduce selective inclusion of more severe or more accessible cases. Potential confounding by age, sex, body mass index, disease etiology, and baseline clinical status was considered during interpretation because these variables may influence both scoring-system values and clinical outcomes.

The sample-size rationale was based on diagnostic accuracy estimation for sensitivity and specificity. Using a reported sensitivity of 85% for Ranson's criteria, a 95% confidence level, and an absolute precision of 10%, the minimum number of patients with severe disease required for sensitivity estimation was calculated using the formula $n = Z^2 \times SN \times (1 - SN) / L^2$, where $Z = 1.96$, $SN = 0.85$, and $L = 0.10$, giving an estimated requirement of approximately 49 severe cases (17). Assuming an anticipated severe acute pancreatitis prevalence of approximately 30%, this calculation would require a larger total sample than 120 patients to achieve the planned number of severe cases. During the fixed twelve-month recruitment period, 120 consecutive eligible patients were enrolled, and the diagnostic analyses were therefore interpreted in light of the observed number of severe and mortality events.

Data were entered and analyzed using IBM SPSS Statistics version 24.0. Quantitative variables were summarized as means and standard deviations after assessment of distributional characteristics, while categorical variables were summarized as frequencies and percentages. Baseline characteristics and clinical outcomes were compared between severe and non-severe groups using independent-samples t-test or Mann–Whitney U test for continuous variables, depending on distribution, and chi-square test or Fisher's exact test for categorical variables, depending on expected cell counts. Diagnostic performance of Ranson's criteria and BISAP score at the predefined cutoff of three or more was evaluated by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy with 95% confidence intervals. Receiver operating characteristic curve analysis was used to estimate the area under the curve for each scoring system, and AUC values were compared using an appropriate paired ROC comparison method. Associations between score category and morbidity outcomes were assessed using odds ratios with 95% confidence intervals. Mortality prediction was

analyzed separately because of the lower number of death events, and mortality-related estimates were interpreted cautiously.

All available eligible records were checked for completeness before final analysis. Patients with missing variables required for either Ranson's criteria, BISAP calculation, Revised Atlanta severity classification, or in-hospital outcome assessment were excluded according to the predefined eligibility criteria. Data were cross-checked against source clinical records and laboratory reports before analysis to reduce transcription errors. The study was conducted after institutional ethical review approval and in accordance with principles of human-subject research, including informed consent, confidentiality of participant data, anonymized analysis, and restriction of identifiable information to authorized study personnel only.

RESULTS

A total of 120 patients with acute pancreatitis were included in the final analysis. According to the Revised Atlanta Classification, 40 patients were classified as having severe acute pancreatitis and 80 as having non-severe disease for diagnostic accuracy analysis. The mean age of the study population was higher among patients with severe disease than among those with non-severe disease, with a mean difference of 9.8 years (95% CI: 4.49 to 15.11; p<0.001). Body mass index was also significantly higher in the severe group, with a mean difference of 2.3 kg/m² (95% CI: 0.30 to 4.30; p=0.024). Sex distribution and gallstone etiology did not differ significantly between severity groups. Mean BISAP and Ranson's scores were both significantly elevated among patients with severe acute pancreatitis, and hospital stay was markedly prolonged in the severe group by a mean of 16.5 days (95% CI: 13.13 to 19.87; p<0.001), indicating a strong clinical gradient between disease severity and resource utilization.

Table 1. Baseline Demographic and Clinical Characteristics Stratified by Disease Severity

Variable	Non-Severe AP (n=80)	Severe AP (n=40)	Effect Estimate	95% CI	p-value
Age, years, mean ± SD	48.2 ± 14.1	58.0 ± 13.6	Mean difference: 9.8	4.49 to 15.11	<0.001
Male sex, n (%)	39 (48.8)	21 (52.5)	OR: 1.16	0.54 to 2.48	0.847
BMI, kg/m², mean ± SD	27.5 ± 4.9	29.8 ± 5.3	Mean difference: 2.3	0.30 to 4.30	0.024
Gallstone etiology, n (%)	50 (62.5)	24 (60.0)	OR: 0.90	0.41 to 1.96	0.843
BISAP score, mean ± SD	0.76 ± 0.82	2.80 ± 1.14	Mean difference: 2.04	1.64 to 2.44	<0.001
Ranson's score, mean ± SD	1.59 ± 1.21	6.30 ± 1.85	Mean difference: 4.71	4.06 to 5.36	<0.001
Hospital stay, days, mean ± SD	9.7 ± 3.4	26.2 ± 10.3	Mean difference: 16.5	13.13 to 19.87	<0.001

AP: acute pancreatitis; BMI: body mass index; BISAP: Bedside Index of Severity in Acute Pancreatitis; CI: confidence interval; OR: odds ratio; SD: standard deviation.

Ranson's criteria at a cutoff of ≥3 identified all 40 patients with severe acute pancreatitis, giving a sensitivity of 100.0% (95% CI: 91.2 to 100.0) and a negative predictive value of 100.0% (95% CI: 94.4 to 100.0). However, 15 patients without severe disease were classified as high risk by Ranson's criteria, resulting in a specificity of 81.2% (95% CI: 71.3 to 88.3) and positive predictive value of 72.7% (95% CI: 59.8 to 82.7). In comparison, BISAP ≥3 identified 24 of the 40 severe cases and missed 16, producing lower sensitivity at 60.0% (95% CI: 44.6 to 73.7) but higher specificity at 96.2% (95% CI: 89.5 to 98.7). The positive predictive value of BISAP was 88.9% (95% CI: 71.9 to 96.1), reflecting strong rule-in performance when the score was ≥3. Overall diagnostic accuracy was similar between Ranson's criteria and BISAP, and the difference in AUC was not statistically significant.

Table 2. Diagnostic Accuracy of Ranson's Criteria and BISAP Score for Predicting Severe Acute Pancreatitis at Cutoff ≥3

Diagnostic Parameter	Ranson's Criteria	BISAP Score	p-value
True positive / False negative	40 / 0	24 / 16	—
False positive / True negative	15 / 65	3 / 77	—
Sensitivity, % (95% CI)	100.0 (91.2–100.0)	60.0 (44.6–73.7)	<0.001
Specificity, % (95% CI)	81.2 (71.3–88.3)	96.2 (89.5–98.7)	0.004
Positive predictive value, % (95% CI)	72.7 (59.8–82.7)	88.9 (71.9–96.1)	0.113
Negative predictive value, % (95% CI)	100.0 (94.4–100.0)	82.8 (73.9–89.1)	0.001

Diagnostic Parameter	Ranson's Criteria	BISAP Score	p-value
Diagnostic accuracy, % (95% CI)	87.5 (80.4–92.3)	84.2 (76.6–89.6)	0.476
AUC (95% CI)	0.942 (0.90–0.98)	0.896 (0.84–0.95)	0.231

AUC: area under the receiver operating characteristic curve; BISAP: Bedside Index of Severity in Acute Pancreatitis; CI: confidence interval.

For in-hospital mortality prediction, 10 deaths occurred in the study cohort. Ranson's criteria ≥3 identified 8 of these deaths, yielding a sensitivity of 80.0% (95% CI: 49.0 to 94.3), whereas BISAP ≥3 identified 6 deaths, yielding a sensitivity of 60.0% (95% CI: 31.3 to 83.2). BISAP demonstrated superior specificity for mortality prediction at 80.9% (95% CI: 72.6 to 87.2), compared with 57.3% (95% CI: 47.9 to 66.1) for Ranson's criteria. The positive predictive values were low for both tools because mortality was an infrequent outcome, but both scores showed high negative predictive values above 95%. The AUCs for mortality prediction were statistically comparable.

Table 3. Diagnostic Accuracy of Ranson's Criteria and BISAP Score for Predicting In-Hospital Mortality at Cutoff ≥3

Diagnostic Parameter	Ranson's Criteria	BISAP Score	p-value
True positive / False negative	8 / 2	6 / 4	—
False positive / True negative	47 / 63	21 / 89	—
Sensitivity, % (95% CI)	80.0 (49.0–94.3)	60.0 (31.3–83.2)	0.325
Specificity, % (95% CI)	57.3 (47.9–66.1)	80.9 (72.6–87.2)	0.001
Positive predictive value, % (95% CI)	14.5 (7.6–26.2)	22.2 (10.6–40.8)	0.386
Negative predictive value, % (95% CI)	96.9 (89.5–99.2)	95.7 (89.5–98.3)	0.712
Diagnostic accuracy, % (95% CI)	59.2 (50.2–67.5)	79.2 (71.1–85.5)	—
AUC (95% CI)	0.874 (0.78–0.97)	0.838 (0.72–0.96)	0.412

AUC: area under the receiver operating characteristic curve; BISAP: Bedside Index of Severity in Acute Pancreatitis; CI: confidence interval.

Both scoring systems were significantly associated with clinically important morbidity outcomes. Patients with Ranson's criteria ≥3 had markedly higher odds of organ failure (OR: 23.05; 95% CI: 6.45 to 82.40; p<0.001), pancreatic necrosis (OR: 12.92; 95% CI: 2.82 to 59.28; p<0.001), ICU admission (OR: 12.71; 95% CI: 4.05 to 39.83; p<0.001), and mortality (OR: 5.36; 95% CI: 1.09 to 26.42; p=0.042). Similarly, BISAP ≥3 was strongly associated with organ failure (OR: 11.29; 95% CI: 4.23 to 30.11; p<0.001), pancreatic necrosis (OR: 11.60; 95% CI: 3.77 to 35.65; p<0.001), ICU admission (OR: 8.95; 95% CI: 3.41 to 23.51; p<0.001), and mortality (OR: 6.36; 95% CI: 1.65 to 24.56; p=0.009). Hospital stay was substantially longer among patients classified as high risk by either scoring system, with a mean difference of 12.8 days for Ranson's criteria ≥3 and 14.6 days for BISAP ≥3.

Table 4. Association of Ranson's Criteria and BISAP Score Categories with Morbidity Outcomes

Outcome	Ranson ≥3 (n=55)	Ranson <3 (n=65)	OR (95% CI)	p-value	BISAP ≥3 (n=27)	BISAP <3 (n=93)	OR (95% CI)	p-value
Organ failure, n (%)	29 (52.7)	3 (4.6)	23.05 (6.45–82.40)	<0.001	18 (66.7)	14 (15.1)	11.29 (4.23–30.11)	<0.001
Pancreatic necrosis, n (%)	16 (29.1)	2 (3.1)	12.92 (2.82–59.28)	<0.001	12 (44.4)	6 (6.5)	11.60 (3.77–35.65)	<0.001
ICU admission, n (%)	25 (45.5)	4 (6.2)	12.71 (4.05–39.83)	<0.001	16 (59.3)	13 (14.0)	8.95 (3.41–23.51)	<0.001
Mortality, n (%)	8 (14.5)	2 (3.1)	5.36 (1.09–26.42)	0.042	6 (22.2)	4 (4.3)	6.36 (1.65–24.56)	0.009
Hospital stay, days, mean ± SD	21.4 ± 11.2	8.6 ± 3.7	Mean difference: 12.8 days (9.65–15.95)	<0.001	25.8 ± 12.1	11.2 ± 6.8	Mean difference: 14.6 days (9.64–19.56)	<0.001

BISAP: Bedside Index of Severity in Acute Pancreatitis; CI: confidence interval; ICU: intensive care unit; OR: odds ratio; SD: standard deviation.

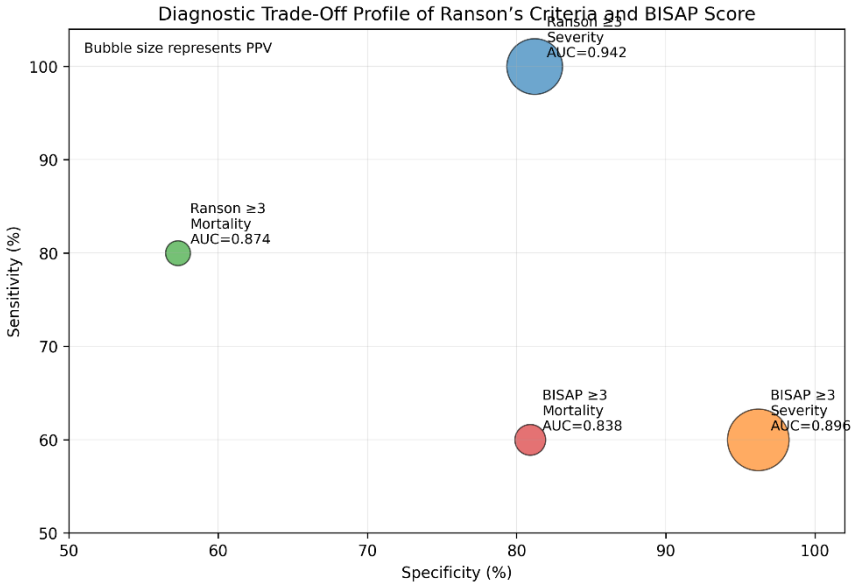

Figure 1. Diagnostic Trade-Off Profile of Ranson's Criteria and BISAP Score

Figure 1 demonstrates the clinically distinct diagnostic profiles of Ranson's criteria and BISAP score across severity and mortality prediction. For severe acute pancreatitis, Ranson's criteria occupied the high-sensitivity zone with 100.0% sensitivity, 81.2% specificity, PPV of 72.7%, and AUC of 0.942, supporting its value as a rule-out tool when the score is below 3. BISAP showed a contrasting high-specificity profile, with 96.2% specificity, 88.9% PPV, and AUC of 0.896, indicating stronger rule-in value when the score is 3 or higher. For mortality, both systems showed lower PPV because only 10 deaths occurred, but Ranson's maintained higher sensitivity at 80.0%, whereas BISAP retained higher specificity at 80.9%. This pattern supports a sequential clinical interpretation in which BISAP may assist early high-risk triage within 24 hours, while Ranson's criteria may provide more sensitive reassessment after 48 hours.

DISCUSSION

In the present study, Ranson's criteria and the BISAP score both demonstrated clinically meaningful prognostic value for acute pancreatitis, but their diagnostic profiles differed in ways that are directly relevant to bedside decision-making. Ranson's criteria showed very high sensitivity for severe acute pancreatitis, identifying all patients classified as severe by the Revised Atlanta Classification, while BISAP demonstrated substantially higher specificity. This pattern suggests that Ranson's criteria may be more useful for ruling out severe disease when the score remains below 3, whereas BISAP may be more useful for ruling in clinically significant risk when the score is 3 or higher. The findings should be interpreted within the framework of the Revised Atlanta Classification, which emphasizes persistent organ failure as the defining feature of severe acute pancreatitis and provides a standardized reference for prognostic evaluation (18).

The baseline characteristics showed that patients with severe acute pancreatitis were older, had higher body mass index, higher BISAP and Ranson's scores, and substantially longer hospital stay than those with non-severe disease. These differences are clinically plausible because increasing age, metabolic burden, systemic inflammatory response, and early organ dysfunction are recognized contributors to adverse outcomes in acute pancreatitis. The absence of significant differences in sex distribution and gallstone etiology suggests that the prognostic separation observed in this cohort was driven more by physiological severity and systemic response than by demographic sex distribution or gallstone status alone. The markedly longer hospital stay among patients with severe disease further supports the clinical relevance of the severity classification, as prolonged admission reflects greater need for monitoring, supportive care, management of complications, and resource utilization.

The high sensitivity and negative predictive value of Ranson's criteria for severity prediction are important findings. In this cohort, no patient with a Ranson's score below 3 developed severe acute pancreatitis, supporting the value of Ranson's criteria as a rule-out tool after completion of the 48-hour assessment. This is consistent with previous comparative work showing that traditional multi-variable scores often retain strong sensitivity because they incorporate both admission variables and evolving physiological changes during early hospitalization (19). However, this benefit comes with an important practical limitation: Ranson's criteria cannot be fully calculated at first presentation. In acute pancreatitis, many early decisions regarding fluid resuscitation, level of monitoring, imaging, and possible intensive care referral must be made within the first 24 hours. Therefore, although Ranson's criteria performed strongly in this study, its delayed availability limits its role as the sole early triage tool.

BISAP showed a contrasting profile. Its sensitivity for severe acute pancreatitis was lower than that of Ranson's criteria, meaning that a proportion of patients who later developed severe disease had BISAP scores below 3 during the first 24 hours. However, its specificity and positive predictive value were superior, indicating that patients with BISAP ≥3 were highly likely to have or develop severe disease. This pattern aligns with previous evidence that BISAP is simple, early, and clinically practical but may sacrifice sensitivity because it uses only five variables measured early in the disease course (20). In resource-limited or high-volume clinical settings, this specificity is useful because a high BISAP score can identify patients who warrant closer monitoring, early senior review, or escalation of care. Nevertheless, a BISAP score below 3 should not be interpreted as complete reassurance when clinical deterioration, persistent systemic inflammatory response, rising urea, hypocalcemia, worsening pain, or evolving organ dysfunction is present.

The AUC values for severity prediction were high for both systems, with Ranson's criteria showing a numerically higher AUC than BISAP. However, the difference was not statistically significant. This finding is important because it prevents an over-simplified conclusion that one scoring system is globally superior. Instead, the two tools appear to offer complementary clinical information. Ranson's criteria provided stronger sensitivity and rule-out value, while BISAP provided stronger specificity and earlier rule-in value. Previous comparative studies have similarly shown overlapping performance between Ranson's criteria, BISAP, APACHE-II, and CT-based indices, with no single tool consistently outperforming all others across all endpoints (21–23). The present findings therefore support a balanced interpretation: scoring systems should assist clinical judgment but should not replace serial assessment, biochemical monitoring, imaging where indicated, and recognition of evolving organ failure.

For mortality prediction, Ranson's criteria again demonstrated higher sensitivity, whereas BISAP showed higher specificity. Both tools had high negative predictive values, but their positive predictive values were low because mortality occurred in only 10 patients. This is a predictable statistical effect when the outcome is uncommon: even a clinically useful test may have limited positive predictive value when event frequency is low. Therefore, the mortality results should be interpreted cautiously and should not be overextended beyond the observed in-hospital event rate. The wide uncertainty expected around mortality estimates also reinforces the need for larger multicenter studies before making firm conclusions about mortality prediction. Similar concerns have been raised in prior prognostic studies of acute pancreatitis, where score performance varied depending on outcome frequency, disease severity distribution, and referral setting (24–27).

The morbidity analysis further supports the clinical utility of both scoring systems. Patients with Ranson's criteria ≥3 and BISAP ≥3 had significantly higher odds of organ failure, pancreatic necrosis, ICU admission, mortality, and prolonged hospital stay. These associations indicate that both scoring systems capture clinically meaningful risk gradients, not merely statistical separation. BISAP ≥3 showed particularly strong associations with pancreatic necrosis, organ failure, and ICU admission, reflecting its utility as an early marker of serious disease. Ranson's criteria also showed strong associations across morbidity outcomes, which may reflect its incorporation of dynamic physiological deterioration at 48

hours. However, because organ failure forms part of both the Revised Atlanta severity definition and the composite morbidity endpoint, this overlap should be acknowledged when interpreting morbidity associations. The morbidity components are clinically important but not mutually exclusive, and their relationship with scoring systems should be interpreted as outcome association rather than independent causal prediction.

The practical implication of these findings is that a sequential approach may be more useful than reliance on either score alone. BISAP can be calculated within the first 24 hours and may help identify patients requiring early escalation, while Ranson's criteria can provide a more sensitive reassessment after 48 hours. This interpretation is consistent with the broader literature suggesting that simple early scores and more comprehensive delayed systems may serve different clinical purposes rather than competing as interchangeable tools (28). In settings where intensive care resources are limited, BISAP may assist early prioritization because of its high specificity, whereas Ranson's criteria may reduce missed severe cases once complete data are available. Such sequential use, however, was not directly tested in this study and should be considered a clinically reasonable interpretation rather than a validated management algorithm.

This study has several limitations. First, it was conducted at a single tertiary care military hospital, which may limit generalizability to community hospitals, non-military institutions, and centers with different referral patterns. Second, although consecutive enrolment was used, the final sample size included fewer severe cases than originally required by the sensitivity-based sample-size rationale, which may reduce precision around diagnostic estimates. Third, mortality occurred in only 10 patients, limiting the stability of mortality-specific sensitivity, specificity, and AUC estimates. Fourth, CT-based severity indices and APACHE-II were not included, preventing broader comparison with radiological and intensive-care prognostic systems. Fifth, although the Revised Atlanta Classification was used as the reference standard, the dichotomization of disease into severe and non-severe categories may reduce the granularity of the moderately severe category. Future studies should report mild, moderately severe, and severe acute pancreatitis separately while also presenting clinically relevant dichotomized analyses. Finally, because morbidity components such as organ failure and ICU admission may overlap with severity definitions and clinical decision-making, future multicenter prospective studies should prespecify independent endpoints, use blinded outcome adjudication where feasible, and include confidence intervals for all diagnostic estimates.

Despite these limitations, the study contributes useful local evidence regarding two commonly available prognostic tools for acute pancreatitis. Its findings reinforce that Ranson's criteria and BISAP should be interpreted according to their diagnostic strengths: Ranson's criteria provide higher sensitivity after 48 hours, whereas BISAP provides earlier and more specific risk identification. Until more advanced tools are routinely validated and accessible across resource-constrained settings, these established scoring systems remain practical aids to structured clinical assessment, especially when combined with serial examination, laboratory trends, imaging findings, and careful monitoring for organ failure (29,30).

CONCLUSION

Ranson's criteria and the BISAP score both demonstrated clinically useful prognostic performance in patients with acute pancreatitis, although their strengths differed. Ranson's criteria showed higher sensitivity and negative predictive value for identifying severe acute pancreatitis, making it more useful for ruling out severe disease after completion of the 48-hour assessment, whereas BISAP showed higher specificity and positive predictive value, supporting its role as an early rule-in tool within the first 24 hours of admission. Overall discriminatory performance for severity and mortality was statistically comparable between the two systems, while mortality estimates should be interpreted cautiously because of the small number of deaths. In clinical practice, the most important determinant of effective prognostication is not reliance on a single score, but active, timely decision-making through repeated

assessment of patients whose condition may change rapidly. Therefore, a pragmatic sequential approach using BISAP for early triage and Ranson's criteria for subsequent reassessment may improve risk stratification in resource-limited settings, although this strategy requires further validation in larger multicenter prospective studies.

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