RESEARCH PAPER

Assessing Prognostic Accuracy of BISAP versus Ranson's Score in Acute Pancreatitis: An Observational Study

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Abstract

Background*: The study evaluated the performance of Bed Side Index for Severity of Acute Pancreatitis (BISAP) and Ranson's scores in predicting severity and clinical outcomes (organ failure, ICU admission, mortality) in patients with acute pancreatitis.*

Methods*: A study was conducted on 96 patients with acute pancreatitis. BISAP scores were calculated within 24 hr of admission while Ranson's scores were assessed on admission and at 48 hr.*

Results*: Alcohol (50%) and gallstones (31%) were the most common etiologies. At admission, 78% of patients had Ranson scores 0-2 while 24% showed progression at 48 hr. The organ failure rates increased progressively with increasing BISAP scores [9% in scores 0-1, 21% in score 2, and 50% in scores ≥ 3 ($p< 0.001$)] and with Ranson's scores [2% in scores 0–2, 21% in 3–5, and 100% in ≥ 6 ($p< 0.001$)]. The patients with a BISAP score ≥3 had a 50% ICU admission, and all patients with a Ranson's score ≥6 needed ICU care. BISAP ≥3 was associated with 25% mortality, while deaths occurred in patients with Ranson ≥6 ($p = 1.9 \times 10^{-11}$). The length of hospital stay and readmission rates increased with severity of acute pancreatitis ($p< 0.001$).*

Conclusions*: BISAP score effectively identified severe cases, ICU need, and mortality risk within the first 24 hr. Although a Ranson score ≥6 showed perfect specificity, its sensitivity was comparatively lower. Ranson's score showed strong predictive power for mortality but relied on 48-hr data, thus limiting its use for immediate decision making.*

Keywords: *Acute pancreatitis, BISAP, Organ failure, Ranson*

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Introduction

Acute pancreatitis is an abrupt inflammation of the pancreas, presenting a clinical spectrum that ranges from mild symptoms to life-threatening severity. Acute pancreatitis affects million of people worldwide and its severity can result in organ failure, systemic complications, and even death. Therefore, early intervention is essential to help reduce mortality. [1] Various prognostic models have been developed to estimate the severity of acute pancreatitis. These include laboratory parameters, imaging and clinical assessments to stratify patients based on the risk of complications and mortality. Among the most widely used tools are the Ranson's scoring system and the Bedside Index for Severity in Acute Pancreatitis (BISAP) scoring system. Both these systems have been widely studied for their utility in clinical practice. [2,3,4]

The Ranson's scoring system, introduced in the 1970s, uses a set of parameters evaluated at admission and after 48 hours to predict disease severity. It requires extensive data collection over two days which can delay decision-making in acute settings. Despite these limitations, it remains a reference standard in many clinical settings. [5] In contrast, the BISAP scoring system has been designed for early and straightforward use. It is a more recent addition (developed in the 2000s) to severity assessment tools. BISAP uses five parameters such as blood urea nitrogen (BUN), impaired mental status (GCS<15), systemic inflammatory response syndrome (SIRS), age more than 60 years, and pleural effusion.

Severe acute pancreatitis is primarily characterized by the dysfunction of major organs, particularly the lungs, kidneys, and cardiovascular system. Several studies have assessed the correlation between scoring systems

and the risk of organ failure, providing insights into their validity and utility. Despite the wealth of evidence, inconsistencies in outcomes across different studies highlight the need for further comparative analysis. [6,7, 8]

An important challenge in managing acute pancreatitis is balancing diagnostic accuracy with ease of application. Ranson's score can be hard to use in low-resource settings, while the BISAP score is quicker but doesn't give as much detail about severity. [9] This challenge emphasizes the importance of evaluating both the tools to identify the most effective one. A very few studies have compared these prognostic scoring systems using the revised Atlanta classification [10]. Despite ongoing advancements in biomarkers and imaging technologies, scoring systems like BISAP and Ranson's remain essential components of clinical practice. [11,12] Therefore, the present study aims to compare the BISAP and Ranson's scoring systems in terms of their accuracy and validity in predicting severe outcomes, particularly organ failure, in patients with acute pancreatitis.

Material and Methods

Study Design

This study was approved by the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth, Krishna Institute of Medical Sciences, Karad, Maharashtra, India. (Ref. No.: KIMSDU/IEC/03/2023). A written informed consent was obtained for participation in the study and use of the patient data for research and educational purposes. The study was conducted in accordance with the Declaration of Helsinki and followed all applicable national regulations for human research. The study was carried out over 18 months, from May 2023 to December 2024.

Inclusion and exclusion criteria

A sample size of 96 patients was determined to estimate the prevalence with 95 % confidence and 10 % precision (assuming $p = 0.5$, $q = 0.5$, and $Z=1.96$). The participants aged 18 years or older diagnosed with acute pancreatitis, with presence of at least two symptoms like characteristic abdominal pain, serum amylase/lipase levels elevated three times the normal value and ultrasonography or CT showing findings consistent with acute pancreatitis were included in the study. The individuals with chronic pancreatitis, incomplete medical records or those lost to follow-up, those who did not provide written informed consent and pregnant or lactating women were excluded from the study.

Patients were followed for a maximum of 90 days post-admission, aligning with the study's aim to capture both immediate and short-term complications of acute pancreatitis. Patients admitted with acute pancreatitis during the study period were screened for inclusion.

Study groups

The patients were divided into two groups based on their risk stratification:1.Low-risk group which included patients with a BISAP or Ranson's score indicating mild or moderate disease, 2. High-risk group which included patients with scores indicating severe disease or complications. The parameters assessed included components of the BISAP score (blood urea nitrogen, impaired mental status [GCS < 15], SIRS, age > 60 years, and pleural effusion), components of the Ranson's score (age, blood glucose, LDH, AST, hematocrit fall, serum calcium, and PaO_2), clinical outcomes (duration of hospital stay, incidence of organ failure, pancreatic necrosis, and mortality), and laboratory and imaging findings (serum amylase and lipase levels, inflammatory markers, and imaging-confirmed necrosis or fluid collections).

Clinical outcomes

Eligible patients underwent a thorough clinical evaluation, including history-taking, physical examination, and laboratory investigations. The BISAP and Ranson's scores were calculated based on data collected on admission and within the first 48 hours of admission. Patients were managed according to standard treatment protocols, and their progress was documented. Follow-up visits were scheduled on Days 15, 30, 60, and 90 to monitor recovery and complications. Data were collected using standardized case report forms. Clinical and laboratory parameters were recorded at admission and during follow-up visits. Imaging studies, including ultrasonography and CT, were reviewed for findings consistent with acute pancreatitis. Outcomes, such as hospital stay, organ failure, and mortality, were documented systematically.

Data analysis

Data were analyzed using SPSS version (version, 20.0). The continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The comparisons of means across multiple groups (e.g., length of stay by severity, BISAP, and Ranson scores) were performed using one-way Analysis of Variance (ANOVA). Associations between categorical variables (e.g., organ failure, ICU need, mortality, and readmission) and severity scores were evaluated using the Chi-square (χ^2) test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant.

Results

Age and sex distribution

The cohort (n = 96) predominantly involved the 31-50 year age band (49%). Median age was 41 years, reflecting the age at which gall-stone and alcohol-related pancreatitis typically manifest. The male predominance was seen with 63% while females were 37%.

Etiology of acute pancreatitis

The most common cause of acute pancreatitis in our 96 patients was alcohol use (48 patients, 50%), followed by gallstones (30 patients, 31%). Hyper-triglyceridemia accounted for 10 cases (10%), and no identifiable cause (idiopathic) was found in 8 patients (8%).

BISAP score at admission

BISAP was calculated within 24 hr. Among the 96 patients, 46% (n-44) had a BISAP score of 1. About 25% (n-24) scored 2, and 19% (n-18) scored 3, 6% (n-6) scored 4, and only 4% (n-4) scored the maximum of 5. No deaths occurred below a score of 3.

Ranson's score at different time points

At admission, the majority of patients (78%) had a Ranson's score between 0–2, indicating mild disease. Only 6% had scores of 5 or higher. After 48 hours, the number of patients with higher scores increased, with 21% having scores between 5-11, reflecting disease progression in some individuals. Overall, 23 patients (24%) showed progression in Ranson's score, while 73 patients (76%) had no score progression. This highlights the importance of reassessment at 48 hours, as initial scores may underestimate severity in a subset of patients (Table 1).

Table 1: Distribution of subjects according to patients Ranson's Score at different time points

Ranson's Score Distribution on Admission		
Ranson's Score Distribution on Admission	Number of Individuals (n = 96)	Percentage wise Distribution (%)
0-2	75	78%
3-4	15	16%
5-6	5	5%
7-11	1	1%
Ranson's Score at 48 hours of Admission		
Ranson's Score Distribution at 48 hr	Number of Individuals (n = 96)	Percentage wise Distribution (%)
0-2	52	54%
3-4	24	25%
5-6	12	13%
7-11	8	8%
Ranson's Score Progression at 48 hrs of Admission		
Ranson's Score Progression at 48 hours	Number of Individuals (n = 96)	Percentage wise Distribution (%)
0-2	-23	-24%
3-4	9	9.4%
5-6	7	7.3%
7-11	7	7.3%
Total Ranson's Score Progression		
Total Progression Status	Number of Individuals (n = 96)	Percentage wise Distribution (%)
Score Progressed	23	24%
Score Not Progressed	73	76%

Organ failure incidence according to BISAP and Ranson scores

A strong association was observed between the severity scores and the incidence of organ failure. In patients with severe pancreatitis, 100% experienced organ failure, while none of the mild cases did. Organ failure rates increased progressively with increasing BISAP scores: 9% in scores 0-1, 21% in score 2, and 50% in scores ≥ 3 ($\chi^2 = 12.9$, $p<0.001$). Similarly, Ranson's score showed a clear trend: 2% organ failure with scores 0-2, 21% in 3-5, and 100% in ≥ 6 ($\chi^2 = 26.3$, $p<0.001$) (Table 2). These findings underscore the predictive utility of both BISAP and Ranson's scores for identifying patients at risk of organ failure.

Table 2: Organ failure incidence according to BISAP and Ranson scores

Distribution of subjects according to patients organ failure by severity			
Organ Failure by Severity	**No Failure**	**Failure**	**% Failure**
Mild	41	0	0
Moderate	32	5	14
Severe	0	18	100
Comparison between organ failure with BISAP			
Organ Failure vs BISAP	**No Failure**	**Failure**	**% Failure**
0–1	40	4	9

2	19	5	21
≥ 3	14	14	50
(χ^2 = 12.9, p < 0.001)			

Comparison between organ failure with Ranson			
Organ Failure vs Ranson	**No Failure**	**Failure**	**% Failure**
0–2	51	1	2
3–5	27	7	21
≥ 6	0	10	100
(χ^2 = 26.3, p < 0.001)			

ICU admission based on BISAP and Ranson scores

A significant association was observed between both BISAP and Ranson's scores and ICU admission (p<0.001). Among patients with BISAP scores ≥ 3, 50% (14 out of 28) required ICU care, compared to only 4 patients in the 0-1 score group. Similarly, ICU need increased with higher Ranson's scores. None of the patients with scores ≥ 6 avoided ICU care, while only 1 patient with a score of 0-2 required ICU (Table 3).

Table 3: Comparison between patients ICU need based on BISAP and Ranson's scores

ICU Need vs BISAP	**ICU No**	**ICU Yes**
0–1	40	4
2	19	5
≥ 3	14	14
(χ^2 = 19.6, p < 0.001)		
ICU Need vs Ranson	**ICU No**	**ICU Yes**
0–2	51	1
3–5	27	7
≥ 6	0	10
(χ^2 = 21.4, p < 0.001)		

Mortality versus BISAP and Ranson threshold

In patients with BISAP score ≥ 3, mortality was 25%, compared to only 1% in those with a score < 3 (Fisher's exact test, p = 0.0006), indicating a statistically significant association between higher BISAP scores and mortality. One patient with a BISAP score of 2 later progressed to a Ranson score of 6 and died, showing that while BISAP is generally good at predicting survival, it may occasionally miss severe cases. Similarly, all deaths occurred in patients with Ranson's score ≥ 6, resulting in a 44% mortality rate, while no deaths occurred in those with scores < 6 (Fisher's exact test, $p = 1.9 \times 10^{-11}$), confirming a very strong association between elevated Ranson's scores and risk of mortality (Table 4).

Table 4: Comparison between patients Mortality with BISAP and Ranson

Mortality vs BISAP	**Survivors**	**Deaths**	**Mortality %**
< 3	67	1	1
≥ 3	21	7	25
(Fisher p = 0.0006)			

Mortality vs Ranson	**Survivors**	**Deaths**	**Mortality %**
< 6	78	0	0
≥ 6	0	8	44
(Fisher $p = 1.9 \times 10^{-11}$)			

Hospital stay by severity, BISAP and Ranson's category

A significant increase in the length of hospital stay (LOS) was observed with increasing severity of acute pancreatitis (p < 0.001). Patients with mild disease had a mean LOS of 5 ± 2 days, those with moderate disease stayed for 9 ± 3 days, and those with severe pancreatitis had the longest stays of 16 ± 5 days. BISAP scores correlated with hospital stay duration. Patients with a BISAP score of 0–1 had a LOS of 7 ± 2 days, score of 2 had 8 ± 3 days, and those scoring ≥3 had significantly longer stays of 12 ± 4 days (p < 0.001). Mean hospital stay increased with rising Ranson scores: 9 days for mild, 12 for moderate, and 15 for severe cases (p < 0.001) (Table 5).

Table 5: Distribution of subjects according to patients Length of stay (LOS) by Severity, and by BISAP and Ranson's scores

Length of stay by Severity	**Mean ± SD (days)**
Mild	5 ± 2
Moderate	9 ± 3
Severe	16 ± 5
(ANOVA p < 0.001)	

Length of stay by BISAP	**Mean ± SD (days)**
0–1	7 ± 2
2	8 ± 3
≥ 3	12 ± 4
(ANOVA p < 0.001)	

Length of stay by Ranson's	Mean ± SD (days)
0-2	9 ± 2
3-5	12 ± 3
≥ 6	15 ± 4
(ANOVA $p < 0.001$)	

90-Day readmission rates

A significant association was found between the severity of acute pancreatitis and patient readmission rates ($\chi^2 = 6.4$, $p = 0.04$). Among patients with mild disease, 6 out of 41 (14.6%) were readmitted. In the moderate group, only 2 out of 37 (5.4%) were readmitted, while in the severe category, 2 out of 18 (11.1%) were readmitted.

Discussion

We performed a head-to-head evaluation of the BISAP and Ranson's scoring systems to assess their accuracy in predicting acute pancreatitis severity. The key findings were as follows. i. A BISAP score ≥3 showed 25% mortality rate, 50% organ failure rates and 50% ICU need, ii. No deaths occurred in the <3 BISAP group, supporting its high negative predictive value, iii. At admission, 78% of patients had a low Ranson's score (0–2), but 24% showed score progression by 48 hours, iv. Ranson's score demonstrated high specificity, especially at scores ≥6, where all patients required ICU care and mortality reached 44%, v. Both BISAP and Ranson's scores showed strong correlation with disease severity, organ failure, ICU admission, and mortality.

The demographic data revealed a predominant incidence of acute pancreatitis in males (63%) and in the 31–50 age group (49%). The most common etiologies identified were alcohol (50%) and gallstones (31%), followed by hypertriglyceridemia (10%) and idiopathic causes (8%). The high rates of alcohol related cases and younger age distribution could be because of its high consumption among males in rural and semi-urban India. [13, 14] Gallstone-related pancreatitis was more common in females and is often manageable with timely cholecystectomy.

In our study, 78% of patients had a Ranson's score between 0-2 on admission while only 6% had scores of 5 or more. However, by 48 hours, 24% had progressed to higher scores (5–11) indicating dynamic nature of acute pancreatitis. This delayed increase in scores shows the limitation of relying only on admission values to judge disease severity and reinforcing the need for reassessment within the first 48 hours.

The BISAP scores were calculated within the first 24 hours. Most patients (71%) had scores of 0–2, indicating a lower risk while 29% had scores ≥3 placing them in a higher risk group. No deaths occurred in <3 group, supporting the high negative predictive value of BISAP. These results align with previous studies by Swetha et al. [15] and Zhang et al. [13], who confirmed that BISAP scores ≥3 are effective in predicting severe outcomes. While BISAP offers a quick, easy way to assess severity using factors like age, BUN, SIRS, pleural effusion, and mental status, Ranson's score includes more detailed lab values that are available only after 48 hours. Our results are consistent with earlier studies [16, 17] emphasizing that Ranson's score is more useful for long-term severity prediction.

A strong association was observed between severity classification and organ failure rates in this study. No cases of organ failure were observed in mild disease while 100% of patients who had severe pancreatitis experienced organ failure. These results align with the Atlanta classification and support findings from Zhu et al., [18] who emphasized persistent organ failure as the defining hallmark of severity.

The Ranson's score was predictive, with failure rates of 2%, 21%, and 100% across scores <3, 3–5, and ≥6 resp. We observed that Ranson ≥ 6 delivered perfect specificity (no false positives) but sensitivity was lagging. Seven organ-failure cases were found within the 3–5 bracket.

The BISAP scores demonstrated a graded relationship with organ failure: 9% in scores 0–1, 21% in score 2, and 50% in scores ≥ 3, with a chi-square of 12.9 and a positive likelihood ratio (LR^+) of 10.5. In line with this, Gao et al. highlighted BISAP's early value in predicting complications like organ failure and death. [19] Singh et al. [20] reported a similar LR^+ of 9.8 in 150 patients, and Karki et al. [21] found an LR^+ of 8.3 in 42 patients, showing that these results are consistent across different sample sizes. Our LR^- of 0.11 outperformed Ranson's 0.4, underscoring BISAP's stronger ability to rule out severe disease. BISAP score is reported to have higher specificity (91%) and lower sensitivity for mortality (56%). [19] Hagjer & Kumar demonstrated better performance of BISAP than Ranson in prediction of organ failure and stated that Ranson and Glasgow scores require 48 hr for full calculation and depend on the data which sometimes is not routinely available at admission in resource limited settings. [22] In our cohort, seven missed cases had haemodilution that masked hematocrit decline. Thus, while Ranson's score showed perfect specificity, it lacked timeliness and sensitivity. This delay is partly

due to factors like serum calcium and hematocrit drop, which are affected by early fluid resuscitation.

The need for ICU admission increased significantly with rising BISAP and Ranson's scores. The patients with a BISAP score ≥3 had a 50% ICU admission rate and all those with a Ranson score ≥6 needed ICU admission. The mortality was strongly associated with both the scoring systems. BISAP ≥3 had a 25% mortality rate compared to 1% in lower scores. A single outlier death occurred in a patient initially classified as BISAP 2, who later progressed to Ranson 6, indicating that while BISAP has a strong negative predictive value, it may not be foolproof. In contrast, Ranson's score demonstrated perfect discriminatory ability in our cohort, with all deaths (n = 8) occurring in patients scoring ≥6. These findings support the continued use of Ranson's score as a reliable mortality predictor.

In the current study, length of hospital stay (LOS) correlated significantly with disease severity. The BISAP and Ranson's scores showed a similar trend wherein higher scores were associated with longer hospitalizations. This pattern aligns with a study by Yadav et al., [18] that reported longer admission duration in high-score groups. Mahajan et al. [14] also reported that Ranson's score ≥6 correlates with increased ICU admission and prolonged inpatient management. Interestingly, a higher proportion of readmissions occurred among patients with mild (14.6%) and severe (11.1%) disease as compared to moderate cases (5.4%). This may reflect inadequate follow up in mild cases or unresolved systemic inflammation in severe cases.

The major strength of this study is its prospective design and it involved participants from rural-urban area which reflects a pattern that closely matches with Indian epidemiology. We did not include APACHE-II or SOFA score comparisons, which limits direct evaluation against commonly used ICU severity metrics.

Conclusion

This study demonstrated that BISAP is a reliable and efficient tool for early risk assessment in acute pancreatitis. BISAP scoring showed a strong link with severe disease, ICU admission, and mortality making it highly useful within the first 24 hours. Although Ranson's score accurately predicted organ failure and mortality, it required 48-hour data, limiting its use for early decisions. Some patients had low initial scores but worsened later, highlighting the need for timely reassessment. Thus, BISAP should be used as the primary scoring method in emergency settings for its speed and practicality, while Ranson's score can support ongoing care and confirm the severity.

Declarations

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Author contributions

SR**:** Methodology, Validation, Formal analysis, Writing original draft; VK**:** Supervision, Project administration, Conceptualization, Manuscript review and editing.

Conflicts of interest statement

The authors declare that they have no competing financial interests.

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