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Bedside Index for Severity in Acute Pancreatitis (BISAP) for Predicting Severity and Outcomes: A Prospective Observational Study in A Tertiary Care Hospital

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ABSTRACT

Background: Acute pancreatitis (AP) is a common abdominal emergency with a variable clinical course. Early prediction of severity is crucial for reducing complications and mortality. The Bedside Index for Severity in Acute Pancreatitis (BISAP) score is a simple tool developed for early risk stratification. This study aimed to evaluate the applicability and accuracy of the BISAP score in predicting the severity, organ failure, and mortality in adult patients with AP.
Methods: A prospective observational study was conducted on 100 adult patients diagnosed with AP within 48 hours of symptom onset at a tertiary care hospital. The BISAP score was calculated for each patient within 24 hours of admission. Patients were followed for outcomes including organ failure (transient or persistent), length of hospital and ICU stay, and mortality. The sensitivity, specificity, and predictive values of the BISAP score were calculated using a receiver operating characteristic (ROC) curve.
Results: The mean age of patients was 36.65±12.62 years, with a male predominance (82%). Alcohol (57%) and gallstones (31%) were the leading aetiologies. Organ failure occurred in 42% of patients (19% transient, 23% persistent), and overall mortality was 18%. The mean BISAP score was 2.57±1.25. An optimal cut-off of ≥2.5 predicted organ failure with a sensitivity of 100%, specificity of 89.7%, positive predictive value of 87.5%, negative predictive value of 100%, and accuracy of 94% (AUC=0.985, $p<0.001$). A significant association was found between higher BISAP scores (≥2.5) and increased mortality ($p<0.001$).
Conclusion: The BISAP score, calculated within 24 hours of admission, is a simple, affordable, and highly accurate bedside tool for predicting organ failure and mortality in acute pancreatitis. It effectively stratifies patients, allowing early intensive care intervention for high-risk individuals.

Keywords: *Acute Pancreatitis, BISAP Score, Severity Prediction, Organ Failure, Mortality, Prognosis.*

INTRODUCTION

Acute pancreatitis (AP) is an inflammatory process of the pancreas with variable involvement of peripancreatic tissues and remote organ systems, leading to significant morbidity and mortality (Bradley, 1993). While most patients experience mild, self-limiting disease, approximately 15-20% develop severe acute pancreatitis (SAP) characterized by persistent organ failure and/or local complications like pancreatic necrosis, which carries a mortality rate of up to 30% (Banks et al., 2013; Ranson et al., 1974).

The cornerstone of improving outcomes in SAP is early identification of patients at risk, enabling timely aggressive fluid resuscitation, intensive monitoring, and nutritional support. Several prognostic scoring systems exist, including Ranson's criteria, Glasgow score, and APACHE-II. However, these systems have limitations: Ranson and Glasgow scores require 48 hours for completion, and APACHE-II involves numerous parameters, some of which are not readily available or relevant (Larvin & McMahon, 1989).

To address these deficiencies, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score was developed. It is a simple, five-point score (Blood Urea Nitrogen >25 mg/dL, Impaired Mental Status [GCS<15], SIRS, Age >60 years, Pleural effusion) that can be calculated within 24 hours of admission (Wu et al., 2008). The primary aim of this study was to prospectively evaluate the accuracy and clinical utility of the BISAP score in predicting the severity, organ failure, and mortality of acute pancreatitis in an adult Indian population in a tertiary care setting.

MATERIALS AND METHODS

2.1 Study Design and Setting

This was a prospective observational study conducted in the Department of General Surgery at a tertiary care hospital in Maharashtra, India, over a period of 18 months (1st January 2020 to 30th June 2021). Approval was obtained from the Institutional Ethics Committee for Academic Research Projects.

2.2 Participants

A total of 100 consecutive adult patients (age >18 years) diagnosed with acute pancreatitis were enrolled. Diagnosis was based on the presence of at least two of the following three criteria: (1) characteristic abdominal pain, (2) serum amylase and/or lipase ≥3 times the upper limit of normal, and (3) radiological evidence of AP on contrast-enhanced computed tomography (CECT) or ultrasound.

Patients with chronic pancreatitis, peptic ulcer disease, mesenteric vascular occlusion, pregnancy, or those not providing informed consent were excluded.

2.3 Study Procedure and Data Collection

After obtaining informed consent, demographic data, detailed medical history, and clinical examination findings were recorded. The BISAP score was calculated for each patient within 24 hours of hospital admission using the following components:

- BUN: Blood Urea Nitrogen >25 mg/dL (1 point).
- IMS: Impaired Mental Status (Glasgow Coma Scale <15) (1 point).
- SIRS: Presence of Systemic Inflammatory Response Syndrome (≥2 of: temperature <36°C or >38°C, heart rate >90/min, respiratory rate >20/min or PaCO2 <32 mmHg, WBC <4000 or >12000 cells/mm³ or >10% bands) (1 point).
- Age: >60 years (1 point).
- PE: Pleural effusion on chest X-ray (1 point).

The primary outcomes were the development of organ failure (transient <48 hours or persistent ≥48 hours, defined by the modified Marshall scoring system) and mortality. Secondary outcomes included length of hospital stay and intensive care unit (ICU) stay.

2.4 Statistical Analysis

Data were compiled in a Microsoft Excel spreadsheet and analyzed using descriptive statistics. Continuous variables were presented as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The optimal BISAP score cut-off for predicting organ failure was determined using a receiver operating characteristic (ROC) curve, calculating the area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The association between BISAP score categories and outcomes (organ failure, mortality) was assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

3.1 Baseline Characteristics of Study Subjects

A total of 100 patients were enrolled. The mean age was 36.65±12.62 years, with the highest incidence in the 31-40 age group (43%). Males (82%) significantly outnumbered females (18%). Alcohol (57%) was the predominant etiology, followed by gallstones (31%) and other causes (12%). The baseline demographic and clinical characteristics are summarized in Table 1.

Table 1: Baseline Characteristics of Study Participants (N=100)

Characteristic	Value
Age (years), mean ± SD	36.65 ± 12.62
Age > 60 years, n (%)	7 (7%)
Sex, n (%)	

Characteristic	Value
Male	82 (82%)
Female	18 (18%)
Aetiology, n (%)	
Alcohol	57 (57%)
Gallstones	31 (31%)
Others	12 (12%)
BISAP Score, mean ± SD	2.57 ± 1.25
ICU Stay (days), mean ± SD	2.39 ± 2.94
Total Hospital Stay (days), mean ± SD	6.85 ± 2.49
Mortality, n (%)	18 (18%)

3.2 BISAP Score Distribution and Outcomes

The distribution of BISAP scores is shown in Figure 1. A BISAP score of 2 was most common (30%), followed by score 4 (26%). Organ failure occurred in 42 patients (19% transient, 23% persistent). All patients with organ failure (n=42) had a BISAP score ≥2.5.

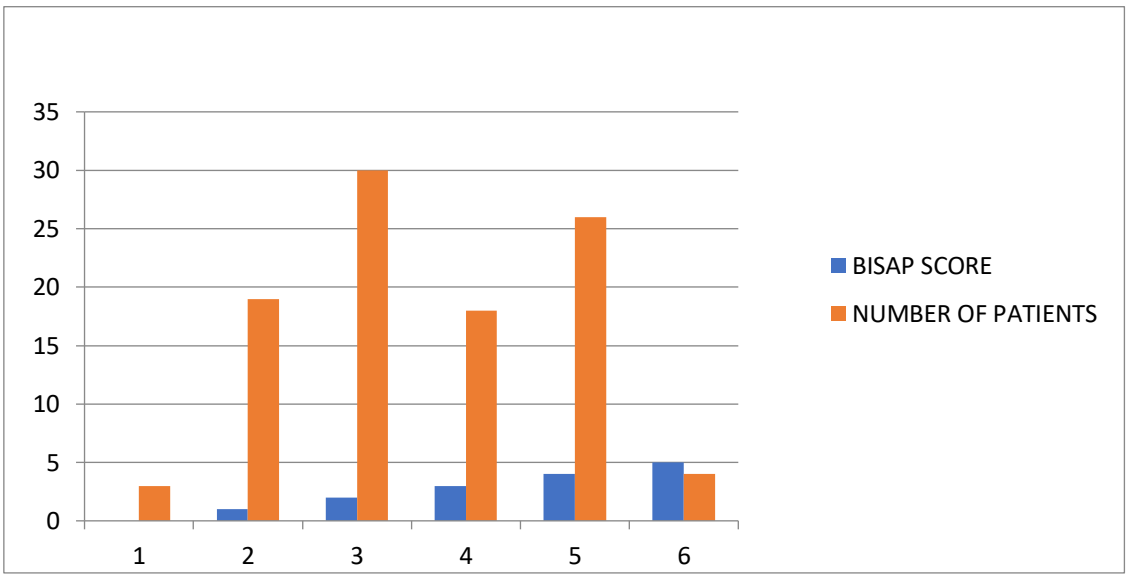

Figure 1: Distribution of Patients According to BISAP Score

Score 0: 3%, Score 1: 19%, Score 2: 30%, Score 3: 18%, Score 4: 26%, Score 5: 4%)

3.3 Predictive Accuracy of BISAP Score for Organ Failure

The ROC curve analysis for the BISAP score predicting organ failure is presented in Figure 2. The Area Under the Curve (AUC) was 0.985 (95% CI: 0.967-1.000, $p<0.001$), indicating excellent discriminatory power. The optimal cut-off point was ≥2.5, yielding a sensitivity of 100%, specificity of 89.7%, PPV of 87.5%, and NPV of 100%, with an overall accuracy of 94% (Table 2).

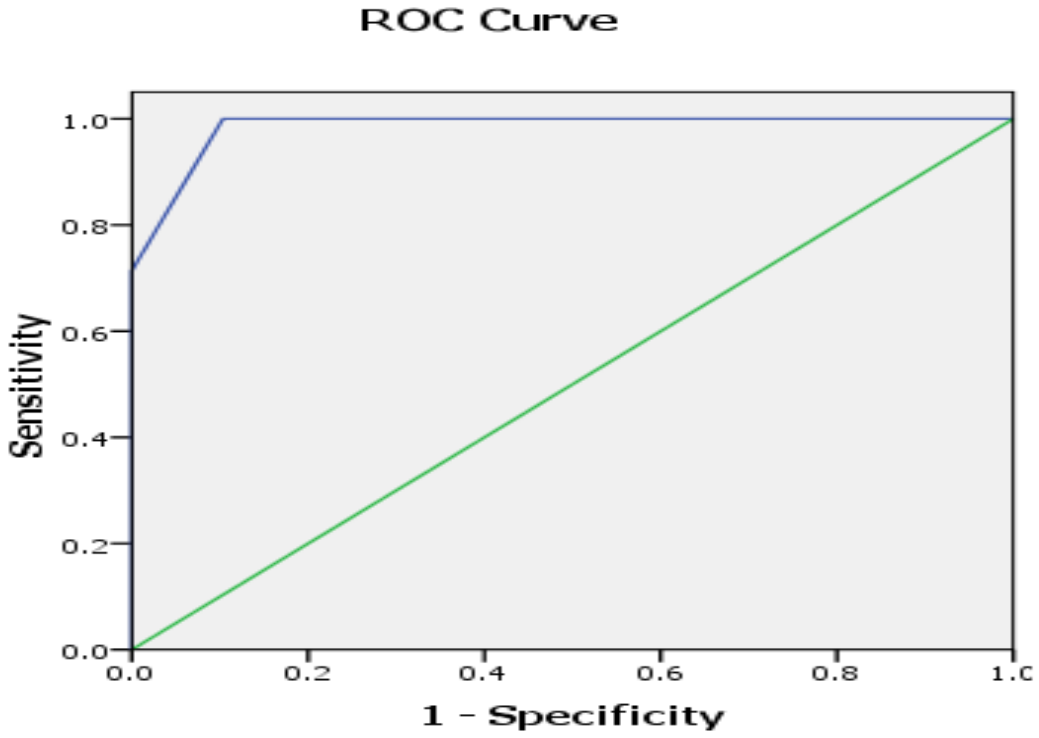

Figure 2: ROC Curve of BISAP Score for Predicting Organ Failure

Table 2: Predictive Value of BISAP Score (Cut-off ≥2.5) for Organ Failure and Mortality

Outcome	Sensitivity	Specificity	PPV	NPV	Accuracy	p-value*
Organ Failure	100%	89.7%	87.5%	100%	94%	<0.001
Mortality	100%	63.4%	37.5%	100%	70%	<0.001
*p-value from Chi-square test for association between score ≥2.5 and outcome.						

3.4 Association with Mortality

Overall mortality was 18%. All patients who died (n=18) had a BISAP score ≥2.5. There was a highly significant association between a BISAP score ≥2.5 and increased mortality (p<0.001) (Table 2). The mean total hospital stay was 6.85±2.49 days, and patients with higher BISAP scores had a significantly longer ICU stay.

DISCUSSION

This prospective study of 100 patients with acute pancreatitis demonstrates that the BISAP score, calculated within 24 hours of admission, is a highly accurate and practical tool for early risk stratification. Our findings confirm that a BISAP score cut-off of ≥2.5 is strongly associated with the development of organ failure and mortality, enabling clinicians to identify high-risk patients promptly.

The demographic profile in our study, with a male preponderance (82%) and alcohol as the leading cause (57%), reflects the common Indian epidemiological pattern, consistent with findings by Kashid et al. (2006). The mean age of presentation (36.65 years) is younger than that reported in Western studies (Pupelis et al., 2008), likely due to early-onset alcohol consumption.

The primary endpoint of our study was the ability of BISAP to predict organ failure. The ROC curve analysis showed excellent performance (AUC = 0.985). A cut-off of ≥2.5 provided 100% sensitivity and 89.7% specificity, meaning no patient with organ failure was missed. This is comparable to or better than other similar studies. Papachristou et al. (2010) reported that a BISAP score ≥3 had a low sensitivity (37.5%) for predicting severe AP, suggesting that a lower threshold (≥2) might be more appropriate for screening, which our data supports. The high negative predictive value (100%) in our study is particularly important, as it reliably rules out severe disease, allowing low-risk patients to be managed safely in a ward setting, thus optimizing resource utilization.

Mortality in our study was 18%, which is higher than in some previous reports (Kashid et al., 2006; Choudhuri et al., 2006). This could be attributed to the higher proportion of patients with BISAP score ≥3 (48%) in our cohort, potentially due to referral bias to a tertiary care center and the constraints of the COVID-19 pandemic during the study period. Crucially, all 18 patients who died had a BISAP score ≥2.5, and the association between a high BISAP score and mortality was highly significant ($p<0.001$), consistent with the meta-analysis by Gao et al. (2015).

The strength of this study is its prospective design and the demonstration that a cut-off of ≥2.5 outperforms the traditionally used cut-off of ≥3 in our population. The BISAP score's simplicity—using vital signs, a common lab value (BUN), mental status, age, and a chest X-ray—makes it uniquely suited for the Indian healthcare setting, where cost and rapid decision-making are critical. However, the study has limitations. It is a single-center study with a relatively small sample size. The high mortality rate may not be generalizable to all settings. Furthermore, the BISAP score should be seen as a dynamic tool, and serial measurements might provide additional prognostic information.

CONCLUSION

The Bedside Index for Severity in Acute Pancreatitis (BISAP) score is a simple, inexpensive, and highly reliable bedside tool. A score of ≥2.5 calculated within 24 hours of admission is a powerful and independent predictor of organ failure and mortality in acute pancreatitis. Its high negative predictive value safely identifies low-risk patients, while its high sensitivity ensures that high-risk patients receive timely intensive care. The BISAP score should be integrated into the early assessment protocol for all patients with acute pancreatitis, particularly in resource-limited settings, to improve triage, guide management, and potentially reduce mortality.

Novelty and Implication: This study validates a lower BISAP cut-off (≥2.5) for the Indian population, providing a more sensitive screening tool for severe disease. Widespread adoption of this score can lead to better resource allocation, early ICU transfer, and improved clinical outcomes for patients with acute pancreatitis.

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