Comparative Study Of BISAP Score With APACHE-II Scoring System To Determine The Severity Of Acute Pancreatitis

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Abstract
Introduction: *Acute pancreatitis (AP) is a significant abdominal emergency characterized by inflammation of the pancreas, primarily due to autodigestion by pancreatic enzymes. Early severity assessment is crucial for management, as severe cases lead to complications and mortality. While various scoring systems exist, the Bedside Index for Severity in Acute Pancreatitis (BISAP) and APACHE-II (Acute Physiology and Chronic Health Evaluation) scores are commonly used, each with unique advantages and limitations in severity prediction.*
Objective: *This study aims to compare the effectiveness of BISAP and APACHE-II scores in predicting acute pancreatitis severity, helping clinicians optimize treatment decisions.*
Methods: *This observational study was conducted at SMS Hospital, Jaipur, involving 76 patients diagnosed with AP based on clinical, biochemical, and imaging criteria. Participants were assessed using both BISAP and APACHE-II scoring within 24 hours of admission, with a focus on accuracy in predicting severe cases and outcomes.*
Results: *Among participants, the mean age was 43 years, and 84.2% were male. Gallstone disease was the leading cause of AP (55.2%), followed by alcohol (34.2%). BISAP scores ≥3 was associated with significantly higher mortality, highlighting BISAP's predictive accuracy. The mean BISAP score was 1.86 ± 1.09, while the APACHE-II score was 6.97 ± 5.66, indicating more severe classifications using BISAP. The study found a moderate positive correlation between BISAP and APACHE-II scores, though only BISAP scores significantly predicted patient outcomes.*
Conclusion: *BISAP offers a rapid and accurate assessment tool for AP severity, especially suitable for early intervention in high-risk patients. Compared to APACHE-II, BISAP is simpler, cost-effective, and demonstrates a high negative predictive value, making it more practical for acute settings.*
Keywords: *Acute pancreatitis; BISAP score; APACHE-II score; severity prediction; abdominal emergency; gallstone pancreatitis;*

I.   Introduction

Acute pancreatitis (AP) is a condition involving inflammation of the pancreas, primarily due to the self-digestion of the gland by its digestive enzymes. This destructive process results in both functional impairment and physical changes to the gland itself [1]. AP can often recur intermittently, sometimes leading to chronic pancreatitis in affected individuals. Severe acute pancreatitis (SAP) develops in approximately 25% of AP cases, presenting with more intense symptoms and higher risks of complications [2].

AP is one of the most common acute abdominal emergencies. Despite advances in medical science and the development of effective treatments, pancreatitis remains a significant public health concern globally. Incidence rates of AP vary worldwide, from 13 to 45 cases per 100,000 population-years, and the number of reported cases has been rising by approximately 2.7% annually [3]. In countries like the United States, Finland, and Scotland, incidence rates are notably higher. Additionally, AP appears to be more prevalent among Black populations, though the precise reasons for this demographic difference remain unclear [4].

Several risk factors predispose individuals to acute pancreatitis, including chronic alcohol consumption, gallstones, repeated exposure to certain drugs, abdominal trauma, cystic fibrosis, and systemic infections such as sepsis [5]. Notably, the causes and age distributions for AP differ significantly between Western and Asian populations, suggesting that genetic and environmental factors may play a role. While about 80% of AP cases are mild and self-resolving without severe complications, the condition can lead to serious complications and significant mortality in up to 20% of patients [6].

Gallstones and alcohol use are responsible for approximately 70% of all AP cases, with gallstones accounting for most cases. The presence of biliary sludge, a collection of particles that can obstruct bile ducts, is found in about 67% of idiopathic (unknown origin) AP cases [7] .Patients who recover from an AP episode often experience recurrent symptoms, and many go on to develop chronic pancreatitis. The recurrence rate is particularly high in alcohol-induced pancreatitis (about 50%) and can range from 32% to 61% in untreated gallstone pancreatitis [8].

AP diagnosis is confirmed by at least two of the following criteria: typical abdominal pain, serum amylase and/or lipase levels exceeding three times the normal upper limit, and characteristic findings on abdominal imaging. Patients with AP typically experience constant, stabbing pain in the mid-epigastric region or right upper quadrant, often radiating to the back or flanks [9]. Contrast-enhanced computed tomography (CT) or magnetic resonance imaging (MRI) is generally reserved for cases where the diagnosis is uncertain based on clinical and laboratory evaluations alone or when the patient does not show clinical improvement within the first 72 hours of hospitalization [10].

Identifying AP patients at risk of developing severe forms early on is crucial for improving their outcomes and minimizing complications. High-risk individuals can benefit from admission to high-dependency care units for better monitoring and supportive treatments, including appropriate fluid and nutritional therapy. Several scoring systems, such as APACHE II, Ranson's, MOSS, MCTSI, and BISAP, have been developed to assess AP severity and predict patient outcomes [11].

One commonly used tool for predicting SAP is the Bedside Index of Severity in Acute Pancreatitis (BISAP) score. This scoring system evaluates blood urea nitrogen levels, impaired mental status, systemic inflammatory response syndrome (SIRS), patient age, and the presence of pleural effusion [12]. The BISAP score, which can be assessed upon admission, has proven accurate in predicting patient outcomes within 24 hours. Research supports the BISAP score as a valuable tool for early decision-making and prompt management due to its simplicity, ease of use, and cost-effectiveness [13].

The APACHE (Acute Physiology and Chronic Health Evaluation) score, specifically APACHE II, is a key tool for assessing illness severity in acute medical settings, particularly intensive care units (ICUs). Originally designed for research and clinical audit purposes, APACHE II remains widely used for critically ill patients, as it systematically evaluates acute physiology, age, and chronic health conditions [14]. This scoring method produces a total score from 0 to 71, allowing for the assessment of disease severity. Despite its selective and reasonably accurate predictive power, APACHE II has limitations in mortality prediction and managing patients with multiple comorbidities within a single diagnostic category[15]. Nevertheless, it remains instrumental in ICU environments, offering a standardized approach for mortality assessment and group evaluations. Although many scoring systems exist to predict severe acute pancreatitis (SAP), the predictive accuracy remains inconsistent. This study, comparing BISAP and APACHE II, aims to enhance decision-making and management for AP patients in critical care [16]

The BISAP and APACHE II scores provide distinct methods for assessing acute pancreatitis (AP). BISAP, based on factors like blood urea nitrogen, age, and pleural effusion, offers rapid assessment, making it suitable for early intervention. Its straightforward approach aids in quick evaluation, essential for managing severe AP cases and reducing complications [17]. Conversely, the APACHE II score delivers a more comprehensive illness severity evaluation, ideal for ICU settings but requiring complex calculations and specific training, which may limit its use in smaller hospitals. Comparing these tools highlights their unique benefits and limitations in optimizing AP patient outcomes and resource allocation [18].

The aim is to compare the BISAP (Bedside Index for Severity in Acute Pancreatitis) and APACHE-II (Acute Physiology and Chronic Health Evaluation) scoring systems in assessing the severity of acute pancreatitis. The primary objective is to evaluate the severity of acute pancreatitis using both BISAP and APACHE-II scores, while the secondary objective focuses on comparing the accuracy of BISAP with APACHE-II to determine which scoring system provides a more precise prediction of outcomes in acute pancreatitis cases.

II.   Materials And Methods

This hospital-based observational study will be conducted in the Department of General Surgery at SMS Hospital, Jaipur, Rajasthan, after obtaining ethical approval. The study aims to assess acute pancreatitis severity using BISAP and APACHE-II scoring systems among patients meeting the inclusion criteria, with a sample size of 74 at 95% confidence and 80% power. Data will be collected using a structured proforma within 24 hours of admission. Patients aged 18 and above with acute abdominal pain and elevated serum amylase/lipase levels or radiological evidence of pancreatitis will be included, excluding those with pancreatic carcinoma or unwilling to participate.

III.   Results

In the study, 52.6% of participants were aged 44 years or younger, while 34.2% were in the 45-54 age range, with an average age of 43.11 ± 9.49 years. The majority of participants (84.2%) were male, and females comprised only 15.8% of the group.

TABLE 1. Aetiology

Aetiology	Frequency	Percentage
GSD	42	55.2
Alcohol	26	34.2
Trauma	4	5.2
Idiopathic	3	4.0
Hypertriglyceridemia	1	1.4

The primary cause of acute pancreatitis among study participants was gallstone disease (GSD), affecting 55.2% of cases. This was followed by alcohol-related pancreatitis in 34.2% of participants, trauma-induced pancreatitis in 5.2%, and hypertriglyceridemia as a cause in 1.4%, highlighting a range of etiological factors in the study population.

Table 2: Clinical Features

Clinical Features	Frequency	Percentage
Abdominal Pain	76	100
Abdominal Distention	42	55.3
Vomiting	53	69.7
Fever	16	21.1
Jaundice	2	2.6

All study participants experienced abdominal pain, with 69.7% reporting vomiting and 55.3% experiencing abdominal distension. Additionally, 21.1% of participants had a fever, and 2.6% presented with jaundice, reflecting the range of symptoms commonly associated with acute pancreatitis in this group.
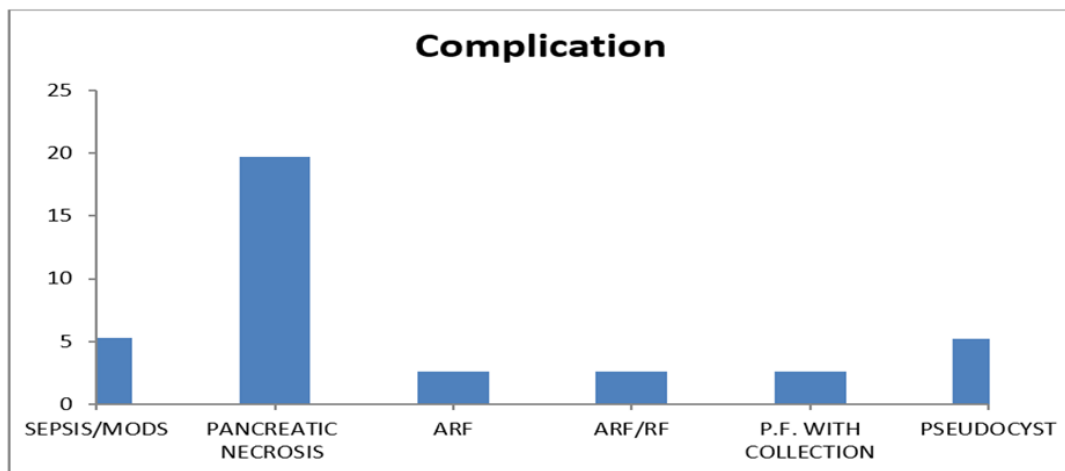

Figure 1: Complications

In the study, pancreatic necrosis was observed in 19.7% of participants, while sepsis or multiple organ dysfunction syndrome (MODS) affected 5.3%. Additional complications included acute renal failure, respiratory failure, and pancreatic fistula with fluid collection, each occurring in 2.6% of participants, indicating a range of severe outcomes in acute pancreatitis cases.

Table 3: Apache II scoring

Apache II scoring	Frequency	Percentage
Mild <9	60	78.9
Severe >9	16	21.1
Mean+ SD	6.97+5.662	

The study found a mean APACHE II score of 6.97 ± 5.66 among participants, with 78.9% categorized as having mild acute pancreatitis and 21.1% classified as severe based on their scores.
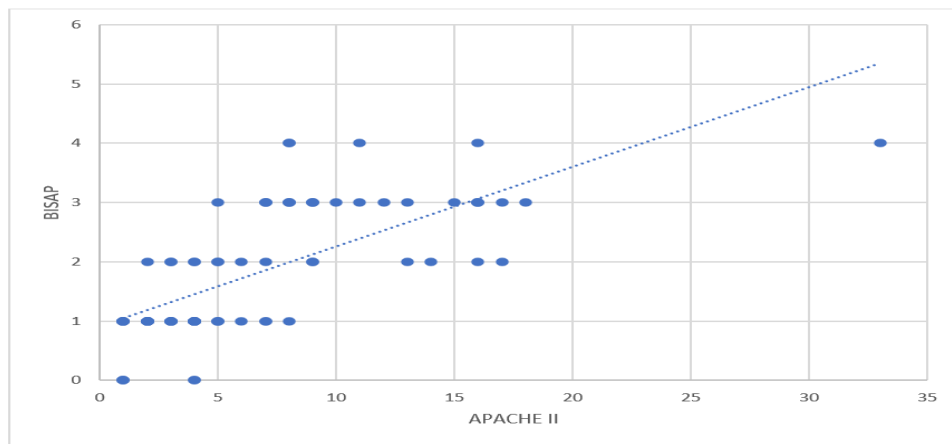
Figure 2: Correlation of Apache II and BISAP scoring

A moderately positive and statistically significant correlation was observed between APACHE II and BISAP scores, indicating that as APACHE II scores increase, BISAP scores tend to increase as well. This relationship suggests consistency between the two scoring systems in assessing severity in acute pancreatitis cases.

Table 4: BISAP scoring

BISAP scoring	Frequency	Percentage
Mild ≤ 2	51	67.1
Severe ≥ 3	25	32.9
Mean$\pm$ SD	1.86$\pm$1.092

The mean BISAP score among study participants was 1.86 ± 1.09. Based on BISAP scoring, 67.1% of participants were classified with mild acute pancreatitis, while 32.9% were identified as having severe acute pancreatitis, highlighting the scoring system's role in distinguishing disease severity.

Table 5: Association of Apache II scoring with the outcome

OUTCOME		Apache II scoring			P value
		<9	**>9**	**Total**	
ALIVE	Count	56	16	72	
	%	94.9%	94.1%	94.7%	
DEATH	Count	3	1	4	0.897
	%	5.1%	5.9%	5.3%	
Total	Count	59	17	76	
	%	100.0%	100.0%	100.0%	

Mortality was observed in 5.9% of participants with an APACHE II score above 9 and in 5.1% with a score below 9. However, the association between APACHE II scores and mortality outcomes was not statistically significant in this study, suggesting limited predictive value for mortality.
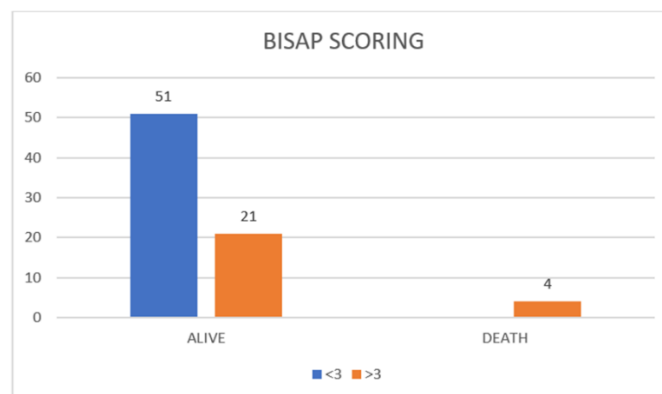

Figure 3: Association of BISAP scoring with the outcome

Mortality was observed in 16% of participants with a BISAP score above 3, while none with a BISAP score below 3 experienced mortalities. This association between higher BISAP scores and mortality outcomes was statistically significant, highlighting BISAP's effectiveness in predicting severe outcomes in acute pancreatitis cases.

IV.   Discussion

Acute pancreatitis (AP) is a prevalent condition caused by pancreatic inflammation, potentially impacting peripancreatic tissues and multiple organs. About 80% of AP cases are mild and self-limiting, with no long-term effects; however, around 10–20% develop severe illness due to pancreatic and peripancreatic necrosis. These cases can progress to systemic inflammatory response syndrome (SIRS), leading to multiorgan failure and, potentially, death. While AP generally has a mortality rate of 2-5%, this can reach 20–30% in severe cases [19].

Early and accurate assessment is essential for initiating intensive treatment in severe acute pancreatitis (SAP) cases. Current multifactorial scoring systems, imaging studies, and ongoing clinical assessments are valuable for predicting SAP; however, the widely used APACHE II and Ranson criteria can be complex and require specific early-stage data. Wu et al. developed the BISAP (Bedside Index for Severity in Acute Pancreatitis) score, addressing these limitations by incorporating readily available admission data such as age, SIRS presence, pleural effusion, mental status, and blood urea nitrogen. With BISAP, early and simple severity assessment is achievable, effectively guiding treatment. Most researchers recommend a BISAP cutoff score of ≥3 for mortality prediction, though some suggest ≥2 [20].

This hospital-based observational study compared the BISAP and APACHE-II scoring systems in assessing acute pancreatitis severity among 76 patients. Most participants (52.6%) were aged 44 years or younger, while 34.2% were between 45 and 54 years, with a mean age of 43 years. Males comprised the majority at 94.7%. Clinically, all participants reported abdominal pain; 69.7% experienced vomiting, 55.3% had abdominal distension, 21.1% presented with fever, and 2.6% with jaundice. Gallstone disease was the leading cause (55.2%), followed by alcohol (34.2%), trauma (5.2%), and hypertriglyceridemia (1.4%). Common complications included pancreatic necrosis (20%), sepsis/MODS (5.3%), and others like renal and respiratory failure (2.6% each). Overall, 8% developed organ dysfunction, and the mortality rate was 5.3%, with 88% of survivors managed conservatively.

In our study, the mean APACHE II score among participants was 6.97 ± 5.66, with 78.9% classified as having mild acute pancreatitis and 21.1% as severe. The mean BISAP score was 1.86 ± 1.09, identifying 67.1% as mild and 32.9% as severe, thus classifying more participants with severe pancreatitis. A statistically significant, moderately positive correlation was observed between APACHE II and BISAP scores. However, only BISAP scoring showed a statistically significant association with patient outcomes, with notably higher mortality when BISAP scores exceeded 3. BISAP demonstrated higher sensitivity (100%) and negative predictive value (100%) than APACHE II in our study.

Hagjer et al. conducted a prospective observational study in a tertiary hospital in Assam, India (2015–2016), involving 60 predominantly male acute pancreatitis patients with a mean age of 37 years, identifying alcohol and gallstones as leading causes. Severe disease developed in 23.3%, with 11.6% mortality. The study demonstrated a significant association between increasing BISAP scores and severity, organ failure, necrosis, mortality, and longer hospital stays. BISAP and APACHE II had similar AUC values for predicting severity and outcomes, with BISAP scores >3 indicating severe disease. Their findings closely align with our study results [21].

Park et al. conducted a retrospective study (2007–2010) on 303 acute pancreatitis patients in a Seoul tertiary hospital, finding severe disease in 10.2% and 2% mortality. BISAP's AUCs for predicting severity and mortality were 0.80 and 0.86, closely aligning with APACHE-II (0.80, 0.87) and outperforming Ranson criteria, CTSI, CRP, hematocrit, and BMI. Singh et al. conducted a prospective study (2005–2007) on 397 patients in Massachusetts, reporting 3.5% mortality. A BISAP score ≥3 correlated with increased mortality, organ failure, and pancreatic necrosis. They concluded BISAP effectively identifies high-risk patients early, enhancing clinical care through timely risk stratification. These findings support our study's results [22,23].

A 2010 study by Papachristou et al., published in the *American Journal of Gastroenterology*, validated BISAP as an effective risk stratification tool for acute pancreatitis (AP). Conducted in a Pennsylvania tertiary center from 2003–2007 with 185 AP patients (mean age 52, equal male-female ratio), the study reported a 3.8% mortality rate. Cutoffs for severe disease were set at ≥3 for BISAP and ≥8 for APACHE-II. The authors highlighted BISAP's simplicity and clinically relevant parameters, showing prognostic accuracy comparable to Ranson's, APACHE-II, and CTSI scores. These findings align with our study, underscoring BISAP's efficacy in assessing AP severity and outcomes [24].

V. Conclusion

Assessing acute pancreatitis severity is essential for guiding treatment and predicting outcomes. Among various scoring systems, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score offers simplicity and efficiency, making it a valuable tool in clinical practice. Unlike the comprehensive APACHE-II system, which can be less suitable for acute pancreatitis due to its complexity, BISAP focuses on relevant, pancreatitis-specific factors, enabling early risk stratification. This study highlights BISAP's advantages over APACHE-II, emphasizing its ease of use, validated accuracy, and cost-effectiveness. By adopting BISAP, clinicians can enhance patient care and improve outcomes in acute pancreatitis management.

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