### **ORIGINAL RESEARCH**

# Prediction of Adverse Outcome and Mortality in Patients with Acute Pancreatitis Using BISAP Scoring System

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#### ABSTRACT

Introduction: Acute pancreatitis (AP) is a very common health problem which requires proper evaluation and timely management in higher centers. Acute pancreatitis is characterized as a pancreatic inflammatory condition that may result in multi-organ dysfunction and a higher death rate. The methods that are currently available to evaluate the severity of acute pancreatitis are costly and are not easily available in primary health level. The BISAP (Bedside Index of Severity in Acute Pancreatitis) is new scoring system which can be used to measure the severity of the acute pancreatitis at the time of admission with routine blood test and clinical evaluation. Severe acute pancreatitis has high mortality rate and it needs intensive management. Hence early prediction of severity and diagnosis is very important Therefore a study was conducted to evaluate the effectiveness of BISAP scoring system, which is done on day one of admission, in predicting the severity of acute pancreatitis in settings, so as to divide the patients into low risk and high risk based on score, and can give more and intense care to high-risk group. Objectives: To evaluate the diagnostic efficacy of BISAP scoring system on predicting severity ofacute pancreatitis in the Department of Gastroenterology, PRS Hospital Thiruvananthapuram. Methods: A cross sectional study was conducted over cases of Acute pancreatitis those are admitted in the wards of Medicine, Surgery and Gastroenterology department of PRS Hospital, Thiruvananthapuram, satisfying the inclusion criteria for a period of 1 year. Their clinical features, laboratory results and imaging modalities were recorded. All patients admitted were scored with BISAP scoring system at the time of admission, and they were followed up after 7 days and 6 weeks and the result is compared with acute pancreatitis severity grading based on Revised Atlanta classification 2012. Data entered in to an excel sheet and analysis done using appropriate statistical software. Results & Discussion: In the study, out of 120 patients studied 98 were males and 22 were females with mean age of 44.4±14.8. Of these, 94 had mild acute pancreatitis, 8 had moderately severe and 18 had severe acute pancreatitis (Revised Atlanta classification 2012). 26 of the studied cases have BISAP score as severe acute pancreatitis. In the present study, the sensitivity obtained was 100, specificity was 92.2 and accuracy was 93.3, Positive Predictive value (PPV) of 69.2, Negative predictive value (NPV) of 100. There were 12 early deaths in the study, of that; all of them were remarked by BISAP score as severe acute pancreatitis. The BISAP score had a sensitivity of 100% in predicting early deaths. It had a NPV of 100% which means the patients are unlikely to die due to AP, if they do not have severe acute pancreatitis by BISAPscore (p value of <.01). The diagnostic accuracy of BISAP score for males and females are 91.8 and 100% respectively. The diagnostic accuracy of BISAP score for age<40 and age>40 are 96.8 and 89.7 respectively. Conclusion: BISAP scoring system is a good predictor of severity in acute pancreatitis. It can also be used to predict deaths in acute pancreatitis. BISAP score can be used as an effective tool in order to stratify patients according to their severity, thereby helping to reduce the mortality and morbidity. as we can divide the patients into low risk and high risk based on score, and can give more and intense care to high-risk group.

Keywords: Severe Acute Pancreatitis, BISAP, Organ failure, Atlanta Classification, Disease Severity, Scoring Systems, Predictive scores

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#### INTRODUCTION

There are many different aetiologies and natural histories for acute pancreatitis, and some individuals experience serious consequences that carry a significant mortality risk<sup>1</sup>. Acute pancreatitis (AP), which is the onset of acute pancreatic inflammation, is one of the gastrointestinal conditions that most frequently necessitate hospitalisation<sup>2</sup>. Several clinical scoring systems have been established to predict the severity of diseases, such the Bedside Index Of Severity In Acute Pancreatitis (BISAP), the Pancreatitis Outcome Prediction (POP) Score, and the Ranson, Chronic Health Evaluation (APACHE-II) score<sup>3</sup>.

According to the 2012 revision of the Atlanta classification<sup>4</sup>, AP can be divided into three severity categories: mild, moderate, and severe. Organ failure and any local or systemic consequences are absent in mild AP. Transient organ failure (resolves in 48 hours) and/or local or systemic consequences are indicators of moderately severe AP (SAP)<sup>5</sup>. Finally, persistent organ failure that may affect one or more organs is a feature of severe AP. For the early identification of SAP, a number of severity assessment methods have been established. The APACHE II system and the Ranson criteria are currently the ones that are most frequently utilised in clinical practise. They are, however, too intricate and clumsy for speedy evaluation<sup>6</sup>. For the early identification of patients at risk of mortality, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score was proposed in 2008. This five-point scoring method is based on five factors: elevated blood urea nitrogen levels (BUN) > 25 mg/dl, mental impairment, systemic inflammatory response syndrome (SIRS) development, older age > 60, and pleural effusion<sup>7</sup>. BISAP has fewer items and is easier to use than conventional scoring systems. To identify individuals at high risk for death or severe illness early on in the course of acute pancreatitis, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score was created<sup>8</sup>. The aim of the study was to analyze the Diagnostic accuracy (efficacy) of BISAP SCORE in predicting the severity of Acute pancreatitis.

#### MATERIALS AND METHODS

The hospital based prospective study was conducted among patients who got admitted with acute pancreatitis (diagnosed based on clinical, laboratory and imaging modalities),in Medicine, Surgery and Gastroenterology department and ICU of PRS hospital, Trivandrum.

#### METHODS OF COLLECTION OF DATA

All patients who were admitted to Medicine, Sur

gery and Gastroenterology department and ICU of PRS hospital, Thiruvananthapuram diagnosed with acute pancreatitis based on clinical, biochemical and ultrasound findings over a period of 1year from (November15<sup>th</sup> 2021 to November14<sup>th</sup> 2022) were enrolled in the study. Prior consent was taken for the purpose of the study. Detailed history was taken, following selection of cases. A thorough clinical examination was done. Vitals and other components of BISAP scoring was recorded.

Blood samples were drawn for carrying out relevant investigations. Ultrasonogram (USG) laboratory thorax and Abdomen was done. Biochemical markers measured within 48 h after admission were analysed. The following investigations were carried out. Complete blood count, Erythrocyte sedimentation rate (ESR), Blood urea nitrogen, serum creatinine, creactive protein (CRP), lactate dehydrogenase (LDH), arterial blood gas (ABG(FiO2/PO2), Serum Calcium, Liver function tests (LFT), Serum Amylase and Lipase, Chest X-ray and/or USG-Thorax, USG-Abdomen, Relevant special investigation: CT-Abdomen. In the study, Severe pancreatitis cases are identified with the presence of organ failure (using Modified Marshall Scoring system). A pre-tested Proforma was used to collect the data.

#### **INCLUSION CRITERIA**

- 1) Age 15 80 years
- 2) Acute pancreatitis due to any cause
- 3) Acute or chronic pancreatitis

#### **EXCLUSION CRITERIA**

- 1) Pancreatitis following Trauma / surgical intervention
- 2) Patients with immune compromised states which can alter the immunological status
- 3) Patients not willing to get enrolled
- 4) Tumors of pancreas causing pancreatitis
- 5) Patients on beta blockers
- 6) Patients on pacemakers

#### STATISTICAL ANALYSIS

For statistical analysis, SPSS v23.0 (IBM Corp., Armonk, NY) was employed. Continuous variables were represented using the mean and standard deviation. For the purpose of predicting severe AP, ROC curves of the scores were used. The predictive accuracy of each scoring system was assessed using areas under the curve (AUCs). Based on the highest sensitivity and specificity values derived from the ROC curves, all optimal cutoffs were found. Calculations were made for sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). Statistical significance was judged to be present when the P value was less than

#### 0.05.

#### RESULTS BASELINE CHARACTERISTICS

Among 120 patients enrolled, 26 (21.7%) had severe AP and 94 (78.3%) had mild AP. The mean age of the patients was  $44.4 \pm 14.8$  years. A male preponderance (81.7%) was found. 95.8 % patients had abdominal pain as their presenting complaint. Alcohol **Table.1 Diagnostic accuracy of BISAP SCORE in early death** 

consumption (76.7%) were the most common cause of AP followed by Biliary stones (18.3%). At the end of the

7<sup>th</sup>day, of the 120 patients studied, 88 (73.3%) were asymptomatic, 18 (15%) had developed local complication, 2 (1.7%) had organ failure and 12 (10%)patients were died. Of the 120 patients studied 12 (10%) had died within a week and 108 (90%) havesurvived.

accuracy of DIS	SAP SCORE III	early u	leath	
		Early death		
	<b>BISAP Score</b>	Yes	No	Total
	Severe	12	14	26

Mild

Total

Of the 120 patients studied, 26 patients who were categorized under severe acute pancreatitis with BISAP scoring system, 12 patients were died within 7 days. 94 patients who were categorized under mild acute pancreatitis with BISAP scoring system has survived. (**Table 1**)

0

12

94

108

94

120

 Table 2: Diagnostic accuracy of BISAP SCORE in early death

Sensitivity	100%			
Specificity	87%			
False Negative	0			
False positive	13%			
Positive Predictive value	46.2%			
Negative Predictive value	100%			
Positive Likelihood ratio	7.7%			
Negative Likelihood ratio	0			
Accuracy	88.3%			

The sensitivity in predicting death is 100%, and specificity is 87%, false negative is 0, false positive is 13, positive predictive value is 46.2, negative predictive value is 100, positive likelihood ratio is 7.7, negative likelihood ratio is 0 and accuracy is 88.3. (**Table 2**)

### Fig.1 Diagnostic accuracy of BISAP SCORE in assessing the severity of Acute pancreatitis when modified Marshall scoring is gold standard



Of the 120 patients studied 26 patients predicted to be severe pancreatitis by BISAP scoring system. have 18 severe pancreatitis patients and 8 mild acute pancreatitis. The sensitivity of BISAP scoring in predicting severe acute pancreatitis is 100%, specificity is 92.2%, false negative is 0, false positive is 7.8, Positive Predictive

Value(PPV) is 69.2, Negative Predictive Value is 100, positive Likelihood ratio is 12.8, negative Likelihood ratio is 0 and accuracy is 93.3%. The measured value of kappa is Kappa is  $0.78^{**}$  which shows Substantial agreement and, p = 0 (less than p=0.01) which is significant. (Figure 1).

Table 3: Distribution of BISAP score based on death

BISAP	Died	Survived	Total	Percentage
SCORE				of death
<3	0	94	94	0%
3	4	12	16	25%
4	6	2	8	75%
5	2	0	2	100%
TOTAL	12	108	120	

The BISAP score of <3 has 0% death were as BISAP score of 5 has 100% death. Above data implies that the percentage of death increases for higher the score. It can be concluded that the chance of death due to severity of acute pancreatitis increases with higher BISAP score (**Table 3**).

## Fig.2 ROC curve for BISAP score in assessing the severity of acute pancreatitis ROC Curve



Diagonal segments are produced by ties.

The area under curve is 0.969 which shows the BISAP scoring system has good diagnostic power and the value can be taken as significant as p < 0.01. (Figure 2)

Figure.3: Diagnostic Accuracy Of BISAP Score Based On Gender



The sensitivity of BISAP score for both males and females are 100%: specificity is 90.2 for males and 100% females. The accuracy for males and females are 91.8 and 100% respectively. The p value for both males and females are p<0.01 which is significant. Thus BISAP score is more accurate for females as compared to males. **Figure.4 Diagnostic accuracy of BISAP score based on age** 



The sensitivity of BISAP score is 100% for all age group studied. The specificity is 96.6% for age <40 and 86.4 for age >40. The accuracy for age <40 and age >40 are 96.8 and 89.7 respectively. Thus, BISAP score is more accurate for age less than 40 years. (Figure 4)

#### DISCUSSION

The study was conducted between November 2021-November 2022 for a period of 1 year. Out of 120 patients studied, 94 had mild acute pancreatitis, 8 had moderate and 18 had severe acute pancreatitis. Among the 18 severe acute pancreatitis, 12 patients died within 7 days of admission. A study conducted by Kumaravel et al among 182 patients, severe AP developed in 20%, which is correlating with the present study (21.7%). In the current study 26 patients, (21.7 %) had BISAP score suggestive of severe acute pancreatitis at the time of admission. A et  $al^{10}$ , study conducted by Vikesh K S evaluated 397 patients using BISAP scoring. 14 (3.5%) deaths out of 397 cases occurred. With rising BISAP score, death showed a statistically significant tendency towards increasing (P < 0.0001).

Alcohol consumption (76.7%) were the most common cause of AP followed by Biliary stones (18.3%) which is in contrast to the findings by Wu Q<sup>11.</sup> Of the 12 early deaths in the study, all of them had BISAP score categorized under severe acute pancreatitis. Thus, BISAP score had a sensitivity of 100% in predicting early deaths. It had a NPV of 100% which means the patients are unlikely to die due to AP, if they do not have severe acute pancreatitis by BISAP score. Thus, BISAP score can also be used to predict death. Also, the chance for death is higher with high BISAP score. In the present study there were 25% death with BISAP score of 3 and 100% death with BISAP score of 5. There were only 12 deaths in the study; hence the data is insufficient to check the trend across the sex, all etiologies and age. All the death in the study were early deaths. After 6 weeks, 100 were asymptomatic, 8 were lost to follow up. In a study conducted by Mutinga M et al approximately half of the deaths were early deaths<sup>12</sup>. Larger studies are necessary to evaluate the proportion of late death in AP. BISAP was proposed to construct a simple and accurate clinical scoring system to estimate the mortality risk of AP at an early stage.<sup>13</sup>

The previous studies show that, there is good correlation between BISAP score and severity of acute pancreatitis, which was clearly reciprocated in our study. Hence BISAP can be used as a clinical scoring system in predicting the severity of acute pancreatitis particularly in resource poor settings. The clinical outcome of the patients with severe acute pancreatitis is determined by the early recognition of the severity of the disease and severity based management of the high risk patients<sup>14</sup>. For severe AP prediction, ROC curve indicated an area under the curve (AUC) of 0.861 for Ranson Score(RS), 0.865 for Glasgow score (GS), 0.829 for BISAP<sup>11</sup> whereas in the current study, the area under curve is 0.969. Compared to the existing scoring systems, the performance Of Chinese simple scoring system(CSSS)<sup>15</sup> was good for the prediction of SAP severity and mortality. The calculated AUC of the CSSS for prediction of disease mortality was 0.838 which is lesser than the current study.

As described in our study, it can also be used as

predicting the mortality in acute pancreatitis. The BISAP score of <3 has 0% death were as BISAP score of 5 has 100% death which is similar to the findings by Hagjer S<sup>16</sup>, Maruti C<sup>17</sup> and Papachristou GI<sup>18</sup>. Above data implies that the percentage of death increases for higher the score. It can be concluded that the chance of death due to severity of acute pancreatitis increases with higher BISAP score. The BISAP scoring system can even be used in primary health centers, as it is mostly basic laboratory parameters which are needed for its calculation. So it helps in early stratification of patients with acute pancreatitis and referral to higher centers if needed.

The BISAP score represents a simple way to identify patients at risk of increased mortality and the development of intermediate markers of severity within 24 hours of presentation. This risk stratification capability can be utilized to improve clinical care and facilitate enrollment in clinical trials. BISAP has high sensitivity and Negative Predictive Value, good specificity and low Positive Predictive Value. This is in contrast to BISAP score sensitivity of 58.33% reported by Kim BG<sup>19</sup> and 69.2% reported by Arif A<sup>20</sup>. So BISAP scoring system can be used as screening tool for severe acute pancretitis. For making specific diagnosis, other tests with high specificity and PPV can be used. This has not been attempted in the current study, hence further studies are required with tests having higher specificity and PPV.

There are several potential limitations of the study that should be noted. The study was conducted mainly in adults; hence the evaluation on BISAP score in predicting severe acute pancreatitis in paediatric age group could not studied. Other parameters like CRP, IL-6. procalcitonin which has high PPV were not evaluated in the study due to the increased cost, resource limitation and availability. It's a single center study with small sample size. Comorbidities which accounts for acute pancreatitis like smoking, metabolic parameters etc. were not taken into consideration. Pregnant patients with acute pancreatitis were not studied. The authors validated the performance of the new scoring system in ICU, rather than in general wards, which may lead over estimation of the effectiveness of the system. Only limited informations were collected, each of which may have prognostic value in SAP.

#### CONCLUSION

BISAP score is a good predictor tool in evaluating the severity of acute pancreatitis. It can also be used to predict death in severe acute pancreatitis At higher centres, the application of BISAP score helps in the early categorisation of patients so that more attention can be given to patients categorised under severe acute pancreatitis.

BISAP is a straight forward grading system that can be used in primary healthcare facilities to expeditiously recommend patients to higher-level facilities that can assist lower mortality and morbidity. The effectiveness of the current scoring systems in predicting persistent organ failure in acute pancreatitis appears to have peaked. Although complex sets of predictive criteria are more accurate, they are also more difficult to utilise and have a restricted practical application. Without developing new techniques, it is doubtful that we will be able to effectively predict the severity of acute pancreatitis.

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