



## Comparison of BISAP (Bedside Index for Severity of Acute Pancreatitis) versus BALTHAZAR CTSI (Computed Tomography Severity Index) scoring in predicting the severity in acute pancreatitis

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## General Note

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## ABSTRACT

An often encountered surgical emergency is acute pancreatitis and poses a significant therapeutic challenge for the health care providers. It requires high clinical suspicion and careful monitoring to treat patients diagnosed with acute pancreatitis effectively. Bedside Index for Severity in Acute Pancreatitis (BISAP) is a scoring system which is simple and has 5 variables that would precisely predict severity as early as within the first 24 hours of the course of acute pancreatitis. Balthazar et al., introduced a grading system, Computed tomography Severity Index (CTSI) for acute pancreatitis which included the entire estimation of the contour, density and size of pancreas, pancreatic necrosis, peripancreatic collection in computed tomography to assess the prognosis in acute pancreatitis. The present study uses the Bedside Index for Severity in Acute Pancreatitis scoring system for grading the severity of acute pancreatitis in patients within 24 hours of hospital admission compared to Computed tomography Severity Index taken 48 hours after onset of symptoms and categorizes the management plan accordingly.

**Keywords:** Acute Pancreatitis, Bedside index, Computed tomography, Blood urea Nitrogen, Scoring system

## 1. INTRODUCTION

An often encountered surgical emergency is acute pancreatitis and poses a significant therapeutic challenge for the health care providers. It requires high clinical suspicion and careful monitoring to treat patients diagnosed with acute pancreatitis effectively. Around 4-5% mortality rate for acute pancreatitis has been reported world over, with higher rates in severe cases. The method of identifying severe cases of pancreatitis has so far been done using Ransons score and APACHE-II (Acute Physiology And Chronic Health Evaluation II) scoring systems, both the systems requiring 48 hrs to grade the severity and the latter requires exhaustive biochemical tests and various parameters to be measured for accurate calculation of the score (Ranson JH et al., 1974, *Knaus WA et al.*, 1985). By 48 hours of admission, it is obvious that the patient has developed multi-organ failure due to severe disease. As there is possibility of rapid deterioration in acute severe pancreatitis, it is important to stratify patients according to the risk at the earliest that is within 48 hours of onset of symptoms. Bedside Index for Severity in Acute Pancreatitis (BISAP) is a scoring system which is simple and has 5 variables that would precisely predict severity as early as within the first 24 hours of the course of acute pancreatitis (Singh VK et al., 2009). Balthazar et al., introduced a grading system, Computed tomography Severity Index (CTSI) for acute pancreatitis which included the entire estimation of the contour, density and size of pancreas, pancreatic necrosis, peripancreatic collection in computed tomography to assess the prognosis in acute pancreatitis.

The present study uses this BISAP scoring system for grading the severity of acute pancreatitis in patients within 24 hours of hospital admission compared to CTSI which taken 48 hours after onset of symptoms and categorize the management plan accordingly.

## Aims and objectives

The aim of our study was to analyze effectiveness of BISAP score in predicting the prognosis in acute pancreatitis patients in comparison with CTSI (CECT severity index) and the objective was to a prospective comparative study for acute pancreatitis to predict the severity based on bed side index of severity for acute pancreatitis and CT severity index. To assess the severity and analyze the comparative efficacy of both the scoring systems and decide treatment plans accordingly.

## 2. MATERIALS AND METHODS

A total of 70 patients admitted in the general surgery department with the diagnosis of Acute Pancreatitis were analysed during a period of two years.

### Inclusion criteria

- Age 15 – 70 years
- Acute pancreatitis due to any cause
- Acute or chronic pancreatitis

### Exclusion criteria

- Associated acute abdomen like perforation, trauma with pancreatitis
- Age <15years
- Patients admitted after 48hours of onset of symptoms.

All patients coming to casualty/ outpatient department with pain abdomen and diagnosed to have acute pancreatitis confirmed by raised serum amylase and Serum lipase were admitted and evaluated.

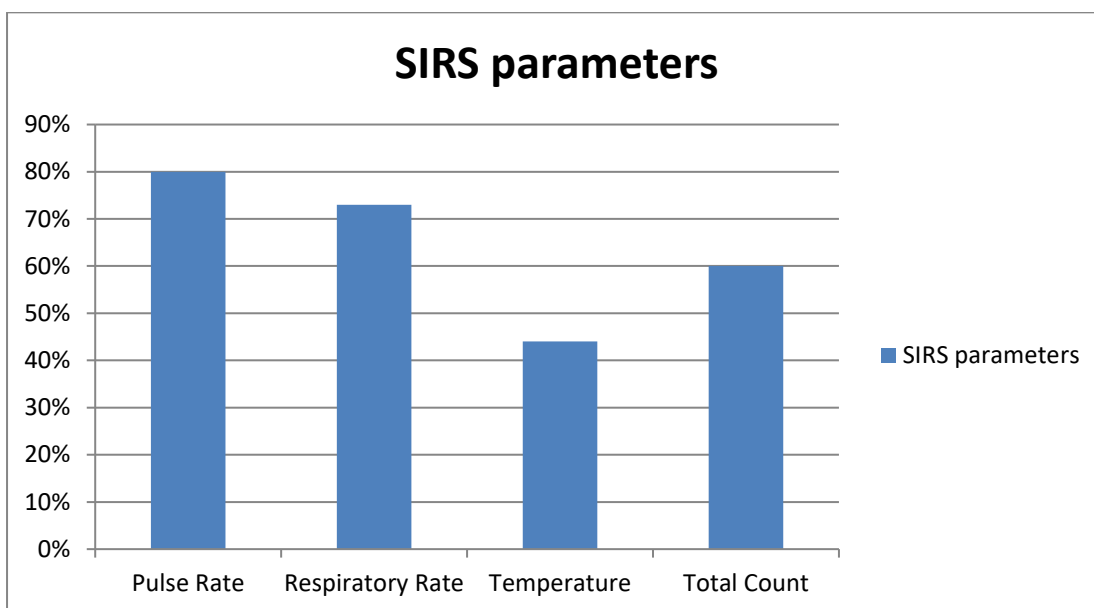
Patient's demographic factors of age and sex were noted. History of alcohol intake was elicited. Presenting complaints and symptoms were noted. Patient's vital signs – pulse rate, respiratory rate, blood pressure, temperature at the time of admission were noted. Patient's mental status at the time of admission was evaluated by Glasgow coma scale. Total count, blood urea, serum creatinine, chest x ray to check for pleural effusion and ultrasonogram abdomen for gallstones were done at the time of admission. With these parameters BISAP scoring was done at the time of admission. CECT whole abdomen was done 48hours after onset of symptoms and CT severity scoring was calculated. The scores in both the systems were compared and analyzed to predict the severity and complications and to plan the management accordingly.

## 3. RESULTS AND OBSERVATION

BISAP scoring takes age greater than 60 years as criteria and hence on tabulation, total of 70 patients were included in the study out of which 17 patients were above 60 years of age. 24 % of the populations in the study were above 60 years of age. 57 patients are male in the study which is 81% of the total population. 51 patients had history of alcohol consumption which is 74% of the total population are and is the most common cause of pancreatitis in the present study. 17 patients developed pancreatitis secondary to gall stone disease which is 24% of the total population. 2 patients had history of post ERCP (endoscopic retrograde cholangio pancreatography) and anomalous annular pancreas induced acute pancreatitis which is 2% of the total population. Blood urea nitrogen (BUN) is one of the parameters in BISAP with additional point added if it is greater than 25. In the present study 21 patients had BUN greater than 25 which is 30% of the total population. Pleural effusion is one of the parameters in BISAP scoring. If pleural effusion is present on chest x-ray radiography the score raises by 1. 42 cases showed signs of pleural effusion on chest radiography which is 60% of the total population. Glasgow coma scale has a maximum score of 15 and minimum score of 3. GCS considered significant in BISAP if it is less than 15 irrespective of the number and increases the score by 1 point. In this study 39 cases had GCS <15 which is 55% of the total population. SIRS is a component of BISAP scoring system which includes pulse rate, respiratory rate, raise or fall in temperature and variation in total count beyond the normal limits. Abnormality in a minimum of two values is considered as SIRS. 80% of cases presented with tachycardia (pulse rate >90beats/minute), 73% of cases presented with tachypnoea (respiratory rate >20/minute), 60% of cases presented with abnormal total count (<4000/>12000/mm<sup>3</sup>) and 44% of cases presented with alteration in body temperature (<36/>38 degree celcius). Two of the four criteria were positive in 56 cases. 80% of the total population presented with systemic inflammatory response syndrome (Diagram 1).

BISAP is calculated as a sum of each positive parameter mentioned above. A score of greater than or equal to 3 signifies acute severe pancreatitis. On statistical analysis of the same in the current study showed 43 patients having a score of more than or equal to 3 which is 61% of the total population.

CT severity index is a cumulative scoring of pancreatic inflammatory changes and amount of necrosis. In the current study 32 cases had CTSI range of 7 - 10 which is a feature of acute severe pancreatitis (Fig: 1-3).



**Diagram1** SIRS parameters



**Figure 1** CT Scan pictures showing Acute Edematous Pancreatitis



**Figure 2** CT scan showing minimal necrosis (< 30%)



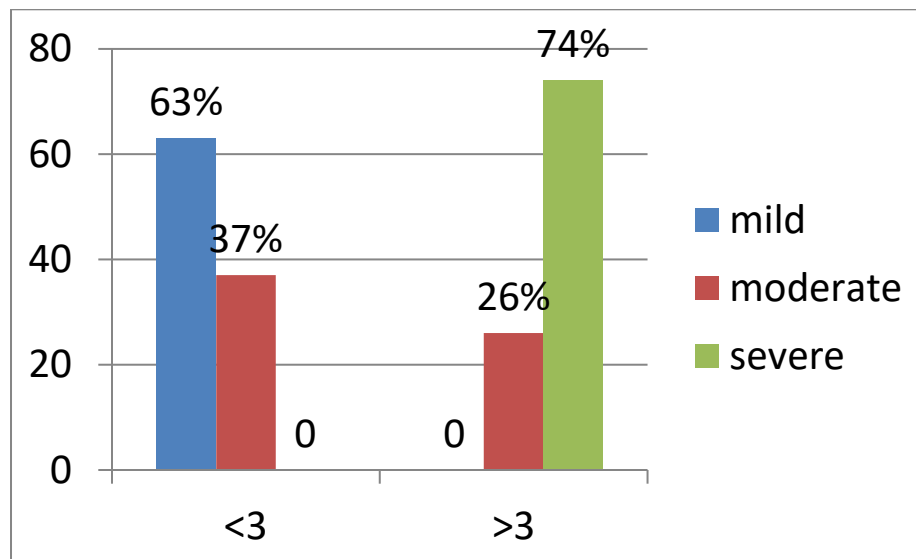
**Figure 3** CECT showing extensive pancreatic necrosis

46% of the total population had acute severe pancreatitis (Table1).

**Table 1** CTSI - CT SEVERITY INDEX

CTSI	Number of cases	Percentage (%)
Mild	17	24
Moderate	21	30
Severe	32	46
total	70	100

BISAP and CTSI are predictor scoring systems in pancreatitis for morbidity and mortality. Correlation of BISAP and CTSI: On cross tabulation analysis of BISAP and CTSI score 74% of cases with BISAP score more than or equal to 3 had CTSI of 7-10 indicating that 74% of cases prognostically evaluated to develop acute severe pancreatitis had the same by CTSI scoring as well (Diagram 2).



**Diagram 2** Correlations of BISAP and CTSI

26% of cases with BISAP score  $\geq 3$  had CTSI score of 4-6. None of the cases had score 0-3 in CTSI with a BISAP of  $\geq 3$ . Similarly, in the subgroup of BISAP  $< 3$  none of the cases had CTSI of 7-10. 37% of cases had CTSI of 4-6 and 63% of cases had CTSI of 0-4. On statistical analysis with this data correlating BISAP and CTSI by Chi-square test, a p-value of  $< 0.05$  was obtained which is clinically

significant. Mortality: BISAP and CTSI are predictors of mortality as well. In the current study there was a mortality of 3 cases that is 4% of the total population. All these 3 cases had a BISAP of 5/5 and CTSI of 10/10.

#### 4. DISCUSSION

With Ranson and APACHE scoring system the severity and prognosis of acute pancreatitis cannot be predicted until 48 hours. Within 48 hours, the severe acute pancreatitis patient manifests with multi organ failure. Wu et al., in the Brigham Pancreas Center did both retrospective and prospective series of studies and developed score which was simple to predict the severity in acute pancreatitis within the first 24 hours of admission (Singh VK et al., 2009). After proper validation, they developed a score which includes 5 parameters could accurately predict the prognosis within the first 24 hours of admission. This is BISAP (Bedside Index for Severity in Acute Pancreatitis) scoring system (Chen L et al., 2013). The BISAP score provides a 1 point was given to each parameter in BISAP score (the initial letter in every parameter corresponds to one point):

- Urea nitrogen (BUN) level in blood more than 25 mg/dL,
- Impaired sensorium, (less than 15/15 in Glasgow Coma Scale)
- Presence of Systemic inflammatory response syndrome, ie.,
  - Temperature of less than 36 degrees or more than 38 degrees Celsius
  - Respiratory rate more than 20/min
  - Pulse rate more than 90/min
  - WBC count less than 4,000 cells/mm<sup>3</sup> or more than 12,000 cells/mm<sup>3</sup> or immature bands > 10%
- Age more than 60,
- Imaging showing Pleural effusion,

All parameters put together correlates to 5 points. When the BISAP score of 3 or more than 3, then there is seven- to twelve-fold increased risk of developing organ failure. The risk for mortality increases with increasing BISAP (De Beaux AC et al., 1995):

- Mortality rate observed with score 0 was 0.1%
- Mortality rate observed with score 1 was 0.4%
- Mortality rate observed with score 2 was 1.6%
- Mortality rate observed with score 3 was 3.6%
- Mortality rate observed with score 4 was 7.4%
- Mortality rate observed with score 5 was 9.5%

In 1985 Balthazar et al., developed a scoring system for acute pancreatitis based on an entire estimation of the contour, density and size of pancreas, pancreatic necrosis, peripancreatic collection in computed tomography to assess the prognosis in acute pancreatitis (Balthazar EJ et al., 1985). When compared to edematous pancreatitis, necrotizing pancreatitis has more chances of developing complications and has higher death rates but pancreatic necrosis does not predict the prognosis in this index. In 1990 Balthazar modified his scoring system by adding the severity of pancreatic necrosis. This modified Index had better accuracy in predicting prognosis than his earlier grading system (Balthazar EJ et al., 1990, Tenner S et al., 1997, Bollen TL et al., 2011).

#### **BALTHAZAR SCORING SYSTEM - CT SEVERITY INDEX**

Balthazar Grading of pancreatitis

Grade A: Pancreas is normal or mild inflammation of Pancreas

Grade B: Focal or diffuse pancreatitis without surrounding inflammation

Grade C: grade B + surrounding inflammation

Grade D: grade C + unilocular fluid collection

Grade E: grade C + more than one fluid collection with retroperitoneal gas shadow

CTSI = Balthazar Grade Score Plus Necrosis Score

Balthazar grade score:

A = 0

B = 1

C = 2

D = 3

E = 4

Necrosis Score:

No necrosis - 0

<30% necrosis - 2

30-50% necrosis - 4

>50% necrosis - 6

CTSI:

Mild Pancreatitis - 0-3

Moderate Pancreatitis - 4-6

Severe Pancreatitis - 7-10

BISAP scoring stratifies patients according to their risk of developing systemic complications prior to the onset of organ failure within the first 24 h of admission. The CTSI is better in predicting the local complications (Thamilselvam P et al., 2008, Khanna AK et al., 2013, Yadav J et al., 2016).

In statistical analysis of the study, a significant p value of <0.05 was obtained, interpreting that BISAP which is done within 24 hours of admission predicts severity accurately in relation to CTSI done after 48 hours confirming the severity. Vikesh K Singh et al., showed similar results in his study, BISAP as a predictor of organ failure and local complications. The rate of organ failure was also compared with the local severity based on CTSI. Among 49% of patients who developed organ failure all had BISAP score more than 3 and had moderate or severe pancreatitis on CTSI. This observation was also similar to the study by Vikesh K Singh et al., on proving them as predictors of organ failure. Similar to our study, Layer et al in his study patients with BISAP score > 3 had developed multiorgan failure and he suggested that the BISAP score stratifies patients prior to onset of organ failure (Layer et al., 2009).

Similarly, Georgios I et al., in their study, patients with higher BISAP score developed more complications than patients with lesser score and he also said that the BISAP score predicts risk in acute pancreatitis more precisely. Its variables are clinical parameters which are simple to get (Georgios I et al., 2010). Stuart Sherman et al in his study- BISAP score in 397 consecutive acute pancreatitis patients at a tertiary care hospital showed similar observations like our study. In his study, mortality rate was high in patients with higher BISAP score. A score of 3 was determined to be the ideal value to predict mortality. Mortality was 18% in patients with BISAP  $\geq$  3 and 1% in patients with score less than 3. When BISAP score was  $\geq$  3, there was significant increased risk of developing organ failure and pancreatic necrosis.

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. In the past, surgery was the mainstay of management of severe acute pancreatitis. Surgery for pancreatitis had high morbidity and mortality, in the present years most of the severe acute pancreatitis are initially managed conservatively in Intensive Care Unit and monitored for signs of deterioration. Scoring systems in acute pancreatitis help in stratifying these patients so that human and clinical resources can be appropriately utilised to manage the patients with severe disease (Tenner S et al., 2013).

## 5. CONCLUSION

BISAP predicts the patients who may progress to severe pancreatitis. BISAP scoring system can be applied to triage the patients according to the severity risk within 24 hours of presentation for appropriate investigations and management. CTSI quantifies the extent of pancreatic damage. Both together help to triage the patient, assess severity, anticipate complications and predict the mortality. Thus, "The BISAP score stratifies patients within the first 24 h of admission according to their risk of in-hospital mortality and was able to identify patients at increased risk of mortality prior to the onset of organ failure".

The BISAP score has definite advantages when compared with other prognosis predicting scores in acute pancreatitis. BISAP score is easy to calculate, needs only vital signs, basic laboratory investigations, and imaging that are usually done during admission or within the first 24 hours of presentation.

### Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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The first author, Dr. Surya Subramanian has funded the study.

## Data availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Ethics committee approval code

CSP-MED/14/OCT/19/197

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