ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Original Research Article

# Bedside Index of Severity in Acute Pancreatitis (BISAP) score for predicting prognosis in acute pancreatitis

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**How to cite this article:** Jayant L. Pednekar, Sachin Patil, Sangeeta Pednekar. Bedside Index of Severity in Acute Pancreatitis (BISAP) score for predicting prognosis in acute pancreatitis. IAIM, 2015; 2(2): 62-70.

**Available online at www.iaimjournal.com**

**Received on:** 07-01-2015 **Accepted on:** 26-01-2015

## Abstract

**Introduction:** Bedside Index of Severity in Acute Pancreatitis (BISAP) is a simple bedside tool which helps in early identification of risk of higher mortality in acute pancreatitis.

**Objectives:** Our aim was to study clinical and laboratory profiles of patients with acute pancreatitis presenting to a tertiary care hospital in Mumbai, India and to stratify patients according to their risk of mortality by applying the BISAP score and its correlation with Computed Tomography Severity Index (CTSI).

**Material and methods:** Patients who came to Lokmanya Tilak Municipal Medical College (LTMMC) and General Hospital, Mumbai with definitive features of acute pancreatitis from January, 2013 to April, 2013 were prospectively observed for 24 hours and their clinical information was collected. CT abdomen was used as the gold standard for the diagnosis of acute pancreatitis. Descriptive analysis for various patient variables was performed using SPSS.

**Results:** Alcoholism was the most common etiology; 97% patients presented with abdominal pain. Higher serum amylase, lipase and blood urea nitrogen levels, hypocalcemia, presence of systemic inflammatory response syndrome and bilateral pleural effusion were found to significantly associate with mortality. There was a statistically significant trend for increasing mortality with increasing BISAP score ($p<0.001$). However, no significant correlation between BISAP score and CTSI was found [($p = 0.101$), Pearson's correlation coefficient = 0.168].

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

**Conclusion:** Traditional severity indices have not been clinically useful since they require collection of huge amount of clinical and laboratory data over time. In such circumstances, BISAP score can predict patients who are at higher risk of mortality.

## Key words

Acute pancreatitis, Computed tomography, Mortality, Mumbai, Prognosis.

## Introduction

Pancreatic inflammatory disease may be classified as acute or chronic pancreatitis. The pathologic spectrum of acute pancreatitis varies from interstitial pancreatitis, which is usually a mild and self-limited disorder, to necrotizing pancreatitis, in which the extent of pancreatic necrosis may correlate with the severity of the attack and its systemic manifestations. The incidence of pancreatitis varies with geographical location but most commonly involves alcohol, gallstones, metabolic factors, and drugs [1].

Mortality in acute pancreatitis may range from 1% to up to 26% in severe pancreatitis. Identification of patients at risk for mortality early in the course of acute pancreatitis is an important step in improving outcome. The management of acute pancreatitis is still a challenge facing the clinician. Yet over the years certain guiding principles have evolved and which have been borne out by the current study also. Various strategies have been used to predict the severity and outcome of acute pancreatitis, including the Ranson's criteria [2], Acute Physiology and Chronic Health Evaluation (APACHE) II [3], Computed Tomography (CT) Severity Index (CTSI) [4], Glasgow and Imrie scoring systems [5]. Each has advantages and disadvantages, and none is currently recognized as a criterion standard. The Mayo Clinic criteria indicate that acute interstitial pancreatitis can be diagnosed with at least one of three abnormalities.

- Diagnostic histology
- Characteristic findings on CT scan and pancreatography combined with elevated IgG4 levels
- Response to glucocorticoid therapy, with improvement in pancreatic and extra pancreatic manifestations [6].

A recent simplified scoring system for the early prediction of mortality was developed from a large cohort of patients with acute pancreatitis. This scoring system, referred to as the Bedside Index of Severity in Acute Pancreatitis (BISAP), incorporates five clinical and laboratory parameters obtained within the first 24 hours of hospitalization [7]. Presence of three or more of these factors was associated with substantially increased risk for in-hospital mortality among patients with acute pancreatitis.

Our aim was to study the prevalence of acute pancreatitis in a tertiary care hospital in Mumbai, India and to study different clinical and laboratory profiles of patients with acute pancreatitis. In addition, we aimed to stratify patient with acute pancreatitis according to their risk of mortality by applying the BISAP score.

## Material and methods

### Study design

After obtaining Institutional Review Board approval, we prospectively observed patients who came to Lokmanya Tilak Municipal Medical College (LTMMC) and General Hospital, Mumbai with definitive features of acute pancreatitis from January, 2013 to April, 2013. Various

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

patient variables were obtained and analysed to find associations with patients' clinical outcomes.

**Setting**

Mumbai is the most populous city in India, with an estimated metropolitan area population of 20.7 million according 2011 census [8]. Greater Mumbai has a literacy rate of 94.7% which is higher than the national average of 86.7% [8]. Apart from Marathi, which is the native language, Hindi, Gujarati and English are spoken and understood well in this region. LTMMC, 1400 plus bedded academic tertiary level hospital, is a major healthcare provider in Sion, Mumbai.

**Patient population**

All patients aged 18 years or more were consented for the study. Definitive features of acute pancreatitis were assessed by clinical presentation, laboratory investigations, and abdominal ultrasonography findings; later confirmed by abdominal CT. Patients with chronic pancreatitis or with surgical causes of acute pancreatitis were excluded from the study. All patients included in the study underwent standard clinical examinations, routine biochemical and hematological investigations and received treatment as decided by their treating physician. Patient identifiers like name, age, date of birth and medical record number were used to generate the data for analysis.

**Data collection and analysis**

Patients who satisfied our inclusion criteria were followed up for 24 hours from admission. Patient variables like age, gender, specific etiologies for pancreatitis, past history of alcohol intake were collected. Presenting symptoms like fever, abdominal pain, abdominal distension, nausea and vomiting were noted for each patient along with physical examination findings. Data like serum amylase, serum lipase, serum calcium levels, blood urea nitrogen (BUN), and presence of pleural effusion and presence of systemic inflammatory response syndrome (SIRS) were collected for all patients. **(Appendix - 1)** Bedside Index of Severity in Acute Pancreatitis (BISAP) score was calculated based on the data collected. **(Appendix - 2)** CT abdomen was used as the gold standard for the diagnosis. CTSI was calculated for each patient and was compared with BISAP score.

**Appendix – 1:** Systemic Inflammatory Response Syndrome (SIRS).

| |
|---|
| • Temperature > 38 $^0$C or <36 $^0$ C<br>• Pulse > 90/minute<br>• Tachypnea > 24/minute<br>• WBC > 12000/mm$^3$ |
| Any two of four will be significant if present simultaneously.<br>A score of > 3 will indicate severe acute pancreatitis (early organ failure/ pancreatic necrosis) |

**Appendix – 2:** Bedside Index of Severity in Acute Pancreatitis (BISAP).

| **Parameters** | **Score** | |
|---|---|---|
| | **1** | **0** |
| Blood Urea Nitrogen | > 25 mg% | < 25 mg% |
| Impaired Mental Status | Present | absent |
| SIRS | 2/4 present | Absent |
| Age | > 60 years | < 60 years |
| Pleural effusion | Present | Absent |

The data were entered in Microsoft excel sheets and descriptive analysis for various patient variables was performed. Analyses were

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

completed using SPSS version 20 (Armonk, NY: IBM Corporation). Chi square test and Pearson's correlation coefficient were used for comparison of proportions between two groups and for studying correlation between numerical variables respectively. P value less than 0.05 was taken as statistically significant.

## Results

Etiologically, majority of deaths occur among those patients who had acute pancreatitis due to dengue and leptospirosis when there is multi-organ involvement. Drug induced hyper triglyceridemia induced, autoimmune and idiopathic pancreatitis has lesser mortalities. Amongst patients presenting to the emergency unit, abdominal pain was the most common complaint followed by fever and abdominal distension. Fever had statistically significant correlation with mortality and alcohol did not bear a statistically significant correlation with mortality. On examination, anemia and abdominal tenderness were amongst the most common findings. Fever, respiratory involvement in the form of tachypnea with bilateral crepitations on auscultation and icterus had statistically significant correlation with mortality. Serum amylase levels more than twice the normal range appeared to be fairly indicative of acute pancreatitis, provided other causes of raised amylase are ruled out and other findings and investigations are consistent with the diagnosis. The more the deviation of serum amylase and lipase above baseline, the more was the mortality.

## Discussion

Traditionally used severity indices such as APACHE II and Ranson's criteria have not been clinically useful since they are cumbersome, require collection of huge amount of clinical and laboratory data over time and do not have acceptable positive and negative predictive value for severe acute pancreatitis. Besides, these scores are applied after 48 hours of admission.

The current study was a prospective observational study done in medical wards in patients receiving conservative treatment. The majority of cases of acute pancreatitis from the present study criteria were from the middle age group. The age distribution reflects the predilection of this disease for middle age. The reason for this being that commonest aetiologies are alcoholism and gall stones, both of which are common in middle age group. According to Villacis X, et al. the mean age was 45.33 years [9]. Our study also had majority of patients from middle age group of 30-64 years as per **Table - 1**. According to a study by Yadav D, et al. the sensitivity and specificity of amylase as a diagnostic test for acute pancreatitis depends on the chosen threshold value [10]. By raising the cut off level to 1000 IU/l (more than three times the upper limit of normal), amylase has a specificity approaching 95%, but a sensitivity as low as 61% in some studies. According to the same study, the diagnostic accuracy of lipase appears to be better than that of amylase. At a cut off activity of 600 IU/l, most studies have reported specificities above 95%, with sensitivities ranging between 55% and 100%. Out of 6 patients with serum amylase > 10000 units, 3 died as per **Table - 2**. But out of 37 patents with serum amylase <1000 units, no mortality was reported. There were 14 patients with raised serum lipase >10000, out of which 4 expired while amongst 36 patients with serum lipase <1000, only 2 expired as per **Table - 2**. This showed that the more the deviation of serum amylase and lipase above baseline, the more is the mortality. Robert JH, et al. studied serum and peritoneal amylase and lipase levels at an early stage in 73 patients with acute pancreatitis [11]. They found that enzymatic score calculated by using serum and peritoneal

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

amylase and lipase levels appears to be a good indicator of severity of disease, being as it is directly and significantly related to mortality rate, prognostic score as proposed by Ranson, and incidence of extrapancreatic spreads as demonstrated by CT scan.

Our study showed that there were 4 patients who had moderate hypocalcemia with serum calcium levels < 7 mg%, 3 expired (75%). This indicates hypocalcemia is associated with poorer outcome in such patients. As per a study done by Ammori BJ, et al. hypocalcemia was significantly more frequent (86% versus 39%, p<0.001) and reached significantly lower levels during severe attacks than during mild attacks [12]. Our data showed no significant statistical correlation between BISAP score and CT severity index. **(Figure - 1)** As per Kim BG, et al. study, BISAP is more accurate for predicting the severity of acute pancreatitis than the serum PCT, APACHE-II, Glasgow, and CTSI scores [13]. Correlation between BISAP score and outcome which was statistically significant was as per **Table - 3**. There were 8 patients in the study who had a BISAP score of 3 or 4 out of which everyone died. Out of 79 patients who had a score of 0, only 2 expired. This proves the statistically significant correlation between BISAP score and outcome. According to a study by Singh MD, et al. there was a statistically significant trend for increasing mortality (P<0.0001) with increasing BISAP score [14]. A score of $\geq$ 3 was associated with increased risk of developing organ failure, persistent organ failure and pancreatic necrosis. Another study done by Villacis X, et al. also concluded with the correct prediction of severity of acute pancreatitis by BISAP score [9]. They found sensitivity and specificity of BISAP score to be 75% and 97.5%. Out of 5 parameters of score, BUN levels, presence of SIRS, impaired mental status and presence of bilateral pleural effusion had significant independent statistical correlation with outcome in the study. According to a study by Halonen KI, et al., in patients with severe acute pancreatitis, advanced age, history of continuous medication, and need for dialysis, mechanical ventilator support, and pressor support predict fatal outcome [15].

## Limitations

The current study was a prospective observational study done in medical wards with conservative approach where patients were monitored only during the hospital stay and were not followed up thereafter. All surgical causes of acute pancreatitis like gall stones, abdominal trauma; structural abnormalities like choledochocele, pancreas divisum, carcinoma of head of pancreas etc. had been excluded by the study. The results and conclusions of the study depend on the type and sample size of population studied. So each and every finding of these results cannot be applied to the general population as such.

## Conclusion

Identification of patients at risk for mortality early in the course of acute pancreatitis is an important step in improving outcome. BISAP score is a simple bedside tool which can be applied within first 24 hours of admission and can predict patients at risk of mortality which require more monitoring and more aggressive treatment.

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ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

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**Source of support:** Nil **Conflict of interest:** None declared.

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

**Table - 1:** Characteristics of the included patients.

| Variable | n | Patient clinical outcome | |
|---|---|---|---|
| | | Discharged | Expired |
| **Study sample size** | 101 | 91 | 10 |
| **Age** | | | |
| Less than 60 years | 96 | 87 | 9 |
| More than 60 years | 5 | 4 | 1 |
| **Gender** | | | |
| Male | 89 | 79 | 10 |
| Female | 12 | 12 | 0 |
| **Etiology** | | | |
| Alcoholism | 80 | 76 | 4 |
| Dengue | 5 | 3 | 2 |
| Leptospirosis | 5 | 1 | 4 |
| Autoimmune | 2 | 2 | 0 |
| Drug induced | 3 | 3 | 0 |
| Hypertriglyceridemia | 3 | 3 | 0 |
| Idiopathic | 3 | 3 | 0 |
| **Presenting symptoms** | | | |
| Fever | 67 | 57 | 10 |
| Abdominal pain | 98 | 89 | 9 |
| Adbominal distension | 55 | 47 | 8 |
| Nausea/vomiting | 62 | 53 | 9 |
| **Past history of alcoholism** | 83 | 76 | 7 |

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

**Table - 2:** Specific findings in patients included in the study.

| Variables | n | Patient clinical outcome | | p value (chi square test) |
|---|---|---|---|---|
| | | Discharged | Expired | |
| **Examination findings** | | | | |
| Abdominal tenderness | 78 | 70 | 8 | 1.00 |
| Anemia | 82 | 74 | 4 | 1.00 |
| Raised temperature | 6 | 2 | 4 | 0.001* |
| Icterus | 4 | 1 | 3 | 0.003* |
| **Glasgow Coma Scale Score** | | | | |
| Mild (>12) | 94 | 90 | 4 | <0.001* |
| Moderate (12-9) | 7 | 1 | 6 | |
| **Serum amylase** | | | | |
| < 1000 U/L | 37 | 37 | 0 | |
| 1000-5000 U/L | 48 | 41 | 7 | |
| 5000-10,000 U/L | 10 | 10 | 0 | 0.001* |
| >10,000 U/L | 6 | 3 | 3 | |
| **Serum lipase** | | | | |
| <1000 U/L | 36 | 34 | 2 | |
| 1000-5000 U/L | 30 | 29 | 1 | |
| 5000-10,000 U/L | 21 | 18 | 3 | 0.043* |
| >10,000 U/L | 14 | 10 | 4 | |
| **Hypocalcemia** | | | | |
| No | 4 | 3 | 1 | |
| Mild (9-7mg/dl) | 93 | 87 | 6 | <0.001* |
| Moderate (7-5.5mg/dl) | 4 | 1 | 3 | |
| **Blood Urea Nitrogen** | | | | |
| <25 mg% | 85 | 83 | 2 | <0.001* |
| >25 mg% | 16 | 8 | 8 | |
| **Presence of Systemic Inflammatory Response Syndrome** | | | | |
| Yes | 20 | 11 | 9 | <0.001* |
| No | 81 | 80 | 1 | |
| **Presence of bilateral pleural effusion** | | | | |
| Yes | 6 | 4 | 2 | 0.048* |
| No | 95 | 87 | 8 | |

*p value statistically significant

ISSN: 2394-0026 (P)
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**Table - 3:** Comparison of BISAP score with patient clinical outcome.

| | | BISAP score | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | **0** | **1** | **2** | **3** | **4** | |
| **Outcome** | **Discharged** | 77 | 8 | 6 | 0 | 0 | 91 |
| | | 97.5% | 100.0% | 100.0% | .0% | .0% | 90.1% |
| | **Expired** | 2 | 0 | 0 | 4 | 4 | 10 |
| | | 2.5% | 0 | 0 | 100.0% | 100.0% | 9.9% |
| **Total** | | **79** | **8** | **6** | **4** | **4** | **101** |
| | | **100.0%** | **100.0%** | **100.0%** | **100.0%** | **100.0%** | **100.0%** |

**Chi square test:** $\chi^2$ = 79.148; df = 4; p < 0.001 (statistically significant)

**Figure – 1:** Correlation between CT Severity Index and BISAP score.

| | | CT index |
|---|---|---|
| BISAP score | Pearson Correlation (r) coefficient | 0.168<br>(Weakly positive correlation) |
| | P value | 0.101 |
| | Significance | Not significant |
| | *n* | 96 |

*(Pearson's correlation coefficient)*