ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 08 | August - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# COMPARISON OF BISAP SCORE AND COMPUTED TOMOGRAPHY SEVERITY INDEX IN PREDICTING THE SEVERITY OF ACUTE PANCREATITIS

General Surgery

**Nimmala Nikitha Reddy N*** — Postgraduate Resident, Department of General Surgery, Sri Siddhartha Medical College and Hospital, Sri Siddhartha Academy of Higher Education, Tumakuru, Karnataka, India *Corresponding Author

**Shivakumar T** — Professor, Department of General Surgery, Sri Siddhartha Medical College and Hospital, Sri Siddhartha Academy of Higher Education, Tumakuru, Karnataka, India

**Vaishnavi G Nakade** — Senior Resident, Department of General Surgery, Sri Siddhartha Medical College and Hospital, Sri Siddhartha Academy of Higher Education, Tumakuru, Karnataka, India

## ABSTRACT

**Background:** Acute pancreatitis is a common surgical emergency with an unpredictable clinical course, ranging from mild self-limiting disease to severe illness with organ failure and death. Early severity prediction is essential to guide monitoring, resource allocation, and outcome improvement. **Aim:** To compare the Bedside Index for Severity in Acute Pancreatitis (BISAP) score and the Computed Tomography Severity Index (CTSI) in predicting severity and mortality in patients with acute pancreatitis. **Materials and Methods:** This observational comparative study included 58 patients diagnosed with acute pancreatitis, recruited over 24 months. BISAP was calculated within 24 hours of admission, and contrast-enhanced CT was performed after 48 hours to derive CTSI. Sensitivity, specificity, predictive values, and correlation between the two scores were analysed; $p < 0.05$ was taken as significant. **Results:** The study population was predominantly middle-aged (41–50 years, 39.7%) with a marked male predominance (81.0%). Pleural effusion was present in 67.2% and SIRS criteria were met in 37.9%. Mean BISAP was $1.72 \pm 0.87$ and mean CTSI was $5.48 \pm 3.09$. ICU admission was required in 20.7%, complications occurred in 24.1%, and mortality was 3.4%; All ICU admissions and deaths occurred in patients with BISAP $\geq 3$. A significant positive correlation was found between BISAP and CTSI ($r = 0.465$, $p = 0.016$). BISAP showed higher specificity (75%) and negative predictive value (90%), while CTSI showed higher sensitivity (100%) and positive predictive value (80%). **Conclusion:** BISAP is a simple, rapid bedside tool for early identification of high-risk patients, particularly for predicting ICU admission and mortality, while CTSI remains valuable for radiological staging of local disease severity. Their moderate correlation supports complementary rather than substitutive use in the assessment of acute pancreatitis.

## KEYWORDS

Acute Pancreatitis; BISAP Score; CTSI; Severity Prediction; ICU Admission; Mortality

## INTRODUCTION

Acute pancreatitis is one of the most frequently encountered surgical emergencies and continues to pose a significant therapeutic challenge because of its unpredictable clinical course and wide spectrum of severity.[1] While many patients experience a mild, self-limiting illness, a considerable proportion progress rapidly to severe disease with systemic inflammatory response, organ failure, pancreatic necrosis, and even death.[2] Mortality in uncomplicated cases is relatively low, but in severe acute pancreatitis it rises sharply, underscoring the importance of early identification of patients likely to deteriorate.

Although approximately 80% of cases follow a benign course, 10–20% develop severe illness characterised by progressive inflammation, local complications, and distant organ dysfunction.[3] The updated Atlanta classification recognises different severity categories, reflecting the clinical need to differentiate mild disease from forms that require intensive management.[4] Traditional multifactorial scoring systems such as Ranson's criteria and APACHE II require numerous biochemical parameters and often need up to 48 hours before a reliable severity assessment can be made, by which time patients with severe disease may already have developed organ failure.[5]

The Bedside Index for Severity in Acute Pancreatitis (BISAP) was introduced to meet the need for a simple, rapid, bedside prognostic tool.[6] It is based on five readily obtainable parameters — blood urea nitrogen (BUN) > 25 mg/dL, impaired mental status, systemic inflammatory response syndrome (SIRS), age > 60 years, and pleural effusion — each contributing one point, allowing calculation within the first 24 hours of presentation. A BISAP score of $\geq 3$ has been shown to identify patients at significantly increased risk of organ failure and mortality.[6]

In contrast to clinical scoring systems, imaging-based assessment plays an important role in evaluating local disease severity. Balthazar and colleagues introduced the Computed Tomography Severity Index (CTSI), which combines morphological grading of pancreatic inflammation with the extent of pancreatic necrosis to provide an objective estimate of disease severity, typically assessed on contrast-enhanced CT performed after 48 hours.[7] Subsequent modifications improved its prognostic accuracy, and CTSI has been shown to correlate well with local complications, need for intervention, and overall prognosis.[8]

BISAP and CTSI therefore address complementary aspects of disease assessment: BISAP emphasises early systemic response and physiological derangement, while CTSI provides detailed anatomical information regarding pancreatic damage and local complications.[9] Several studies have shown that BISAP tends to have higher specificity and positive predictive value for severe disease and mortality, whereas CTSI often demonstrates higher sensitivity and negative predictive value, particularly for pancreatic necrosis.[9] Despite the availability of multiple scoring systems, there is no universal consensus on the single best tool for predicting severity, and performance may vary with patient population, timing of assessment, and available resources. Against this background, comparing the predictive performance of BISAP and CTSI in assessing the severity of acute pancreatitis is clinically relevant.

### Objectives

1. To assess the BISAP score in patients with acute pancreatitis.
2. To compare the BISAP score and the CTSI in acute pancreatitis.
3. To assess the sensitivity and specificity of BISAP and CTSI in predicting severity of acute pancreatitis.

## MATERIALS AND METHODS

This observational comparative study was conducted in the Department of General Surgery at Sri Siddhartha Medical College and Hospital, Tumakuru, and the District Hospital, Tumakuru, over a period of 24 months. Patients presenting to the outpatient department, emergency services, inpatient wards, and intensive care units with a clinical diagnosis of acute pancreatitis were screened for eligibility using purposive consecutive sampling. The diagnosis of acute pancreatitis was based on the presence of at least two of the following: characteristic abdominal pain, serum amylase/lipase more than three times the upper limit of normal, and characteristic findings on imaging.[4]

Based on the reported sensitivity of BISAP of 91.7%, a precision of 10%, and an assumed prevalence of 50%, the minimum calculated sample size required for the study was 58 patients. Recruitment continued consecutively until this target was achieved.

A detailed history was recorded for each participant, encompassing demographic information, presenting complaints, duration of symptoms, and comorbidities. Physical examination focused on general condition, abdominal findings, and neurological status, including Glasgow Coma Scale (GCS) assessment. SIRS was assessed using temperature, heart rate, respiratory rate, and white blood cell count.[2] Blood samples were collected within the first 24 hours of presentation for BUN estimation and routine laboratory investigations, and a chest X-ray was performed to assess pleural effusion. The BISAP score was calculated using the five predefined parameters within the first 24 hours of admission.[6] After 48 hours of symptom onset, contrast-enhanced CT of the abdomen and pelvis was performed, and the CTSI was calculated based on pancreatic morphology grading and the extent of necrosis.[7,8] All patients continued to receive standard clinical management as per hospital protocol, and the study did not influence therapeutic decisions.

### *Inclusion and Exclusion Criteria*

**Inclusion Criteria:** (1) patients clinically diagnosed with acute pancreatitis based on clinical presentation, laboratory findings, and imaging confirmation; (2) patients aged between 18 and 70 years; (3) patients who provided informed written consent for participation.

**Exclusion Criterion:** (1)patients with chronic kidney disease were excluded, since altered renal physiology could confound BUN-based scoring and disease severity assessment.

### *Statistical Analysis*

Data were entered into Microsoft Excel and analysed using appropriate statistical software. Quantitative variables were expressed as mean ± standard deviation, and categorical variables were expressed as frequency and percentages. Comparative analysis of continuous variables was performed using the unpaired t-test, and associations between categorical variables were assessed using the chi-square test. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated for both BISAP and CTSI against a composite reference standard of clinical severity (defined by ICU admission, complications, or mortality). Receiver operating characteristic (ROC) curve analysis was performed to evaluate predictive performance, and Pearson correlation was used to assess the relationship between BISAP and CTSI scores. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee prior to initiation of the study, and written informed consent was obtained from all participants; confidentiality was maintained by anonymising patient data.

## RESULTS

A total of 58 patients diagnosed with acute pancreatitis were included in the study. The highest proportion of patients belonged to the 41–50 years age group (39.7%, n = 23), followed by 51–60 years (24.1%, n = 14), 21–30 years (15.5%, n = 9), 31–40 years (13.8%, n = 8), and 61–70 years (6.9%, n = 4). Males predominated (81.0%, n = 47) over females (19.0%, n = 11). Most patients belonged to the middle (55.2%) or low (34.5%) socio-economic strata. Abdominal pain alone was the commonest presenting symptom (37.9%), followed by pain with vomiting (20.7%). Comorbidities were absent in 51.7% of patients; diabetes (24.1%) and hypertension (19.0%) were the leading comorbid conditions.

Baseline physiological parameters reflected moderate systemic involvement: mean pulse rate was 96.34 ± 14.31/min, mean systolic blood pressure 130.38 ± 19.40 mmHg, mean respiratory rate 22.21 ± 4.13/min, mean $SpO_2$ 92.67 ± 3.31%, and mean GCS 14.81 ± 0.47. Mean BUN was 26.98 ± 8.78 mg/dL. SIRS criteria were fulfilled in 37.9% of patients, and pleural effusion was present on imaging in 67.2%. The mean BISAP score was 1.72 ± 0.87 (range 0–3), and the mean CTSI was 5.48 ± 3.09 (range 0–11); a BISAP score of ≥ 3 was recorded in 20.7% of patients (Table 1).

**Table 1: Key Baseline and Outcome Parameters (n = 58)**

| Parameter | Value |
|---|---|
| Age group with highest frequency | 41–50 years (39.7%) |
| Male sex | 81.0% (n = 47) |
| SIRS criteria met | 37.9% (n = 22) |
| Pleural effusion | 67.2% (n = 39) |
| Mean BISAP score | 1.72 ± 0.87 |
| Mean CTSI score | 5.48 ± 3.09 |
| ICU admission | 20.7% (n = 12) |
| Complications | 24.1% (n = 14) |
| Mortality | 3.4% (n = 2) |

On CT evaluation, pancreatic inflammation was seen in 55.2% of patients, enlargement in 32.8%, and normal morphology in 12.1%. Peripancreatic fluid collections were absent in 36.2%, single in 36.2%, and ≥ 2 collections in 27.6%. Necrosis was absent in 50.0% of patients, while ≤ 30%, 30–50%, and ≥ 50% necrosis were each observed in 15.5–19.0%.

BISAP score showed statistically significant associations with age ($p = 0.041$), sex ($p = 0.017$), symptom pattern ($p = 0.030$), comorbidities ($p < 0.001$), SIRS ($p = 0.006$), ICU admission ($p < 0.001$), and mortality ($p = 0.047$), but not with complications ($p = 0.096$). GCS declined significantly with rising BISAP category ($p = 0.044$), and mean BUN increased from 17.50 ± 4.44 mg/dL at BISAP 0 to 31.33 ± 5.82 mg/dL at BISAP ≥ 3 ($p < 0.001$). Individual CT parameters — pancreatic morphology ($p = 0.391$), fluid collections ($p = 0.424$), and degree of necrosis ($p = 0.214$) — did not show statistically significant independent association with BISAP score. However, the composite CTSI score showed significant association with BISAP ($p = 0.003$), rising from a mean of 4.25 ± 3.95 at BISAP 0 to 6.42 ± 2.07 at BISAP ≥ 3 ($p = 0.024$).

All patients who required ICU admission (n = 12) and both patients who died had a BISAP score ≥ 3; no ICU admissions or deaths occurred among patients with BISAP < 3. Pearson correlation analysis demonstrated a statistically significant moderate positive correlation between BISAP and CTSI scores ($r = 0.465$, $p = 0.016$), indicating that as clinical severity assessed by BISAP increased, radiological severity assessed by CTSI also tended to increase.

**Table 2: Diagnostic Accuracy of BISAP and CTSI in Predicting Severe Acute Pancreatitis***

| Parameter | BISAP | CTSI |
|---|---|---|
| Sensitivity | 88% | 100% |
| Specificity | 75% | 71.7% |
| Positive Predictive Value (PPV) | 72% | 80% |
| Negative Predictive Value (NPV) | 90% | 78% |

**Reference standard: composite clinical severity defined by ICU admission, complications, or mortality.*

## DISCUSSION

The present study compared BISAP and CTSI in predicting the severity and outcomes of acute pancreatitis in 58 patients. The predominance of middle-aged, male patients observed in this cohort is consistent with earlier reports. Chen et al. demonstrated that BISAP was significantly associated with severity, necrosis, and mortality across varied age groups in a large Chinese cohort, confirming its utility as a reliable prognostic indicator.[10] Yadav et al. similarly reported that most patients with acute pancreatitis belonged to middle-aged groups and that BISAP effectively stratified severity, achieving an AUC of 0.962 for severe disease and 0.846 for mortality prediction.[11] These observations align with the significant association between age and BISAP category ($p = 0.041$) found in the present study.

The marked male predominance (81.0%) observed here mirrors findings by Senapati et al., who reported that higher BISAP scores were strongly associated with organ failure, complications, and mortality, with a higher proportion of affected patients being male.[12] The significant association between sex and BISAP score ($p = 0.017$) in the present study is consistent with this pattern, likely reflecting greater exposure to established risk factors such as alcohol use among male patients.

Although socio-economic status did not show a statistically significant association with BISAP score in this study ($p = 0.098$), Kim et al. reported that BISAP achieved an AUC of 0.873, performing comparably to CT-based scoring systems and demonstrating its effectiveness as a simple, cost-effective tool independent of demographic background.[13] This supports the interpretation that disease severity is driven more by physiological derangement than by socio-economic factors.

BISAP demonstrated strong, statistically significant associations with SIRS, ICU admission, and mortality in the present study — all ICU admissions and both deaths occurred exclusively in patients with BISAP ≥ 3. This finding parallels the work of Gompertz et al., who

reported excellent BISAP performance for organ failure (AUC 0.977, specificity 99.1%, PPV 83.3%) in a retrospective cohort of 128 patients.[14] The rise in BUN and decline in GCS with increasing BISAP category observed in this study corroborate the physiological basis of the score and are consistent with the findings of Nie et al. and Chatterjee et al., who reported strong predictive accuracy of BISAP (AUC 0.89 and 0.811, respectively) using clinical and biochemical markers.[15,16]

Individual CT features — morphology, fluid collections, and necrosis — were not independently associated with BISAP category in the present study, but the composite CTSI score was significantly associated ($p = 0.003$). This is consistent with Harshit Kumar and Griwan, who demonstrated that composite modified-CTSI scoring outperformed individual radiological features (AUC 0.919), emphasising the importance of aggregate radiological severity over isolated CT findings.[17] Jingoniya et al. similarly reported high CTSI sensitivity (95.8%) for identifying severe disease, supporting the value of CT-based composite scoring once imaging becomes available.[18]

The moderate positive correlation between BISAP and CTSI observed in this study ($r = 0.465$, $p = 0.016$) indicates that clinical and radiological severity are related but not interchangeable, reflecting their different physiological bases — BISAP capturing early systemic response and CTSI capturing structural damage that typically becomes evident only after 48 hours. Ranjan et al. reported a BISAP sensitivity of 75% and specificity of 76.2% for predicting severe disease, broadly comparable to the present findings.[19] In the current study, BISAP showed higher specificity (75%) and NPV (90%), while CTSI showed higher sensitivity (100%) and PPV (80%), consistent with the pattern described by Coluoglu et al., who found that BISAP $\geq 3$ predicted severe disease with high specificity (91.6%) and NPV (94.9%) in a large cohort of 1,000 patients.[20] This complementary profile suggests that BISAP is most useful for rapidly and confidently ruling out severe disease at the bedside, whereas CTSI, once available, is more useful for confirming severe disease and characterising local complications that guide further management.

These findings support a combined-use strategy in clinical practice: BISAP for immediate triage at admission, followed by CTSI once imaging becomes available, to refine severity assessment and detect complications such as necrosis. In settings with limited or delayed access to CT, the high NPV of BISAP is particularly valuable for safely identifying patients who can be managed on a standard ward rather than in intensive care.

This study has certain limitations. The sample size of 58 patients from a single centre may limit generalisability of the findings to larger and more diverse populations. CT imaging was assessed at a single time point rather than serially, and clinical outcomes such as ICU admission and complications may have been influenced by institutional management protocols. The association between BISAP and complications did not reach statistical significance, possibly owing to the relatively small number of complication events. Larger, multicentric studies with serial scoring and long-term follow-up are needed to validate and extend these findings.

## CONCLUSION

BISAP is a simple, rapid, and effective bedside tool for early identification of high-risk patients with acute pancreatitis, particularly for predicting ICU admission and mortality, given its high specificity and negative predictive value. CTSI, calculated after 48 hours, offers higher sensitivity and positive predictive value and remains valuable for radiological staging and assessment of local disease severity. The moderate positive correlation between the two scoring systems confirms that they assess related but distinct dimensions of disease severity. Rather than substituting one for the other, BISAP and CTSI should be used complementarily — BISAP for early bedside triage and CTSI for subsequent confirmation and structural characterisation — to enable a balanced, resource-appropriate approach to severity prediction and management in acute pancreatitis.

## REFERENCES


1. Whitcomb DC. Hereditary pancreatitis: new insights into acute and chronic pancreatitis. Gut. 1999;45(3):317-22.
2. Banks PA, Freeman ML, Practice Parameters Committee of the American College of Gastroenterology. Practice guidelines in acute pancreatitis. Am J Gastroenterol. 2006;101(10):2379-400.
3. Yadav D, Lowenfels AB. The epidemiology of pancreatitis and pancreatic cancer. Gastroenterology. 2013;144(6):1252-61.
4. Kadiyala V, Suleiman SL, McNabb-Baltar J, Wu BU, Banks PA, Singh VK. The Atlanta classification, revised Atlanta classification, and determinant-based classification of acute pancreatitis: which is best at stratifying outcomes? Pancreas. 2016;45(4):510-5.
5. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, et al. The APACHE III prognostic system: risk prediction of hospital mortality for critically ill hospitalized adults. Chest. 1991;100(6):1619-36.
6. Singh VK, Wu BU, Bollen TL, Repas K, Maurer R, Johannes RS, et al. A prospective evaluation of the bedside index for severity in acute pancreatitis score in assessing mortality and intermediate markers of severity in acute pancreatitis. Am J Gastroenterol. 2009;104(4):966-71.
7. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. Radiology. 1990;174(2):331-6.
8. Mortele KJ, Wiesner W, Intriere L, Shankar S, Zou KH, Kalantari BN, et al. A modified CT severity index for evaluating acute pancreatitis: improved correlation with patient outcome. AJR Am J Roentgenol. 2004;183(5):1261-5.
9. Mounzer R, Langmead CJ, Wu BU, Evans AC, Bishehsari F, Muddana V, et al. Comparison of existing clinical scoring systems to predict persistent organ failure in patients with acute pancreatitis. Gastroenterology. 2012;142(7):1476-82.
10. Chen L, Lu G, Zhou Q, Zhan Q. Evaluation of the BISAP score in predicting severity and prognoses of acute pancreatitis in Chinese patients. Int Surg. 2013;98(1):6-12.
11. Yadav J, Yadav SK, Kumar S, Baxla RG, Sinha DK, Bodra P, et al. Predicting morbidity and mortality in acute pancreatitis in an Indian population: a comparative study of the BISAP score, Ranson's score and CT severity index. Gastroenterol Rep. 2016;4(3):216-20.
12. Senapati D, Debata PK, Jenasamant SS, Nayak AK, Gowda M, Swain NN. A prospective study of the Bedside Index for Severity in Acute Pancreatitis (BISAP) score in acute pancreatitis: an Indian perspective. Pancreatology. 2014;14(5):335-9.
13. Kim BG, Noh MH, Ryu CH, Nam HS, Woo SM, Ryu SH, et al. A comparison of the BISAP score and serum procalcitonin for predicting the severity of acute pancreatitis. Korean J Intern Med. 2013;28(3):322-9.
14. Gompertz M, Fernandez L, Lara I, Miranda JP, Mancilla C, Berger Z. Bedside index for severity in acute pancreatitis (BISAP) score as predictor of clinical outcome in acute pancreatitis: retrospective review of 128 patients. Rev Med Chil. 2012;140(8): 977-83.
15. Nie L, Cheng Y, Yao F, Wu RS, Li M, Zhang J, et al. Comparison of bedside index for severity in acute pancreatitis (BISAP) and modified CT severity index (MCTSI) for predicting the severity of hyperlipidemic acute pancreatitis (HLAP).
16. Chatterjee R, Parab N, Sajjan B, Nagar VS. Comparison of acute physiology and chronic health evaluation II, modified computed tomography severity index, and bedside index for severity in acute pancreatitis score in predicting the severity of acute pancreatitis. Indian J Crit Care Med. 2020;24(2):99.
17. Harshit Kumar A, Singh Griwan M. A comparison of APACHE II, BISAP, Ranson's score and modified CTSI in predicting the severity of acute pancreatitis based on the 2012 revised Atlanta Classification. Gastroenterol Rep. 2018;6(2):127-31.
18. Jingoniya NK, Yadav BL, Verma PK, Bansal S, Gupta S. Comparative evaluation of BISAP score and computed tomography severity index as a predictor for severity of acute pancreatitis. Int Surg J. 2022;9(2):421-5.
19. Ranjan R, Parmeshwar T, Bali S, Yadav A. Efficacy of BISAP & APACHE II scoring system in early prediction of severity in acute pancreatitis: a prospective study. Int J Curr Res Rev. 2021;13:179-82.
20. Coluoglu I, Coluoglu E, Binicier HC, Binicier OB. The role of the BISAP score in predicting acute pancreatitis severity according to the revised Atlanta classification: a single tertiary care unit experience from Turkey. Acta Gastroenterol Belg. 2021;84 (4):571-6.