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Original Research Article

Comparative evaluation of BISAP score and computed tomography severity index as a predictor for severity of acute pancreatitis

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ABSTRACT

Background: Acute severe pancreatitis is life threatening condition with organ failure, pancreatic necrosis, infections, and death. Multiple factor scoring systems are used for triage decision to manage of acute pancreatitis according to severity. Our purpose of this study was to assess the efficiency of the bedside index of severity in acute pancreatitis (BISAP) score and computed tomography severity index (CTSI) scoring system to predict severity of acute pancreatitis.
Methods: This hospital based observational, prospective study was conducted from 01 March 2019 to May 2020. An inclusion criterion was patients admitted with diagnosis of acute pancreatitis. Comparative analysis was done for BISAP and CTSI in terms of severity and mortality.
Results: The mean age was 44.7±16.2 years and male to female ratio was 1.9:1. BISAP score had 91.7% sensitivity and 51.4% specificity in predicting severity of acute pancreatitis with 38.6% positive predictive value (PPV) and 94.9% negative predictive value (NPV). CTSI score had 95.8% sensitivity and 44.4% specificity in predicting severity of acute pancreatitis with 36.5% PPV and 96.9% NPV. The area under curve (AUC) for BISAP and CTSI was 0.853 (95% CI: 0.769–0.937) and 0.901 (95% CI: 0.831– 0.97) respectively.
Conclusions: We conclude that BISAP score is better predictor of severity and mortality in acute pancreatitis and can safely be utilized to predict severity of acute pancreatitis in situations where use of CT is limited due to cost factor or availability, especially in rural areas. BISAP score is a scoring system that can be easily calculated with available clinical data even in small hospital setups.

Keywords: Pancreatitis, BISAP score, CT severity index

INTRODUCTION

Acute severe pancreatitis is life threatening condition with organ failure, pancreatic necrosis, infections, and death. The main diagnostic guidelines include assessment of risk factors of severity at admission and determination of severity.[1]

The decisions for triage and the use of an intensive care unit (ICU) are based on the presence systemic inflammatory response syndrome (SIRS), organ failure and severe comorbid condition. Multiple factor scoring systems are used for triage decision to manage of acute pancreatitis according to severity.

Several scoring systems have been used to predict the severity of pancreatitis. Contrast enhanced computed tomography (CECT) is used in diagnosis and staging of acute pancreatitis. CT evaluation results (CT severity index) were found to be better prognostic indicator owing to greater sensitivity and specificity. However there is no advantage of performing a CECT on admission for

prognostic purpose compared with simpler and more easily obtained clinical scoring system.

Another newer scoring system is bedside index of severity in acute pancreatitis (BISAP) score. BISAP score is simple bedside score and contains 5 criteria. It is easy to obtain, inexpensive and accurate method for early identification of hospitalized patients of acute pancreatitis at risk. BISAP scoring system requires only physical examination of vital signs, laboratory data, and imaging for detection of pleural effusion that are commonly documented within 24 hours of presentation.[2]

Accuracy of BISAP scoring system at predicting in severe acute pancreatitis (SAP) is superior to the CT scan because all parameters of BISAP score can be easily collect within 24 hours of admission. Simple scoring using the collected data can provide early detection of severity of pancreatitis along with guidance to proper treatment of pancreatitis.[3]

Our purpose of this study was to assess the efficiency of the BISAP score and CTSI scoring system to predict severity of acute pancreatitis.

METHODS

This hospital based observational, prospective study was conducted in department of surgery, SMS Medical College and Attached Hospital, Jaipur from 01 March 2019 to May 2020.

Inclusion criteria were patients admitted with diagnosis of acute pancreatitis based on the presence of at least two of following three criteria: characteristics epigastric abdominal pain, with or without radiation to the back, serum amylase or lipase levels elevated to at least three times the upper limit of normal and imaging finding consistent with acute pancreatitis. Patients with pre-existing chronic kidney disease (CKD), that is likely to be associated with elevated blood urea nitrogen value resulting in a higher BISAP score and chronic pancreatitis were excluded from this study.

Primary objectives were to determine the relationship between BISAP score and CT severity index for predict severity in acute pancreatitis and to determine the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) of BISAP score and CT severity index for predict severity in acute pancreatitis. A secondary objective was to assess diagnostic accuracy of BISAP score and CT severity index for severity.

BISAP score was calculated within 24 hours for severity of acute pancreatitis and CTSI was calculated within 3-7 days to assess the morphology of pancreas to grade severity of pancreas. Comparative analysis was done for BISAP and CTSI in terms of severity and mortality (defined as organ failure persisting more than 48 hours).

This study was approved with ethical committee of our institute. Informed and written consent was taken from the patient.

Table 1: BISAP Score component.

Component	Point
Blood urea nitrogen (BUN) >25 mg/dl	1 point
Impaired mental status (Glasgow coma scale <15)	1 point
SIRS, defined as ≥2 of the following:	
Temperature <36 degree C or >38 degree C;	1 point
Respiratory rate >20 beats per minute or PaCO2<32 mmHg;	
Pulse >90 beats/min	
WBC count <4×109 or >12×109/l or >10% immature bands	
Age >60 years	1 point
Pleural effusion on imaging (chest X-ray or ultra-sonography)	1 point

<3 Mild pancreatitis; ≥3 severe pancreatitis

Table 2: CT severity index.

Parameters	Points
Grading of pancreatitis	
Normal pancreas	0
Enlargement of pancreas	1
Peripancreatic inflammation	2
Single acute peripancreatic fluid collection	3
≥2 acute peripancreatic fluid collection	4
Pancreatic necrosis	
None	0
≤30%	2
30%-50%	4
≥50%	6

Statistical analysis

Quantitative/ continuous data were presented in terms of means and standard deviation and analyzed by using unpaired t-test. Sensitivity, specificity, PPV and NPV and accuracy were calculated. Receiver operating characteristic (ROC) curve was made for BISAP score and CTSI score and compared. P value <0.05 will be taken as significant.

The sample size was 96 patients for desired confidence level of 95% and 10% absolute error to verify the expected 62.5% sensitivity of BISAP for severity.

RESULTS

The mean age±standard deviation (SD) (range) was 44.7±16.2 (16-83) years and male to female ratio was 1.9:1 (65.6% female and 34.4% male). Of the 96 patients, 88 patients (91.6%) had biliary pancreatitis followed by 6 patients (6.3%) of alcoholic pancreatitis and 2 patients

(2.1%) of hyperlipidaemia. Pain was present in all patients and 24 patients (25%) presented with shock. Twenty patients (28.12%) having urine output <300 ml.

Of the 96 patients, 57 patients (59.37%) patients had BISAP score ≥3 (severe disease) and 39 patients (40.62%) had BISAP score <3 (mild disease). CTSI score ≥6 (severe disease) was present in 63 patients (65.6%) and CTSI <6 (mild disease) was present in 33 patients (34.4%) (Table 3).

Table 3: Demographic and clinical profile (n=96).

Clinical and radiological characteristics	Mean (range)/n (%)
Mean age ± SD (range) years	44.7±16.2 (16-83)
Male to female ratio	33:63 (1.9:1)
Etiology	
Biliary pancreatitis	88 (91.6)
Alcoholic pancreatitis	6 (6.3)
Hyperlipidaemia	2 (2.1)
BISAP score	
≥3 (severe disease)	57 (59.37)
<3 (mild disease)	39 (40.62)
CTSI score	
≥6 (severe disease)	63 (65.6)
<6 (mild disease)	33 (34.4)

BISAP: bedside index of severity in acute pancreatitis; CTSI: computed tomography severity index

Severe acute pancreatitis was present in 24 patients. BISAP score 2, 3, 4 and 5 had 8.3%, 20.8%, 58.3% and 12.5% SAP respectively (Table 4). CTSI score 5, 7, 8, 9 and 10 had 4.2%, 8.3%, 20.8%, 16.7% and 50% SAP respectively (Table 5). Of the 8 mortality, BISAP score ≥3 had 7 mortality and BISAP score <3 had one mortality, while all mortality was present in CTSI score ≥6.

Table 4: SAP and mortality according to BISAP score.

BISAP score	Number of patients (n=96) %	SAP (n=24) %	Mortality (n=8) %
Score-1	25 (26.04)	0	0
Score-2	14 (14.6)	2 (8.3)	1 (12.5)
Score-3	32 (33.3)	5 (20.8)	2 (25)
Score-4	21 (21.9)	14 (58.3)	5 (62.5)
Score-5	4 (4.2)	3 (12.5)	0

BISAP: bedside index of severity in acute pancreatitis; SAP: severe acute pancreatitis

We found that BISAP score had 91.7% sensitivity and 51.4% specificity in predicting severity of acute pancreatitis with 38.6% PPV and 94.9% NPV. BISAP score had accuracy of 61.5%. CTSI score had 95.8% sensitivity and 44.4% specificity in predicting severity of acute pancreatitis with 36.5% PPV and 96.9% NPV. CTSI score had 57.3% accuracy.

Table 5: SAP and mortality according to CTSI score.

CTSI score	Number of patients (n=96) %	SAP (n=24) %	Mortality (n=8) %
Score-2	2 (2.08)	0	0
Score-3	4 (4.2)	0	0
Score-4	12 (12.5)	0	0
Score-5	15 (15.6)	1 (4.2)	0
Score-6	11 (11.5)	0	1 (12.5)
Score-7	16 (16.7)	2 (8.3)	0
Score-8	14 (14.6)	5 (20.8)	4 (50)
Score-9	8 (8.3)	4 (16.7)	0
Score-10	14 (14.6)	12 (50)	3 (37.5)

BISAP: bedside index of severity in acute pancreatitis; SAP: severe acute pancreatitis

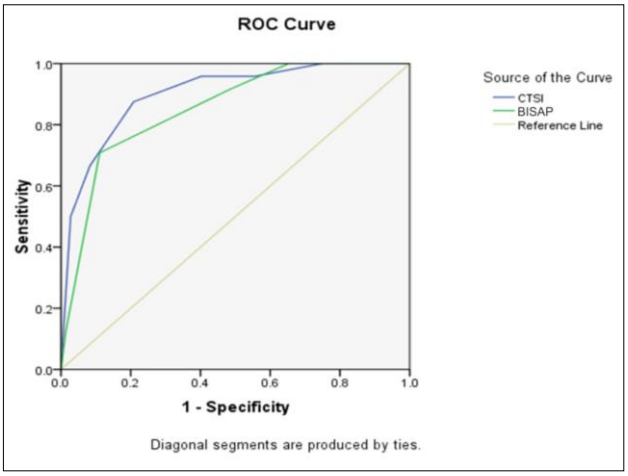

Figure 1: Comparison of BISAP and CTSI in predicting severity.

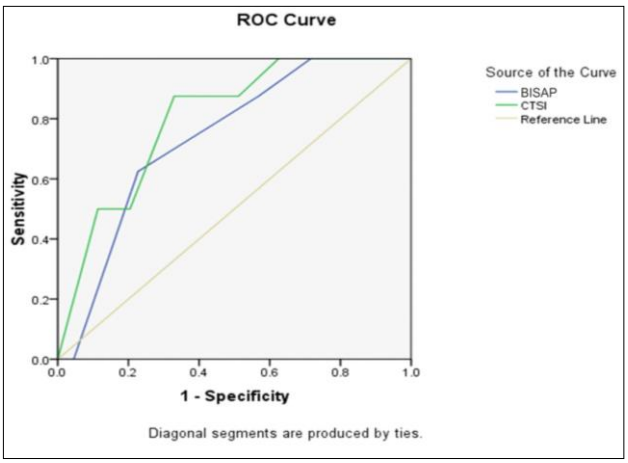

Figure 2: Comparison of BISAP and CTSI in predicting mortality.

We observed that BISAP score had 87.5% sensitivity and 43.2% specificity in predicting mortality among acute pancreatitis with 12.3% PPV and 97.4% NPV. BISAP score had accuracy of 46.4%.CTSI score had 100%

sensitivity and 37.5% specificity in predicting mortality among acute pancreatitis with 12.7% PPV and 100% NPV. CTSI had accuracy of 42%.

ROC curves of BISAP and CTSI scores in predicting severity was plotted. The AUC for BISAP and CTSI was 0.853 (95% CI: 0.769–0.937) and 0.901 (95% CI: 0.831–0.97) respectively (Figure 1). ROC curves of BISAP and CTSI scores in predicting mortality were plotted. The AUC for BISAP and CTSI was 0.735 (95% CI: 0.587–0.884) and 0.800 (95% CI: 0.668– 0.933) respectively (Figure 2).

DISCUSSION

This study was conducted in Department of General Surgery, SMS hHospital, Jaipur for duration of one year among 96 patients of acute pancreatitis. Acute pancreatitis is one of the common presentations in emergency departments. Early evaluation of the severity of acute pancreatitis is essential, to allow the clinician to predict the patient's clinical course, estimate prognosis, and determine the need for admission to the intensive care unit. Severe pancreatitis can be defined by various systems that predict complications and mortality.

Morphology of acute pancreatitis can be detected by CT scan usually performed at least 72 hours after symptoms onset but within 7 days to assess amount of necrosis best in this phase. CT is used as best predictor of the severity of the disease. The cost factor and lack of widespread availability of CT remains a big problem in our country.

The BISAP score is simple and inexpensive. It can be easily used to predict the severity of pancreatitis and the subsequent triage of patients at the earliest.

We analyzed the effectiveness of BISAP scoring in predicting the severity of acute pancreatitis and how well it correlates with the CT severity index. Our aim was to assess accuracy of BISAP score in predicting the severity of pancreatitis. If proved to be accurate in predicting mild acute pancreatitis, we could avoid CT scan in mild pancreatitis. Thus we may reduce cost of investigation in mild pancreatitis.

The mean age was 44.7±16.2 (16-83) years and male to female ratio was 1.9:1. Of the 96 patients, 88 patients (91.6%) had biliary pancreatitis followed by 6 patients (6.3%) of alcoholic pancreatitis and 2 patients (2.1%) of hyperlipidemia. The most common cause of pancreatitis was gallstone followed by alcoholism.[4-7]

We observed severe acute pancreatitis (SAP) in 24 patients (25%) of the 96 patients. SAP was present in 57 patients (59.4%) and 63 patients (65.6%) according to BISAP and CTSI score respectively. The AUC for predicting severity by BISAP and CTSI was 0.853 (95% CI: 0.769–0.937) and 0.901 (95% CI: 0.831–0.97) respectively.

In our study, the sensitivity of BISAP and CTSI score was 91.7% and 95.8% respectively, the specificity of BISAP and CTSI score was 51.4% and 44.4% respectively in predicting severity of acute pancreatitis. The NPV of BISAP and CTSI score was 94.9% and 96.9% respectively and PPV of BISAP and CTSI score was 38.6% and 36.5% respectively.

The AUC of BISAP and CTSI for predicting severity of acute pancreatitis was 0.962 (95% CI 0.923-1.002) and 0.904 (95% CI 0.846-0.961) respectively. The sensitivity of BISAP and CTSI was same (97.6%) and specificity of BISAP and CTSI was 94.8% and 83.1% respectively. The PPV of BISAP and CTSI were 91.1% and 75.9% respectively and NPV was 98.6% and 98.5% respectively.[8]

AUC, sensitivity, specificity, NPV and PPV for predicting severity of acute pancreatitis were 0.873, 79.2%, 88.5%, 82.1% and 86.4% respectively for BISAP score and 0.788, 62.5%, 65.4%. 65.4% and 62.5% respectively for CTSI score.[9]

Papachristou et al found AUC for predicting severity of acute pancreatitis was 0.81 (CI 0.74-0.87) and 0.84 (CI 0.76-0.89) for BISAP and CTSI respectively and CTSI had 85.7% sensitivity and 71% specificity.[10]

AUC, sensitivity, specificity, NPV and PPV for predicting severity of acute pancreatitis were 0.80, 74.2%, 68.3%, 77.8% and 63.4% respectively for BISAP score and 0.66, 65.4%, 50%. 60.9% and 54.8% respectively for CTSI score.[5]

In our study, mortality rate was 8 patients (8.3%). In our study, the mortality was 8.3% (8 patients). The AUC for predicting mortality by BISAP and CTSI was 0.735 (95% CI: 0.587–0.884) and 0.800 (95% CI: 0.668–0.933) respectively.

In our study, the sensitivity of BISAP and CTSI score was 87.5% and 100% respectively, the specificity of BISAP and CTSI score was 43.2% and 37.5% respectively in predicting mortality among acute pancreatitis. The NPV of BISAP and CTSI score was 97.4% and 100% respectively and PPV of BISAP and CTSI score was 12.3% and 12.7% respectively.

The AUC of BISAP and CTSI for predicting mortality in acute pancreatitis was 0.846 (95% CI 0.772-0.920) and 0.804 (95% CI 0.717-0.891) respectively. The sensitivity of BISAP and CTSI was same (100%) and specificity of BISAP and CTSI was 69.2% and 60.7% respectively. The PPV of BISAP and CTSI was 26.7% and 22.1% respectively and NPV of BISAP and CTSI was same (100%).[8]

AUC, sensitivity, specificity, NPV and PPV for predicting mortality in acute pancreatitis were 0.83, 88.9%, 55.6%, 97.2% and 22.7% respectively for BISAP score and 0.57,

71.4%, 44.7%. 91.3% and 16.1% respectively for CTSI score.[5]

In the study by Hagjer et al AUC of BISAP and CTSI for predicting severity of acute pancreatitis were 0.87 and 0.65 respectively, sensitivity of BISAP and CTSI were 71.4 and 37.9, specificity of BISAP and CTSI were 95.7 and 90.3, PPV of BISAP and CTSI were 83.3 and 78.6 and NPV were 91.7 and 60.9 respectively. Predicting mortality in acute pancreatitis, AUC of BISAP and CTSI were 0.892 (95% CI 0.81-0.97) and 0.509 (95% CI 0.40-0.78) respectively, sensitivity of BISAP and CTSI were 85.7 and 17.2, specificity of BISAP and CTSI were 88.7 and 93.5, PPV of BISAP and CTSI were 50.0 and 71.4 and NPV of BISAP and CTSI were 97.9 and 54.7 respectively.[11]

In the all above studies, AUC and NPV had obtained result similar to our finding of BISAP score in predicting severity of acute pancreatitis. In this study, the results of BISAP score and CT severity index are comparable and BISAP score can be used as a good predictor in detecting severity of acute pancreatitis especially in developing countries like India where maximum patients are belong to poor socioeconomic condition and from rural areas with limited resources.

Limitation of our study was decrease number of patients of alcoholic pancreatitis due to separate admission into Gastro-enterology and medicine department and single institutional in nature. We did not include traumatic pancreatitis patients.

CONCLUSION

We conclude that BISAP score is better predictor of severity and mortality in acute pancreatitis and can safely be utilized to predict severity of acute pancreatitis in situations where use of CT is limited due to cost factor or availability, especially in rural areas. BISAP score is a scoring system that can be easily calculated with available clinical data even in small hospital setups.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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