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Evaluation of the BISAP Score in Predicting Severity and Prognosis of Acute Pancreatitis in Indian Patients

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Abstract
The present study was to evaluate the accuracy of Bedside Index for Severity in Acute Pancreatitis (BISAP) in predicting the severity and prognoses of Acute Pancreatitis (AP) in Indian patients. Clinical data for 70 patients with AP were analyzed prospectively to compare BISAP with Acute physiology and Chronic Health Evaluation II and Modified Computed Tomography Severity Index Score (MCTSI) in predicting the severity of AP and mortality, in patients with severe AP (SAP) using the Area Under the receiver-operating characteristic curve (AUC). There were significant correlations between the scores of any two systems. BISAP performed similarly to other scoring systems in predicting SAP, mortality in AP patients, in terms of the area under the receiver-operating characteristic curve. BISAP score is valuable in predicting the severity of AP and prognoses of SAP in Indian patients.
Conclusion: we compared BISAP scores with APACHE II, and CTSI scores in predicting the severity and prognoses of AP in Indian patients. We demonstrated that BISAP has the advantages of simplicity and speed over traditional scoring systems and performed similarly to other scoring systems in predicting SAP and the prognoses of SAP in AUC. We confirmed that the BISAP score is an accurate means for risk stratification and prognostic prediction in Indian patients with AP.

Keywords: Acute Pancreatitis, BISAP, APACHE II, severity.

Introduction
Acute pancreatitis (AP) is a common disease with wide clinical variation and its incidence is increasing. The average mortality rate in severe acute pancreatitis approaches 2-10 %.[1]
Severe acute pancreatitis (SAP) develops in about 25% of patients with acute pancreatitis. Severe acute pancreatitis is a two-phase systemic disease. The first phase is characterised by extensive pancreatic inflammation and/or necrosis and is followed by systemic inflammatory response syndrome (SIRS) that may lead to multiple organ dysfunction syndrome (MODS) within the first week. About 50% of deaths occur within the first week of the attack, mostly from mods. The formation of infected pancreatic necrosis or fluid collection occurs usually in the second week.
The factors which cause death in most patients with Acute Pancreatitis seem to be related specifically to multiple organ dysfunction syndrome and these deaths account for 40-60% of in-hospital deaths in all age groups.[2]
The “second or late phase” which starts 14 days after the onset of the disease, is marked by infection of the gland, necrosis and systemic complications causing a significant increase in mortality. The association between increasing age and death from Acute Pancreatitis is well documented, respiratory failure is the most common type of organ failure in acute pancreatitis.[2]
According to the severity, Acute Pancreatitis is divided into mild Acute Pancreatitis (absence of organ failure and local or systemic complications, moderately severe Acute Pancreatitis (no organ failure or transient organ failure less than 48 hours with or without local complications) and severe Acute Pancreatitis (persistent organ failure more than 48 hours that may involve one or multiple organs).[3]
Initial evaluation of severity should include assessment of fluid loss, organ failure (particularly cardiovascular, respiratory, or renal compromise), measurement of the

APACHE II score, and systemic inflammatory response syndrome (SIRS) score. [4,5] Routine abdominal computed tomography (CT) scan is not recommended at initial presentation because there is no evidence that CT improves clinical outcomes and the complete extent of pancreatic and peripancreatic necrosis may only become clear 72 hours after the onset of Acute Pancreatitis.[6]

Several classification systems have been presented to assess the severity of acute pancreatitis. Presence of SIRS (systemic inflammatory response syndrome), scores such as the Ranson's the Glasgow, and Acute Physiology and Chronic Health evaluation (APACHE II) are practical for assessing the severity of the disease but are not sufficiently well validated for predicting mortality. Early organ dysfunction predicts disease severity and patients require early intensive care treatment. Antibiotic 1prophylaxis is usually ineffective and early enteral feeding results in reduction of local and systemic infection. [6,7]

The management of Acute Pancreatitis has changed significantly over the past years. Early management is nonsurgical, solely supportive and patients with infected necrosis with worsening sepsis need intervention. Early intensive care has definitely improved the outcome of patients.[8] A reliable risk stratification tool to predict the severity and progress of acute pancreatitis is of great clinical importance for the management of this disease.

Currently a variety of scoring systems are available to evaluate the severity of AP, including Ranson's criteria, Glasgow scale, Acute Physiology and Chronic Health Evaluation (APACHE II), Harmless Acute Pancreatitis Score, Pancreatitis outcome prediction score and Computed Tomography Severity Index

Main limitation of Ranson's criteria is that the evaluation cannot be completed until 48 hours following admission which may lead to missing an early therapeutic window and increased mortality.[9]

APACHE II has the advantage of the allowing determination of disease severity on the day of admission, but complexity is its major drawback [10,11] CTSI is calculated based on CT findings of some local complication and cannot reflect the systemic inflammatory response [12,13] and usually not done in initial 72 hours.

In 2008, WU et al [13] retrospectively developed a new scoring system, Bedside Index for Severity in Acute Pancreatitis (BISAP), to estimate the risk of hospital mortality in patients with AP. It has the advantage of simplicity and can be performed within first 24 hours of admission.

The present study is designed to evaluate BISAP scores in predicting severity and prognosis in patients presenting with AP.

Materials and Methods

The study protocol was approved by the Ethics Committee of Jawharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh. Informed consent was obtained from each patient. prior to study enrollment. Clinical data for pancreatitis patients who were hospitalized at our hospital from 2017 to 2019 were collected. Patients with incomplete clinical data. Depending on disease status, all patients underwent fasting, gastrointestinal decompression, acid suppression, suppression of pancreatic enzyme secretion, improvement of microcirculation, anti-infection treatment, fluid infusion, enteral nutrition, or complication treat.

The diagnosis of AP was based on the presence of two of the following three features: (i) abdominal pain characteristic of AP, (ii) serum amylase and / or lipase ≥ 3 times the upper limit of normal, and (iii) characteristic findings of AP on abdominal CT scan.

The BISAP and APACHE-II scores were calculated using data from the first 24 h from admission. MCTSI was calculated in patients who underwent CECT within 72 h from onset of symptoms Patients were classified as mild AP or severe AP, based on the presence of organ failure for more than 48 h. Organ failure included shock (systolic blood pressure < 90 mm Hg), pulmonary insuffi ciency (arterial PO2 < 60 mm Hg at room air or the need for mechanical ventilation), or renal failure (serum creatinine level >2 mg / dl after rehydration or hemodialysis)

The ability of the BISAP, APACHE II, MCTSI scores to predict the severity of AP as well as, organ failure, and mortality in SAP patients, and the ability of the BISAP and CTSI scores to predict organ failure and mortality were compared.

Statistical Analysis

Data was entered in MS EXCEL version 2013 and analysis was done using IBM SPSS (statistical package for social sciences) version 20.0(SPSS inc., Armonk, NY). Categorical variables were presented as percentage and numeric data are presented as Mean ± SD. Association between categorical variables was calculated by Fischer exact test while association between numerical values was calculated by independent sample t test. Correlations between scores of difference systems were evaluated using Pearsons's correlation coefficient. The ability of each scoring system to predict AP severity and SAP complications was measured and compared by the area under the receiver-operating curve (AUC).

Observations and Results

A total of 70 patients were included in this study over a period of two years (from December 2017 to December 2019) in Department of Surgery Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India.

Age Distribution

Table 1:

Age in years	No of patients	Percentage %
15-19	1	1.4%
20-39	31	44.2%
40-60	33	47.1%
>60	5	7.1%
Total	70	100

Majority of the patients 33(47.1%) were in age group (40-60) which was closely followed by patients in age group (20-39yrs) which was 31(44%.2) with mean 42.47±13.25

Sex Distribution

Table 2:

Sex	Percentage
Male	29 (41.4%)
Female	41 (58.6%)
Total	100%

Out of 70 patients of acute pancreatitis 29 (41.4%) were male and 41(58.6%) were female

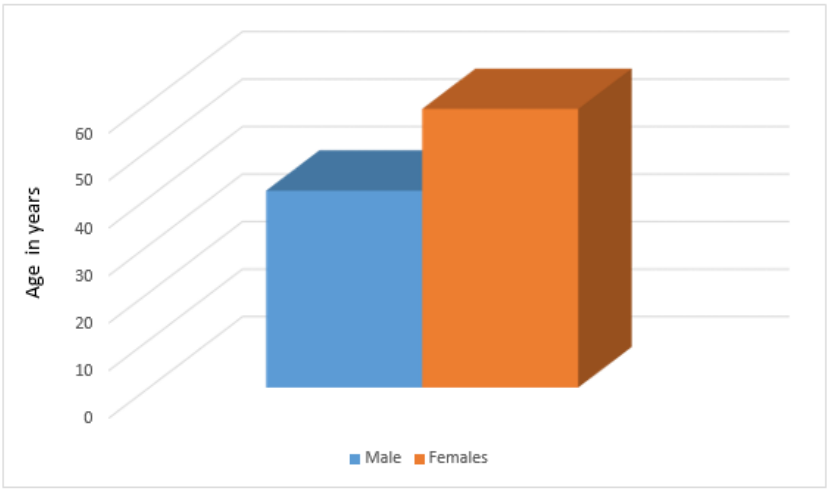

Fig. 1:

Cause of Acute Pancreatitis

Table 3:

Etiology	No of Patients	Percentage %
Gallstones	58	82.8
Alcohol	10	14.2
Idiopathic	1	1.4
Hyperlipidemia	1	1.4
Other causes	0	0

Out of 70 patient's gallstone was the implicating factor in 58 (82.8%) of the patients, Alcohol as a causative factor was present in 10 patients (14.28%), Idiopathic (microlithiasis, biliary sludge) was present in1(1.4%), Hyperlipidemia in 1(1.4%) and other causes (inherited, drug induced) accounted for 0 case each of AP

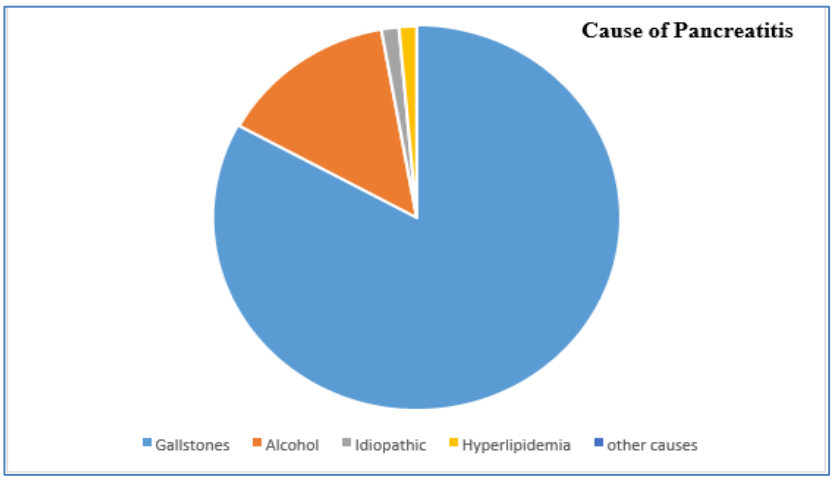

Fig. 2:

Presentations of Patients of Acute Pancreatitis

Table 4

Symptoms	No of Patients	Percentage %
Pain	70	100
Nausea	46	65.7
Vomiting	54	77.1
Retching	21	30
Abdominal Distention	20	28.5

All patients (70) presented with Pain Abdomen (100%) as chief complaint along with Nausea (65.7%), vomiting (77.1%), Retching (30%) and Abdominal distention was seen in 20(28.5%) patients

Table 5

Signs	No of Patients	Percentage %
Tenderness	43	61.4
Guarding	27	38.5
Tachycardia(>90)	33	47.1
Tachypnea(>20)	6	8.5
Fever	54	77.1
Organ failure	12	17.1
Shock	10	14.2

Tenderness was present in 43(61.4%) of patients, guarding in 27(38.5%), tachycardia in 33(47.1%), tachypnea in 6(8.5%), fever in 54(77.1%), organ failure was present in 12(17.1%) and Shock was seen in 10(14.2%) of patients.

Clinical Profile and Outcome

Table 6:

Parameter (N)	Discharge	Death	P value
Diabetes mellitus (6)	6	0	1.00
Hypertension (3)	3	0	1.00
Alcoholics (10)	9	1	0.549
Gallstones (58)	54	4	1.000
MODS (8)	6	2	0.097
Pleural effusion (11)	10	1	1.00
ARDS (2)	1	1	0.139

Diabetes mellitus was seen in 6 patients, 3 were hypertensive, 10 were alcoholic out which 1 patient expired, all 70 patients had Gallstone as the causative factor, 8 patients developed MODS out of which 2 expired, 11 had pleural effusion out which 1 expired, 2 patient developed ARDS out of which 1 expired.

There was no significant difference between presence of DM, hypertension, alcohol, MODS, pleural effusion and ARDS with regard to death by Fischer exact test ($p>0.05$), although a significant difference was obtained between presence of gallstones in our patients with the mortality of patient ($p<0.001$).

Mean of BISAP, APACHE II and MCTSI in MAP and SAP

Table 7:

	MAP	SAP
Indices	Mean ± SD (MAP)	Mean ± SD(SAP)
BISAP	1.302±.6957	3.375±.5000
APACHE II	3.600±2.175	11.368±2.521
MCTSI	2.00±.000	9.00±1.033

Mean value for BISAP for mild pancreatitis was 1.302±.6957, for severe pancreatitis it was 3.375±.5000.

Mean value for APACHE II for mild pancreatitis was 3.600±2.175, for severe pancreatitis it was 11.368±2.521.

Mean value for MCTSI for mild pancreatitis was 2.00±.000, for severe pancreatitis it was 9.00±1.033.

To compare this scoring system, we used pearsons correlation. On comparing BISAP with APACHE II we observed they were highly correlated (r=0.620), and this relation was found to be highly significant ($p<0.001$).

On comparing BISAP with MCTSI we observed they were highly correlated (r=0.741), and this relation was found to be highly significant ($p<0.001$).

On comparing APACHE II with MCTSI we observed they moderately correlated and this relation was found to be highly significant ($p<.001$)

Table 8:

Correlations				
		MCTSI	APACHEII	BISAP
MCTSI	Pearson Correlation	1	.463**	.741**
	Sig. (2-tailed)		.000	.000
	N	70	70	70
APACHEII	Pearson Correlation	0.463**	1	.620**
	Sig. (2-tailed)	.000		.000
	N	70	70	70
BISAP	Pearson Correlation	.741**	.620**	1
	Sig. (2-tailed)	.000	.000	
	N	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

Mortality

ROC curve yielded an Area Under Curve (AUC) of .892 (95% CI .763- 1.000) for BISAP, .878 (95% CI 0.784-0.973) for APACHE II, .758 (95% CI 0.532-0.985) for MCTSI.

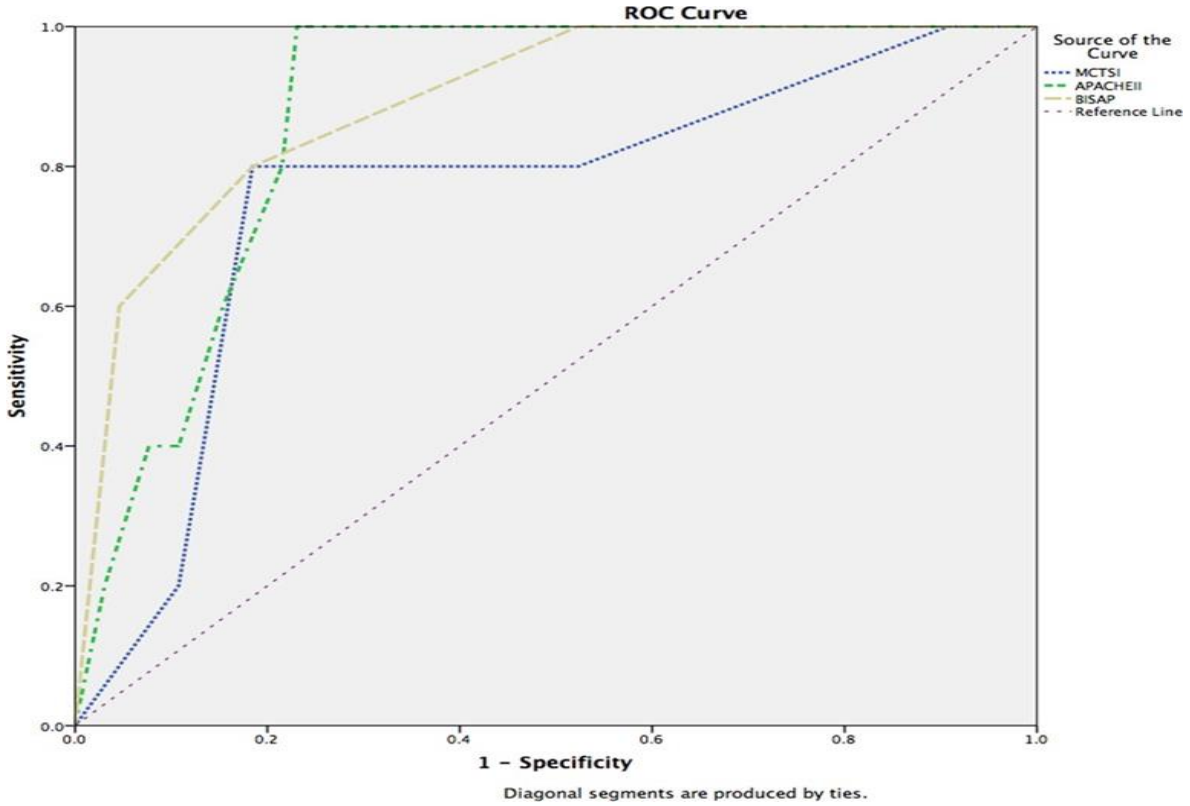

Fig. 3: Sensitivity and specificity of BISAP in predicting mortality is 80% and 81% respectively.

Comparison of BISAP, APACHE II, and MCTSI in predicting SAP

ROC curve yielded an AUC .868 (95% CI .766-.969), .943 (95% CI .877-1.000) for APACHE II, .863 (95% CI .764-.962) for MCTSI in predicting SAP

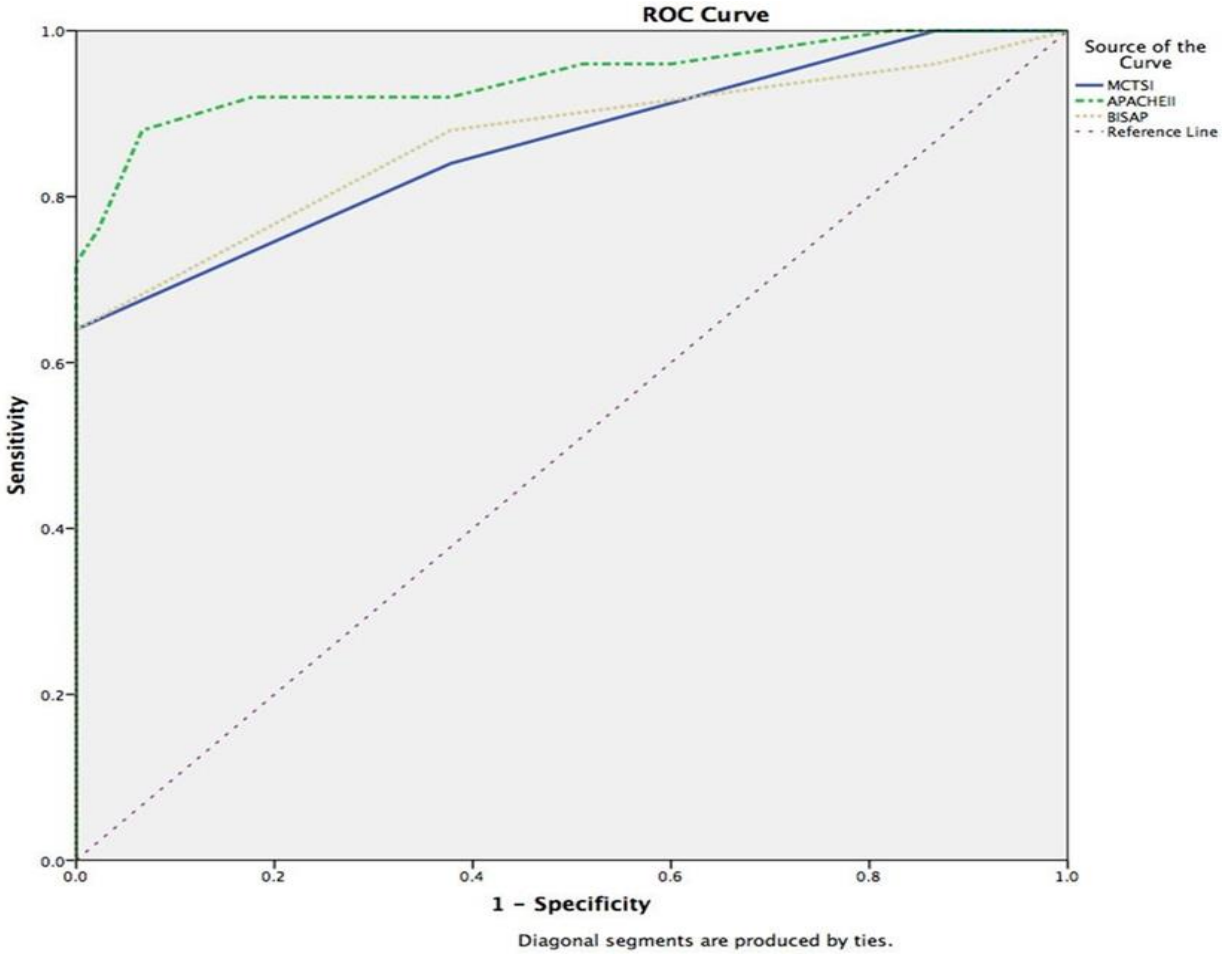

Fig. 4: Sensitivity and specificity of BISAP in predicting SAP was 61.5% and 100% respectively.

Duration of Hospital stay.
Mean duration of hospital stays for patients in Low Mortality (MAP) group as per BISAP was 9.94±4.05 whereas it was 13.19 ± 3.41 in high mortality (SAP) group.

Discussion
This is **prospective non-randomized study** of patients of acute pancreatitis over a period of two years from December 2017 to December2019 in Jawaharlal Nehru Medical College and Hospital, Aligarh, Uttar Pradesh, India.
This study was conducted to study the clinical profile of patients of acute pancreatitis and to compare bed side index for severity in acute pancreatitis (BISAP) with acute physiology and chronic health evaluation II (APACHE II) and modified computed tomography index (MCTSI)
70 patients were included in our study BISAP, APACHE II and MCTSI score was calculated for all 70 patients and were classified into mild and severe acute pancreatitis accordingly.
Age – In our study the mean age of the studied population was 42.47±13.25. In study conducted by Chen[14] et al on Chinese patients mean age was 53.6±16.6. In Singh [15] et al the mean age was 52 ± 17. In study by Papachristou[16] et al mean age was 51.7. In another study by Harshit[17] et al the mean age was 48.42. In study by Cho JH[18] et al Mean age of presentation was lower as compared to other study because North Indian belt is prone for gallstone disease.[19]
Sex ratio- in our study Male to Female ratio was 1:1.413 According to study conducted by vengadakrishnan. K[20] et al male to female ratio was 3.07:1 the difference be so because gallstone disease is prevalent in north indian belt which is more common in females. Another study conducted by singh et al and chen et al in chinese patient's ratio of male to female was found to be 1:1.34, 1:238:1 respectively. In study by Harshit et al male to female ratio was .51

Cause of Pancreatitis
Most common etiology is gallstone. In my study gallstone was the implicating factor in 60 (85.7%) of the patients, Alcohol as a causative factor was present in 10 patients (14.28%), Idiopathic (microlithiasis, biliary sludge) was present in 1(1.4%), Hyperlipidemia in 1(1.4%) and other causes (inherited, drug induced) accounted for 0 case each of AP. In the study conducted by Chen et 66% had biliary pancreatitis, 6.8% had alcohol pancreatitis and rest by other causes (hyperlipidemia, idiopathic). by Vengadakrishnan. K.et al 49 % had gallstone pancreatitis whereas 51% had alcoholic pancreatitis. In a study by Harshit et al 74% had gallstone pancreatitis and 18% had alcoholic pancreatitis. In study by Cho JH et al 54% had biliary pancreatitis, alcoholic 22%, idiopathic 21% others 3%.

Pneumonia/pleural effusion/pulmonary insufficiency
In my study 11 patients (15.7%) developed pleural effusion. In study by Vengadakrishnan. K, 13.6% of the patients developed pleural effusion which is comparable. In study by cheng et al 3.4% of the patient developed pulmonary insufficiency. In study by Harshit et al 54% of the patients developed pleural effusion.

Comparison of BISAP, APACHE II, and MCTSI scores in predicting SAP
ROC curves yielded an AUC of 0.808 (95% CI, 0.766–0.969) for BISAP, 0.943 (95% CI, 0.877–1.000) for APACHE II, and 0.863 (95% CI, 0.764–
0.962) for MCTSI in predicting SAP
Sensitivity and specificity of BISAP in predicting SAP was 61.5% and 100% respectively at cutoff value 3 set for BISAP. In a study by Chen et al sensitivity and specificity of BISAP in predicting SAP was 84.6% and 46.7% respectively at cutoff value set at 2. Papachristou et al found that at cutoff value of 3, BISAP had sensitivity of 37.5% and specificity of 92.4% in predicting SAP. In study Harshit et al BISAP had AUC of 0.684 (0.518–0.849), APACHE II 0.834 (0.711–0.957 and MCTSI 0.919
(0.844–0.994). In study by Cho JH et al BISAP had sensitivity (95% CI) of 61.9 (38.4-81.9), APACHE II had sensitivity of 81.0 (58.1-94.6), MCTSI had sensitivity of 66.7 (43.0-85.4) which is comparable with our study.

Comparison of BISAP, APACHE II, and MCTSI scores in predicting mortality in SAP
ROC curves yielded an AUC of 0.892 (95% CI, 0.763–1.000) for BISAP, 0.878 (95% CI, 0.784–0.973) for APACHE II, and 0.758 (95% CI, 0.532–
0.985) for CTSI in predicting mortality, with BISAP having sensitivity and specificity of 80 and 81% respectively at cutoff value 3, APACHE II having sensitivity and specificity of 100%, 76% respectively at cutoff value 8 and sensitivity and specificity of MCTSI was 80%, 81% respectively at cutoff value 7 in predicting mortality in SAP
A study by Papachristou et al reported that with the cutoff value set at 3, BISAP score had a sensitivity of 37.5%, a specificity of 92.4% in predicting moratlity in SAP. In study by Chen et al setting cutoff value of 3 for BISAP yielded a sensitivity and specificity of 51.4% and 67.4% respectively in predicting mortality in SAP. In study by Zhang133 et al BISAP had sensitivity and specificity of 66.7%,81.9% respectively in our study setting a cutoff value at 3 yielded sensitivity (80%) and specificity (81.5%) in predicting mortality in SAP.
Compared with previous data, the sensitivity obtained for BISAP scores in the present study was higher; however, the specificity was lower. Several factors may contribute to these differences. First, there are differences in the characteristics of study participants, such as lifestyle, and genetic basis. In addition, etiologic distribution may also explain the noted differences.
Finally, the criteria used for the diagnosis of SAP might be different among various studies.
In conclusion, we compared BISAP scores with Ranson, APACHE II, and CTSI scores in predicting the severity and prognoses of AP in Indian patients. We demonstrated that BISAP has the advantages of simplicity and speed over traditional scoring systems and performed similarly to other scoring systems in predicting SAP and the prognoses.
of SAP in AUC. We confirmed that the BISAP score is an accurate means for risk stratification and prognostic prediction in Indian patients with AP.

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