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Clinical prediction of outcomes in acute pancreatitis with various prognostic indicators and modified CTSI

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Abstract
Introduction: Acute pancreatitis is the most common cause of patients presenting to the emergency department with pain abdomen. It is an inflammatory process of the pancreas that can range from mild inflammation to severe extensive pancreatic necrosis and multi-organ failure with mortality rates of 20% to 30%. Diagnosis can be difficult, because there is no pathognomic clinical presentation and no diagnostic gold standard.

Material and Methods: It was a prospective cross-sectional descriptive study conducted in the Department of Gastroenterology at Sapthagiri Institute of Medical Sciences and Research Center from December 2019 – August 2020 among 100 patients.

Results: The total patients studied in this study were 100, which comprises of 93 males and 7 females. Among the male population the maximum age group is 41-50. Next comes the 31-40 which includes 30 patients. Among the female population the maximum age group is 41-50 which includes about 4 patients. In our study distribution of the SAP within and above the cut off value of the different prognostic scores. 11 patients with SAP had RANSONs score < 3 and 10 with SAP had RANSON score ≥ 3. 11 patients with SAP had APACHE II score of ≥8 whereas 10 had APACHE II score < 8. But only 8 patients with SAP had BISAP score < 3 and 13 SAP patients had BISAP score ≥ 3. MCTSI score in 11 SAP was < 4 and 10 patients with MCTSI had ≥ 4.

Conclusion: BISAP score is simple and it is the better scoring system in predicting the prognosis when compared to other scores & MCTSI. BISAP score has many advantages when compared to other scoring systems.

Keywords: Acute pancreatitis, modified CTSI, RANSON, APACHE II, BISAP

Introduction
Acute pancreatitis is the most common cause of patients presenting to the emergency department with pain abdomen. It leads to tremendous physical, emotional and financial burden [1, 2]. It is an inflammatory process of the pancreas that can range from mild inflammation to severe extensive pancreatic necrosis and multi-organ failure with mortality rates of 20% to 30% [3, 4, 5]. Diagnosis can be difficult, because there is no pathognomic clinical presentation and no diagnostic gold standard [6].

The incidence of pancreatitis has been in increasing trend in the past 3 decades. It is common in the young age group and equal predilection to both the sexes. Alcoholic pancreatitis is more common in men than women. Prediction of severity may play an important role in decreasing the morbidity and mortality. Clinical identification of severity is by Revised Atlanta classification. There have been numerous biochemical markers like the serum amylase, serum lipase but their assessment in severity is uncertain. So, various scoring systems have been used [7, 10].

There are many prognostic scoring systems to predict the severity and the outcome of the disease. In this study four scoring systems namely RANSON, APACHE II, BISAP and Modified CTSI are compared in predicting the outcome of acute pancreatitis. The outcomes such as acute severe pancreatitis, pancreatic necrosis, mortality and number of days stayed in hospital are considered in the study. Then the scoring systems are compared in predicting mortality, pancreatic necrosis, and acute severe pancreatitis [11, 13].

Aims and Objectives
To assess severity of disease in acute pancreatitis using various prognostic indicators to compare the scoring systems for prognostication of acute pancreatitis.

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Material and Methods

Study design: It was a prospective cross-sectional descriptive study conducted in the Department of Gastroenterology at Sapthagiri Institute of Medical Sciences and Research Center, Bangalore.

Study period: December 2019 - August 2020

Sample size: Data was gathered from a total of 100 patients

Inclusion criteria
1) All adult patients admitted to Gastroenterology ward/ICU with typical abdominal pain & serum amylase, lipase values more than 3 times the normal
2) USG abdomen/ CECT abdomen – features suggestive of acute pancreatitis

Exclusion criteria
1) Acute episodes in patients with chronic pancreatitis
2) Recurrent pancreatitis
3) Patients less than 18 years of age
4) Pancreatic trauma

APACHE II and BISAP scores were calculated using data from the first 24 hours after admission and the Ranson's score using data from the first 48 hours. CT scan was taken within 48 hrs after admission.

1) Severe AP
Severe AP was defined by persistent organ failure for more than 48 hours on basis of Revised Atlanta classification[16]. Organ failure was defined as a score of 2 or more for one of the three systems (respiratory, cardiovascular, and renal) using the modified Marshall scoring system [26] shown in below tabular column.

2) Pancreatic Necrosis
This finding is easily found by the CECT scan. This is detected by the non-enhancement on CECT scan in the pancreatic parenchyma.

Statistical Analysis
The data was reported as the mean +/- SD or the median, depending on their distribution. The differences in quantitative variables between groups was assessed by means of the unpaired t test. Comparison between groups were made by the Non-parametric Mann - Whitney test. The chi square test was used to assess differences in categorical variables between groups. Data was analyzed by diagnostic efficiency derived from the receiver operating characteristic [ROC] Curve and area under the ROC curve. Sensitivity, specificity and predictive values were determined. P value of <0.05 using a two-tailed test will be taken as being of significance for all statistical tests. All data was analyzed with a statistical software package. (SPSS, version 20.0 for windows).

After calculating the sensitivity, specificity, PPV, NPV for the scoring systems such as RANSON, BISAP, APACHE II, MCTSI in predicting mortality, pancreatic necrosis, acute severe pancreatitis, the results will be compared to derive at the conclusion.

Results
In our study, tabular column 1 gives the age sex distribution of the disease in the various age groups. The total patients studied in this study were 100, which comprises of 93 males and 7 females. Among the male population the maximum age group is 41-50. Next comes the 31-40 which includes 30 patients. Among the female population the maximum age group is 41-50 which includes about 4 patients.

Table 1: Age Sex Distribution

Age	Males	Females	Total
≤ 30	19	1	20
31 - 40	30	2	32
41 - 50	31	4	35
51 - 60	7	0	7
≥ 60	6	0	6
Total	93	7	100

Table 2: Mean SD for Age

Sex	N	Mean +/- SD	Range	
Males	93	39	+/- 12	18 - 72
Females	7	39	+/- 9	23 - 50
Total	100	39	+/- 11	18 - 72

On the whole, it is 39+/-11. It is 39+/- 12 for males and 39+/-9 for females. Males greater than 60 years of age affected by the disease are 6%. This is the least age group affected.

Table 3: Etiology

Etiology	No. of cases
Gall Stones	3
Alcohol	74
unknown	23

The tabular column 3 shows the different causes of the acute pancreatitis in prevalent in our population. In our area, the most common cause is alcohol. Next it is due to some unknown causes. The unknown cause may be drugs, increase in cholesterol and hypercalcemia. These unknown causes need further analysis, even in unknown causes some patients had history of consumption of alcohol during the earlier days and had stopped consumption of alcohol in recent years. Next common cause is the gallstone. Number of patients who had gall stone pancreatitis is three. On linking with the etiology with the sex incidence we could find out that the gall stone pancreatitis is more common in the females.

C. Severe acute pancreatitis (Sap) Vs various prognostic scores

Table 4: Severe Acute Pancreatitis vs Prognostic Scores with MCTSI

	SAP		Total	P value
RANSON	YES	No		
<3	11	58	69	NS
≥3	10	21	31	

Total	21	79	100	
APACHE II				
<8	10	64	74	0.0041
≥8	11	15	26	
Total	21	79	100	
BISAP				
<3	8	74	82	<0.0001
≥3	13	5	18	
Total	21	79	100	
MCTSI				
<4	11	49	60	NS
≥4	10	30	40	
Total	21	79	100	

The above tabular column 4 shows the distribution of the SAP within and above the cut off value of the different prognostic scores. 11 patients with SAP had RANSONs score < 3 and 10 with SAP had RANSON score ≥ 3. 11 patients with SAP had APACHE II score of ≥8 whereas 10 had APACHE II score < 8. But only 8 patients with SAP had BISAP score < 3 and 13 SAP patients had BISAP score ≥ 3. MCTSI score in 11 SAP was < 4 and 10 patients with MCTSI had ≥ 4.

So out of 21 SAP patients BISAP picked out 13, RANSON picked 10, APACHE II picked 11 and MCTSI picked 10 same as RANSON. The p value of the BISAP score is <0.0001 which shows significant relationship between BISAP score and mortality.

Table 5: Severe Acute Pancreatitis vs Prognostic Scores with MCTSI

	Ranson	APACHE II	BISAP	MCTSI
Sensitivity (Sen.)	48%	52%	62%	48%
Specificity (Spec.)	73%	81%	94%	62%
Positive Predictive Value (PPV)	32%	42%	72%	25%
Negative Predictive Value (NPV)	84%	86%	90%	82%
Relative Risk (RR)	1.7	1.2	9.7	1.1
Odds Ratio (OR)	2.1	2.7	27.1	1.0

In above table 5, on looking sensitivity, specificity, PPV, NPV, and the odds ratio BISAP score has the sensitivity of 62% and the MCTSI has the least sensitivity of 48% along with RANSON's. APACHE II score showed a sensitivity & specificity of 52% & 81% respectively.

The specificity of the BISAP score is 94%. PPV and NPV of the BISAP score is 72%, 90% respectively. The odds ratio is 27. Greater than 1 is said to significant. So BISAP score predicts SAP well compared to MCTSI score.

AUC 1 Comparison of scoring systems with MCTSI in predicting severe acute pancreatitis
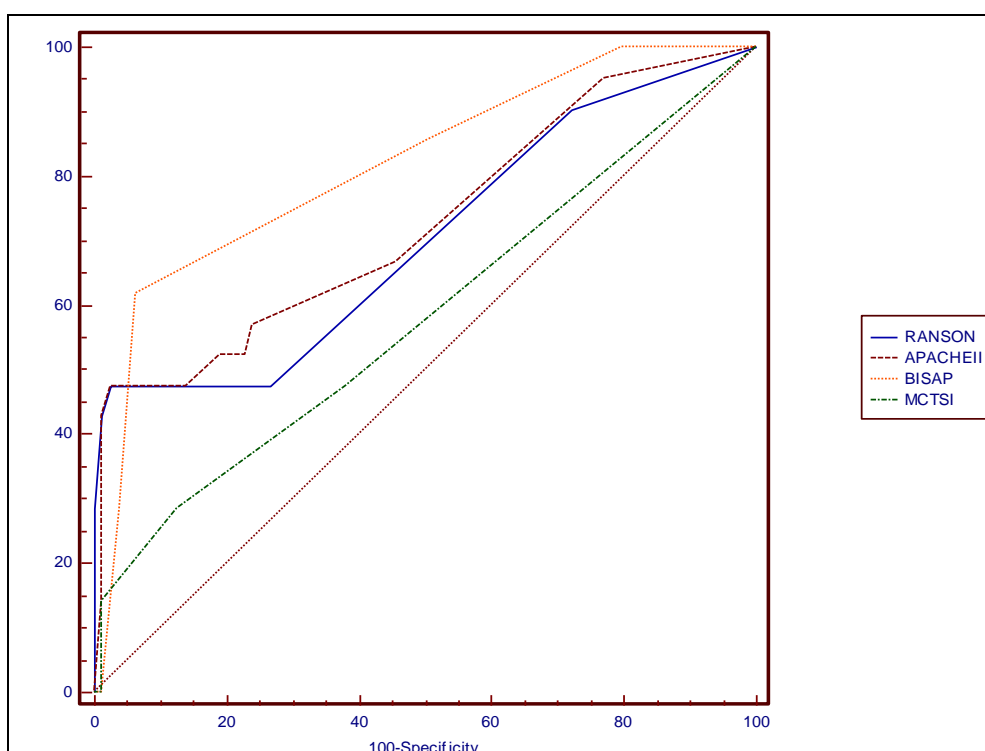

Fig 1: ROC curve for SAP prediction

The above graph is the ROC for SAP. The orange coloured dotted line shows the BISAP score, the blue coloured line shows the RANSON score, the red coloured dotted line indicates the APACHE II, MCTSI score by green dotted line and the pink coloured dotted line is the reference line.

The BISAP score line is high above all lines, the area covered below the line is maximum when compared with other line sources of the graph i.e RANSON, APACHE II, MCTSI group.

Table 6: Area under curve

SAP	AUC	95% CI	P VALUE
RANSON	0.705	0.605 to 0.792	NS
APACHE II	0.725	0.626 to 0.809	0.0041
BISAP	0.815	0.725 to 0.886	<0.0001
MCTSI	0.558	0.455 to 0.657	NS
Mortality			
RANSON	0.626	0.524 to 0.721	NS
APACHE II	0.660	0.558 to 0.752	NS
BISAP	0.886	0.807 to 0.941	<0.0001
MCTSI	0.524	0.422 to 0.625	NS
Panc Necrosis			
RANSON	0.608	0.506 to 0.704	NS
APACHE II	0.719	0.620 to 0.804	0.0078
BISAP	0.667	0.566 to 0.758	NS
MCTSI	0.928	0.858 to 0.970	<0.0001

The tabular column 6 summarizes the AUC of the various scoring systems in predicting SAP, mortality, pancreatic necrosis. AUC of BISAP's score in predicting SAP and mortality is high as compared to other scores whereas AUC of MCSTI score in predicting pancreatic necrosis is higher than other scores with significant p values.

Discussion
In present study, the mean age was 39 years. This mean age was comparable to study by Kashid *et al.* [14] which had a mean age of 35 years. This age group in present study was as the patients affected were mostly alcoholic. However other studies had higher mean age group with highest being a mean age group of 68 years by Larvin *et al.* [15] In our present study that males were more affected than females with male percentage of 93% & females of 7%. But these results did not match the study by Larvin *et al.* [15] which showed about 53% of female population & 47% of males affected. The other studies which included Kashid *et al.*, [14] Choudhari *et al.*, [16] Pupelis *et al.* [17] all showed more percentage of male patients being affected. In our study males were more affected as alcohol being a predominant risk factor for the disease. In our study, the most common etiology is alcohol but in other studies the most common etiology is gall stones. In our study gall stone is most common etiology in females.

The present study had a hospital stay of 6 days which is comparable to the study by Farell *et al.* In contrast, other studies by Kashid *et al.* [14] and Choudhari *et al.* [16] had increased hospital stay as 11 and 12 days respectively.

The sensitivity, specificity, PPV, NPV of the BISAP score in predicting mortality is consistent with study done by Vikesh Singh and group. The sensitivity is higher when compared to the GEORGIOS and group study. This suggests that BISAP score does well in predicting mortality. In our study, AUC of BISAP score in predicting SAP. The AUC of BISAP in SAP prediction is 0.81 which is similar to study by Georgios and group. This indicates BISAP score is able to predict development of the organ failure in first 24 hours. In the study performed by Vikesh shingh [18] it was

found that patients with ≥3 score in BISAP had 7.4 times more prone to develop SAP.

Conclusion
To conclude BISAP score is simple and it is the better scoring system in predicting the prognosis when compared to other scores & MCTSI. BISAP score has many advantages when compared to other scoring systems. On the whole when BISAP scoring system is combined with MCTSI score, then assessment of acute pancreatitis becomes some more accurate. When combined they can be used to triage the patients, anticipate complications, assess the severity, predict the mortality.

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