General Surgery

A COMPARATIVE STUDY OF "BEDSIDE INDEX FOR SEVERITY OF ACUTE PANCREATITIS" AND "CT SEVERITY INDEX" IN PREDICTING OUTCOME

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ABSTRACT Acute pancreatitis is a common gastroenterological emergency with varying severity. It is characterized by typical upper abdominal pain, ≥ 3 fold elevations in serum amylase or lipase level and confirmatory findings on cross sectional abdominal imaging. This study was conducted in Dept. of Surgery, AGMC & GBP Hospital among 205 patients of acute pancreatitis cases admitted in Surgery ward for a period of two years. The severity of acute pancreatitis was evaluated by applying BISAP's and CTSI's scoring system separately for each patient. The outcome of the patient was analyzed by total length of hospital stay, presence of organ failure and in-hospital mortality. Total 19(9.3%) patients stayed hospital for 11 days or more, 163 patients stayed in hospital for 6-10 days and all (23) mild cases stayed up to 5 days in hospital. Out of 205 patients, 7 (3.4%) patients died in hospital and 22 (10.73%) patients developed failure of organ. Overall sensitivity of BISAP scoring was better than CTSI scoring in correctly identifying the probability of the outcome of pancreatitis. BISAP scoring is also simple clinical scoring system & can be instantly done at bedside. Hence, BISAP scoring is considered better in predicting outcome in comparison to CTSI scoring. But, future large scale studies are suggested to decipher the accurate and reliable scoring system for managing acute pancreatitis patients.

INTRODUCTION:

Acute pancreatitis is an inflammatory process of the pancreas with varying involvement of regional tissues or remote organ systems and with potentially devastating consequences. The most common causes of acute pancreatitis are alcohol consumption & gallstones which account for approximately seventy five percent of the cases.[1,2] Almost all patients with acute pancreatitis present with upper abdominal pain of acute onset. In approximately ninety percent of patients this pain is typically accompanied by nausea, vomiting, restlessness, agitation .[3] The warning signs of pancreatitis include fever suggesting infection, hypovolaemia due to fluid accumulation, visual loss due to retinopathy and tetany due to severe hypokalemia or fulminant pancreatitis.[4] The diagnosis of acute pancreatitis is based on typical abdominal pain, ≥ 3 fold elevations in serum amylase or lipase level and confirmatory findings on cross sectional abdominal imaging.[5] A diffusely enlarged, hypo echoic pancreas is the classic USG finding in acute pancreatitis. CT scan of abdomen is the most important in the diagnosis of acute pancreatitis, intra-abdominal complications and for assessment of severity.[6]

A number of parameters have been developed and evaluated for the prediction of severity in acute pancreatitis. These include single parameters like presence of pleural effusion, serum blood urea nitrogen (BUN) , creatinine, hematocrit, levels of C-reactive protein, procalcitonin and multi-parameter scores like Ranson's score, Systemic Inflammatory Response Syndrome (SIRS), Bedside Index of Severity In Acute Pancreatitis (BISAP), Acute Physiology And Chronic Health Evaluation (APACHE)-II, Balthazar's CTSI (Computed Tomograghy Severity Index), Modified Mortele's CTSI and revised Atlanta classification.[7,8,9] Bedside Index of Severity In Acute Pancreatitis (BISAP) is a five-parameter scoring system developed for bedside assessment of severity of acute pancreatitis which includes blood urea nitrogen, impaired mental status, presence of SIRS, age, and pleural effusion.[10] A CT severity score (the Balthazar score) has been developed based upon the degree of necrosis, inflammation, and the presence of fluid collections. Computed Tomography Severity Index (CTSI) equals an unenhanced CT score plus necrosis score.[11] The present study aimed to evaluate the value of BISAP scoring for predicting outcome of acute pancreatitis in an Indian setting and comparing it the CTSI scoring systems.

MATERIALS & METHODS:

This study was done in Dept. Of Surgery, AGMC & GBP Hospital during October 2015 - September 2017 with prior approval from Ethical Committee of AGMC & GBPH, Agartala, Tripura. In this study, total 205 patients diagnosed as acute pancreatitis irrespective of sex, area were evaluated after obtaining informed consent. Sample size was calculated from the average number of acute pancreatitis patients admitted in surgery ward in last three years data record. Patients with confirmed diagnosis of acute pancreatitis based on elevated Serum Enzymes (amylase and lipase) level and /or radiological evidence by CT scan or USG were included. Those who had chronic pancreatitis, carcinoma pancreas, pancreatitis due to trauma and who did not give consent of taking part in this study were excluded from this study. Within 24 hours of admission, each of the patients was evaluated for BISAP score and CTSI score. The severity of acute pancreatitis was evaluated by applying BISAP's and CTSI's separately for each patient. The outcome of the patient was analyzed subsequently by total length of hospital stay, presence of organ failure, recovery and in-hospital mortality. Data analysis was done by SPSS-15. Descriptive statistics was expressed in frequency and percentage. Chi-squire statistics was applied to assess significant association. P value<0.05 was considered to be significant. Both scoring system was compared their using Sensitivity, Specificity, Positive predictive value and Negative predictive value for prediction of outcomes.

BISAP Scoring System: Patients are assigned 1 point for each of the following during the first 24 hours of admission : **i)** BUN >25 mg/dL, **ii)** impaired mental status, **iii)** SIRS, **iv)** age >60 years, **v)** presence of a pleural effusion.[10] SIRS characterized by any two or more of these: Heart rate > 90 beats per min, Respiratory rate >20 per min or PaCO2 <32 mm Hg, Temperature >38˚C or <36˚C, White blood cell count >12000/cu.mm or <4000/cu.mm or Band forms >10%.[12] Patients were classified as **Mild** (score 0-1), **Moderate** (score 2-3) and **Severe** (score 4-5) pancreatitis as per **BISAP score** .[10]

CTSI Scoring System: This system developed based upon the appearance of pancreas in unenhanced CT : [77] normal CT (0 point), focal or diffuse enlargement of pancreas (2 points), fluid collection in single location (3 points), two or more fluid collections or gas bubbles in/or adjacent to pancreas (4 points), no necrosis (0 points), <30% necrosis (2 points), 30-50% necrosis (4 points) and >50% necrosis (6 points). Computed Tomography Severity Index (CTSI) equals an unenhanced CT score plus necrosis score. Severity of acute pancreatitis was calculated as **Mild** (0-3), **Moderate** (4-6) and **Severe** (7-10) as per **CTSI** score.[9,11]

RESULT:

Total participants in this study were 205. Different characteristics of the study population are studied in details in this study and their distribution is provided in number as well as in percentage of total population in below mentioned Table 1. In our study, out of 205 patients who suffered from acute pancreatitis mostly were male 185(90.2%), 20- 40 years age 125(61%), addicted to alcohol 185(90.2%) and smoking 194(94.2%). Also, 153(74.6%) patients had Amylase level between 500IU/L-600IU/L , 159 (77.6%) patients had

serum Lipase level within 600IU/L-700IU/L and 171 (83.4%) had BUN level <25mg/dl.

Table 1: Distribution of different characteristics of all patients

Characteristics	No. of patients	Percentage
Age groups		
<20 years	4	2.0
20yrs to 40yrs	125	61.0
41yrs to 60yrs	71	34.6
> 61years	5	2.4
Gender		
Male	185	90.2
Female	20	9.8
Religion		
Hindu	201	98.0
Muslim	4	2.0
Locality		
Rural	193	94.1
Urban	12	5.9
Socioeconomic Status		
BPL	77	37.6
APL	128	62.4
Addiction to alcohol		
Yes	185	90.2
No	20	9.8
Smoking Habit		
Yes	194	94.6
No	11	5.4
INVESTIGATIONS		
Serum Amylase Level		
500 - 600 IU/L	153	74.6
601 - 700 IU/L	27	13.2
> 701 IU/L	25	12.2
Serum Lipase Level		
6OO -700 IU/L	159	77.6
701 -800IU/L	23	11.2
>800IU/L	23	11.2
Sodium Level		
146 - 150 m mol/L	149	72.7
151 - 155mmol/L	30	14.6
>156mmol/L	26	12.7
Potassium Level		
<5.8mmol/L	153	74.6
5.9 - 6.1mmol/L	26	12.7
>6.1 m mol/L	26	12.7
Jaundice		
Absent	176	85.9
Present	29	14.1
BUN Level		
>25mg/dl	34	16.6
<25mg/dl	171	83.4
OUTCOMES		
Hospital Stay		
Up to 5 days	23	11.2
6 - 10 days	163	79.5
>11 days	19	9.3
In-Hospital Mortality		
Yes	7	3.4
No	198	96.6
Organ failure		
Yes	22	10.73
No	183	89.27

Out of 205 patients 23 (11.2%) patients stayed in hospital up to 5 days, most of the patients i.e 163(79.5%) stayed in hospital 6-10 days and 19 (9.3%) had hospital stay 11 days or more. Seven (3.4%) patients died in our study and 198(96.6%) patients recovered from acute episodes of pancreatitis. A total 22(10.73%) patients developed organ failure.

In this study, 163 (79.5%) patients were in CTSI mild grade as compare to 157(76.6%) patients in BISAP grading. 28 (13.7%) patients

showing moderate CTSI score and 30 (14.6%) in BISAP score. 14 (6.8%) patients were of severe pancreatitis in CTSI scoring system whereas 18 (8.8%) patients were diagnosed severe pancreatitis according to BISAP grading. BISAP grading is also showing significant association to CTSI grading system (Table no 2) in distribution of patients according to severity.

Table 2: Distribution of patients as per severity in BISAP and CTSI scoring

		CTSI Grade			n=205	Chi-square (Sig. 2 tailed)
		Mild	Moderate	Severe		
BISAP Grade	Mild	156	1	0	**157**	**p=.001****
	Moderate	7	22	1	**30**	
	Severe	0	5	13	**18**	
Total		163	28	14	205	

Table 3 shows that among the total 19(9.3%) patients who stayed hospital for 11 days or more, 12 were severe in BISAP score and 9 were severe in CTSI score. Total 7 (3.4%) patients died in hospital . Among them 6 severe and 1 moderate case (BISAP score) and 5 severe, 1 moderate, 1 mild case (CTSI score). Among the 22 patients who had organ failure; 14 severe, 8 non-severe in BISAP score and 11 severe, 11 non-severe in CTSI score.

Table 3: Distribution of all patients according to BISAP and CTSI scoring for all outcomes

|	BISAP Grade				CTSI Grade			
Length of hospital Stay								
	Mild	Moderate	Severe	**Total**	Mild	Moderate	Severe	**Total**
Up to 5 days	23	0	0	**23**	23	0	0	**23**
6 - 10 days	132	25	6	**163**	137	21	5	**163**
11 days or more	2	5	12	**19**	3	7	9	**19**
In-hospital mortality								
Yes	0	1	6	**7**	1	1	5	**7**
No	157	29	12	**198**	162	27	9	**198**
Failure of organ								
Yes	1	7	14	**22**	2	9	11	**22**
No	156	23	4	**183**	161	19	3	**183**

For comparing the outcome of mortality, organ failure and hospital stay eleven days or more, all the acute pancreatitis cases were divided into severe cases and non-severe cases (mild+ moderate) in both BISAP and CTSI scoring systems. Predictive analysis done for severe cases of both grading system for analysis of each outcome i.e mortality, organ failure and hospital stay eleven days or more. Specificity, positive predictive value and negative predictive value were almost similar for BISAP and CTSI scoring in assessing the outcomes as depicted in Table 4.

Table 4: Comparison of outcomes in between BISAP and CTSI scoring

Outcome	Scoring	Sensitivity (%) 95% CI	Specificity (%) 95% CI	PPV(%) 95% CI	NPV(%) 95% CI
Mortality	BISAP	**85.71** (42.13%-99.64%)	**93.93** (89.65%-96.83%)	**33.33** (21.09%-48.33%)	**99.46** (89.4%-96.58%)
	CTSI	**71.42** (29.04%-96.33%)	**95.45** (91.55%-97.9%)	**35.71** (20.11%-55.08%)	**98.95** (96.7%-99.67%)
Organ failure	BISAP	**63.64** (40.66%-82.8%)	**97.86** (94.61%-99.41%)	**77.78** (55.8%-90.66%)	**95.81** (92.94%-97.55%)
	CTSI	**50** (28.22%-71.78%)	**98.36** (95.28%-99.66%)	**78.57** (52.54%-92.39%)	**94.24** (91.5%-96.13%)
Hospital stay 11days or more	BISAP	**63.16** (38.36%-83.71%)	**96.77** (93.11%-98.81%)	**66.67** (45.87%-82.52%)	**96.26** (93.45%-97.89%)
	CTSI	**47.36** (24.45%-71.14%)	**97.31** (93.84%-99.12%)	**64.29** (40.17%-82.83%)	**94.76** (92.19%-96.51%)

PPV- positive predictive value, NPV- negative predictive value, CI- confidence interval

But, sensitivity of BISAP was 85.71% in comparison to 71.42% in CTSI in assessing mortality among severe pancreatitis patients. Also, in assessing organ failure among the severe pancreatitis cases BISAP

(63.64%) was more sensitive than CTSI (50%). Severe pancreatitis patients according to BISAP scoring was found to be more sensitive (63.16%) in predicting the probability of hospital stay eleven days or more than CTSI (47.36%) severe cases.

Fig 1: Comparison of BISAP vs CTSI sensitivity in assessing outcomes
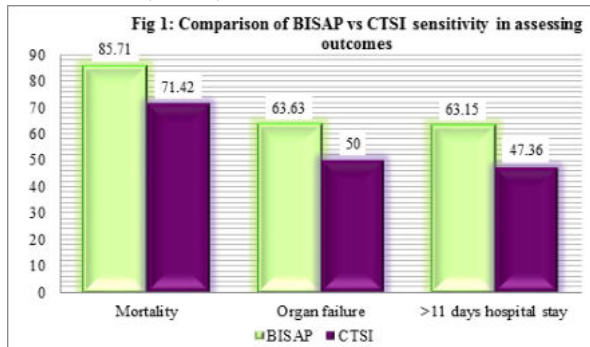
So, overall sensitivity of BISAP scoring was better than CTSI scoring in correctly identifying the probability of the all outcome of pancreatitis (Figure 1) .

DISCUSSION:

In our study we evaluated the usefulness of BISAP and CTSI as markers of prognosis of the acute pancreatitis and compared the accuracy and predicted the outcome between the two scoring systems. In this study, 90.2% (185) patients were male and 9.8% (20) patients were female. Khanna AK *et al* also found 51.4% male patients in among all acute pancreatitis patients [13] and Senapati D *et al* also reported 62.19% male and 37.81% female patients in their study.[14] Among the total 205 patients in this study, 125 (61%) belonged to the age groups 20 yrs to 40 yrs followed by 71 (34.6%) belong to 41yrs to 60 yrs. Another study also revealed that maximum population suffering from acute pancreatitis were 20-40 years of age (40.3%) followed by 40-60 years of age (29.1%).[13] Kumar HA *et al* reported that most of the patients 42% belong to 40-60 years followed by 24% (20-40 years of age).[15] There were 90.2% (185) patients who were addicted to alcohol whereas a total of 20(9.8%) patients were non- alcoholic in the study. Studies also found to report alcoholic patients 18% [15] and 22% [18]. Senapati D *et al* found most common etiology among men was alcoholism .[14]

Total 7 (3.4%) patients died in our study. Another study also reported near similar mortality rate i.e. 7 (3.8%) out of 185 patients. [17] Other studies reported mortality rate in between 5 to 8.5% [14,15,16,18] Also, 22 (10.73%) patients were found to have organ failure in our study. There are studies which reported high prevalence of organ failure 15.8%, [14] 21.6% [17] and 29% [16] than our study. Out of 205 patients, severe acute pancreatitis cases were 14 (6.8%) in CTSI and 18 (8.8%) in BISAP grading in this study. Senapati D *et al* also reported 16 out of 246 cases (6.5%) developed severe pancreatitis in BISAP scoring. [14] Few studies also reported quite high prevalence of severe pancreatitis than our study 22-30%. [15,16,17] In this study, out of 18 patients who had BISAP score >3, 7 died (38.9%). This report is quite similar with findings by Cho JH *et al* reporting 8 (34.7%) patients died who had BISAP score ≥3.[19] In our study, BISAP score of >3 had a sensitivity of 85%, specificity of 93%, a positive predictive value of 33% and a negative predictive value of 99% for mortality. Senapati D *et al* found that a BISAP score of ≥3 had a sensitivity of 92%, specificity of 76%, a positive predictive value of 17%, and a negative predictive value of 99% for mortality.[14] In our study CTSI score >6 had a sensitivity of 71%, specificity of 95%, a positive predictive value of 35% and a negative predictive value of 98% for mortality. Cho JH *et al* reported CTSI scoring ≥ 3 had a sensitivity of 66%, specificity of 67%, a positive predictive value of 23%, and a negative predictive value of 93%.[19] This difference could be due to the difference in set up of cut off value for defining severe pancreatitis. There were not many differences of outcomes between the two scoring systems but CTSI is less efficacious than the clinical scoring system BISAP in predicting outcomes of acute pancreatitis between BISAP and CTSI. BISAP scoring is simple clinical scoring system & can be instantly done at bedside than the CTSI scoring system as the availability of CT scan is limited to places and it is costly. Therefore, for early detection of severity and prediction of outcomes BISAP is considered to be a critical concern in the prognosis and management of acute pancreatitis.

CONCLUSION:

In our study BISAP scoring is considered to be better scoring system than the CTSI scoring system for assessing outcome of acute pancreatitis for being more sensitive and more convenient. As it is difficult to conclude the best scoring system with this study having small sample size (205), large scale studies involving more sample size over a longer periods of time is suggested to properly validate the findings of this study. However, this study will definitely help as a reference on which further larger studies could be conducted in future.

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