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COMPARISON OF BISAP, NLR AND CTSI TO RECOGNIZE AND PROGNOSTICATE THE SEVERITY OF ACUTE PANCREATITIS IN EMERGENCY DEPARTMENT

General Medicine

Dr. Mohnish Tripathi
Dr. Meenakshi Shukla
Dr. Nikita Trehan
Dr. Pankaj Singh

ABSTRACT

AIMS AND OBJECTIVES: This study aims to recognize and prognosticate the severity of AP in the emergency department (ED); Comparison the BISAP scoring With NLR (Neutrophil-lymphocyte ratio) and CTSI (computerized tomography severity index).
MATERIAL AND METHODS: This is a prospective observational study; was done at tertiary care hospital from JAN 2017 TO DEC.2017**.** All Patients coming to triage with complain of abdominal pain and epigastric pain aged 18-65yrs. Several patients predicted mild and severe pancreatitis by BISAP, NLR, and CTSI. Prognostication of severe pancreatitis by BISAP when compared to NLR and CTSI in terms of ALOS, Complication, and Death.
RESULTS: Out of all 82 patients, who were diagnosed with acute pancreatitis, BISAP score described48 patients (58.5%) with scores <3 will have MAP and 34 patients (41.5%) with scores>3 will have SAP. NLR score described 67.1% as MAP and 32.9% as SAP.CTSI described 57.1% as MAP and 42.9% as SAP. The mean ALOS of BISAP score was 8.6765 days and median was7.37613 while mean ALOS of NLR was 8.9259 days and 6.2137 medians and mean ALOS of CTSI was 9.8518 and median 7.7940. Mean ALOS of all severe acute pancreatitis patients were found similar in all scores and there was no statistically significant difference (p-value->0.05%) between BISAP with NLR and CTSI.
CONCLUSION: BISAP scoring has 100% sensitivity and 100% NPV in comparison to NLR and CTSI. It can be used in day-to-day practice in ED along with the routine clinical approach to identify and prognosticate SAP.

KEYWORDS

Acute pancreatitis (AP), BISAP, NLR and CTSI

INTRODUCTION

Acute pancreatitis (AP) is one of the most common diseases of the gastrointestinal tract that requires acute hospitalization and despite the special care is still associated with significant morbidity and mortality worldwide. Data not normally obtained at the time of hospitalization is included in the Ranson and modified Glasgow scores. In addition, both require 48 hours to be completed, missing a potentially valuable early therapeutic window. The most commonly utilized predictive scoring system for clinical research studies in AP is the Acute Physiology and Chronic Health Examination (APACHE) II. However, the APACHE-II was originally developed as an intensive care tool and requires the collection of a large number of parameters, some of which may not be relevant to prognosis in AP. The new scoring systems such as the Bedside Index of Severity in Acute Pancreatitis (BISAP) that can be performed during the first 24 hours of hospitalization The BISAP score was developed as a simple system to assess the risk of in-hospital mortality in AP and is a facile tool available for early prediction of persistent organ failure and mortality [1].

Acute pancreatitis (AP) is a rapid pancreatic inflammation defined by the activation of pancreatic enzymes, which causes the pancreas to self-digest. Early, rapid, and precise risk categorization of AP patients would allow for evidence-based early initiation of intensive care therapy for patients with severe AP (SAP) to avoid negative outcomes, whereas mild AP (MAP) could be treated on the common ward. An ideal scoring system should promise an early, quick, simple, accurate, and reproducible description of disease severity. Several scoring methods are available to predict severity, complications but they are complicated and require data that are not routinely collected early on arrival [2].

Acute pancreatitis is a prevalent inflammatory illness of the pancreas that can affect other regional tissues or distant organ systems. The cause of the sickness is unknown, although it has a fatality rate of 5–10%. Most cases (80–90%) are mild and self-limited with a good outcome. The remaining 10–20% of patients with severe disease characteristically have pancreatic necrosis or distant organ failure and can anticipate the need for intensive care and possible operative intervention with a mortality rate of up to 40%. In the initial examination and management of acute pancreatitis, early diagnosis and exact staging of disease severity are critical aims. While individuals with moderate acute pancreatitis can be handled with fluid resuscitation and supportive treatment, those with severe acute pancreatitis require intensive care and nutritional therapy (ICU). Due to the risk of rapid deterioration in severe acute pancreatitis, the assessment of severity becomes crucial to a clinician [3].

This study aims to recognize and prognosticate the severity of AP in the emergency department (ED); Comparison the BISAP scoring With NLR (Neutrophil-lymphocyte ratio) and CTSI (computerized tomography severity index).

MATERIALS AND METHODS

Study design and setting: This is a prospective observational study; was done at tertiary care hospital Emergency Department and Department of Gastroenterology, Noida from JAN 2017 TO DEC.2017**.**

INCLUSION CRITERIA: All Patients coming to triage with complain of abdominal pain and epigastric pain aged 18-65yrs.

EXCLUSION CRITERIA: Pregnant patients and Patients with Oncology problems. Patients with known diagnosed pancreatitis who has received treatment from outside

Primary outcome: Number of patients predicted as mild and severe pancreatitis by BISAP, NLR and CTSI.

Secondary outcome: Prognostication of severe pancreatitis by BISAP when compared to NLR and CTSI in terms of ALOS, Complication and Death.

Ethical consideration: Institutional ethical committee approval for the study was taken on 27 Dec 2016. Written informed consent was taken from all patients or their attendees, if patient is altered sensorium.

Consent was taken again in those patients for whom attendees gave consent, when they became alert and eligible to give consent. All personal identifiers were kept strictly confidential and stored separately from the clinical information collected. We had also explicitly advised physicians not to alter their patient care for the study but to continue with usual care.

Statistical analysis: Categorical variables were numerically coded. Data was entered in Microsoft Excel 2017 worksheet and exported in

SPSS v13 for windows for statistical analysis. Descriptive statistics was performed. Numbers and percentages were used to present categorical data. Continuous data was summarized as mean ± SD (Standard deviation). All the statistical Software (SPSS 13.0Inc. Chicago, Illinois, USA). Severity prediction of BISAP, NLR and CTSI scores as primary outcome predicted as sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). ROCS (AUC) were calculated for each score for severity predictions. Chi-square test was used for demographic data and its statistical significance i.e. age group, sex ratio. Unpaired t test was used for analyzing the secondary outcomes. A p-value of <0.05 was considered to be significant.

RESULT

Patients coming to emergency department with triage complaint of abdominal pain (epigastric pain) were enrolled. Total, 988 patients, came during study period from which 889 patients were diagnosed with acute gastritis, acute cholecystitis, cholelithiasis, acute appendicitis, GERD, peptic perforation, acute coronary syndrome, inflammatory bowel disease and functional bowel disease and 99 patients were diagnosed with acute pancreatitis, in which 10 patients we found were above 65 years of age, 7 patients had Carcinoma Pancreas.

1. Sex distribution

Study was carried out in 82 patients after applying inclusion and exclusion criteria. Out of 82 patients, 26 (31.7%) patients were female and 56 (68.3%) patients were males. **[Figure 1]**

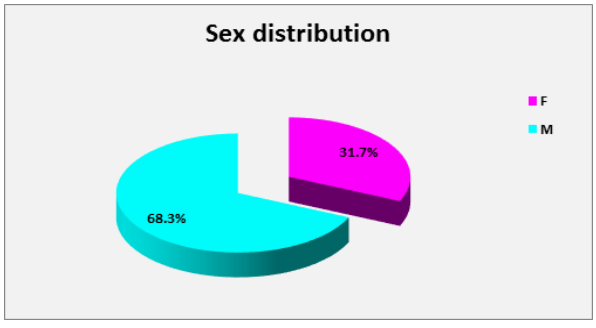

Figure 1: Sex distribution

The number of males developing mild AP were 62.5% and severe AP were 76.5%.The number of females developing mild AP were 37.5% and severe AP were 27.5%.Sex did not differ significantly between mild and severe AP groups. P value came out to be 0.231(statistically non-significant). **[Table 1, Figure 2]**

Table 1: Sex distribution of patients developing mild AP and severe AP

SEX	Mild AP		Severe AP		p-value
	Frequency	%	Frequency	%	
Female	18	37.5%	8	23.5%	0.231
Male	30	62.5%	26	76.5%	
Total	48	100%	34	100%	

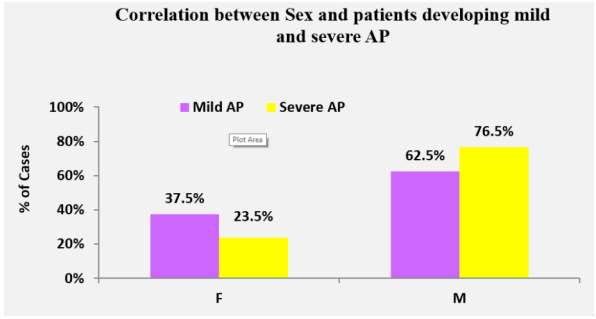

Figure 2: Correlation between Sex and patients developing mild and severe AP

2. Age Distribution

Amongst 82 patients; age of the patients as per inclusion criteria was from 18-65years and median age was 34.5 and mean 37.10 ± 11.73. Majority of patients were between 31 to 40years. **[Table 2, Figure 3]**

Table 2: Age distribution

Age Groups	Frequency	%
18 - 20 yrs	3	3.7%
21 - 30 yrs	22	26.8%
31 - 40 yrs	31	37.8%
41 - 50 yrs	14	17.1%
>50 yrs	12	14.6%
Total	82	100%
Mean ± SD	37.10 ± 11.73	
Median	34.5	
Min – Max	17 – 65	

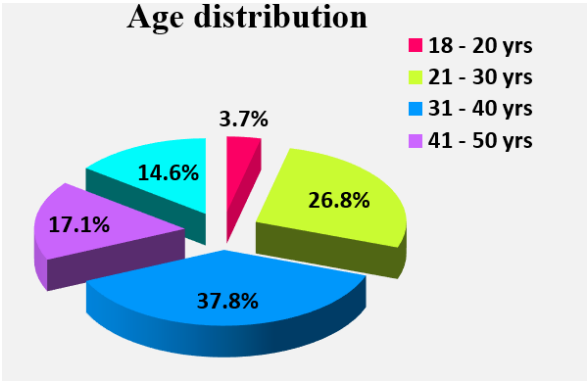

Figure 3: Age distribution

In 18-20yrs age group, there were no patients who developed mild AP and 8.8% patients were diagnosed with severe AP. In 21-30yrs age group, 21.1% developed mild AP and 26.5% developed severe AP .In 31-40yrs age group, 39.6% had mild AP and 35.3% had severe AP. In 41-50 yrs age group, 20.8% patients had mild AP and 11.8% had severe AP. Patients above 50 yrs age, 12.5% had mild AP and 17.6% had severe AP. Age did not differ significantly between mild and severe AP groups. P value came out to be 0.227 (statistically non-significant). **[Table 3, Figure 4]**

Table 3: Correlation between age groups and patients developing mild and severe AP

Age Groups	Mild AP		Severe AP		p-value
	Frequency	%	Frequency	%	
18 - 20 yrs	0	0.0%	3	8.8%	0.227
21 - 30 yrs	13	27.1%	9	26.5%	
31 - 40 yrs	19	39.6%	12	35.3%	
41 - 50 yrs	10	20.8%	4	11.8%	
>50 yrs	6	12.5%	6	17.6%	
Total	48	100%	34	100%	

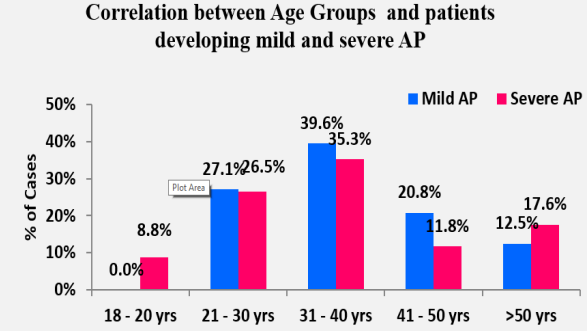

Figure 4: Correlation between age groups and patients developing mild and severe AP

All 82 patients who were included in the study were subjected to BISAP Score, NLR Score, and CTSI Score separately as a marker of prognosis. Severity of pancreatitis was predicted by BISAP score and then was compared with NLR and CTSI as primary outcome. All Severe pancreatitis patients were analysed for secondary outcome in terms of ALOS, complications, death by applying BISAP score comparing it with NLR and CTSI.

3. Primary Outcome

Out of all 82 patients, who were diagnosed with acute pancreatitis, BISAP score described48 patients (58.5%) with score<3 will have MAP and 34 patients (41.5%) with score >3 will have SAP. NLR score described 67.1% as MAP and 32.9% as SAP. CTSI described 57.1% as MAP and 42.9% as SAP. **[Figure 5]**

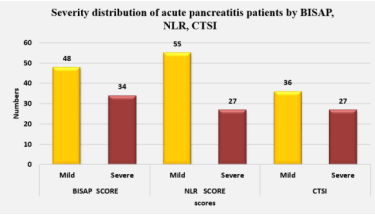

Figure 5: Severity distribution of acute pancreatitis patients by BISAP, NLR, and CTSI.

Table 4: Severity prediction of all scores

Scores		Outcome		Total	True positive rate	True negative rate	False positive rate	False negative rate
		Mild	Severe					
BISAP	Mild	48 (TN)	0 (FN)	48				
	Severe	3 (FP)	31 (TP)	34				
	Total	51	31	82	100.00	94.12	5.88	0.00
NLR	Mild	45 (TN)	10(FN)	55				
	Severe	6 (FP)	21 (TP)	27				
	Total	51	31	82	67.74	88.24	11.76	32.26
CTSI	Mild	34 (TN)	2 (FN)	36				
	Severe	0 (FP)	27 (TP)	27				
	Total	34	29	63	94.44	100.00	0.00	5.56

TN : True Negative (concordance - matching mild);
TP : True Positive (concordance - matching severe);
FN : False Negative (discordance - severe outcome was predicted as mild);
FP : False Positive (discordance – mild outcome was predicted as severe)

BISAP score was found to be 100% (95% CI: 88.8-100) sensitive, 94% (95% CI: 83.5-98.7) specific, 91.2% (95% CI: 76.3-98.1) PPV, 100% (95% CI: 92.5-100) NPV and ROC Area under curve (AUC) was 0.97 (95% CI: 0.94-1.00) in predicting SAP [Figure 6]

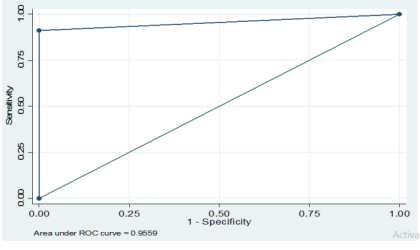

Figure 6: Receiver Operating Characteristic (ROC) analyses for predicting SAP by BISAP

NLR was found to have 67.7% (95% CI: 48.6-83.3) sensitivity, 88.2% (95% CI: 76.1-95.6) specificity, 77.8% (95% CI: 57.7-91.4) PPV, 81.8% (95% CI: 69.1-90.9) NPV and AUC was 0.80 (95% CI: 0.69-0.87). **[Figure 7]**

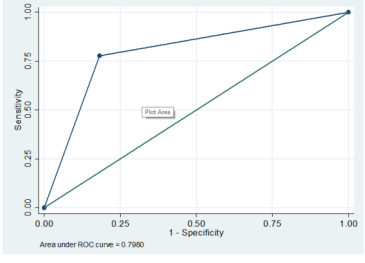

Figure 7: Receiver Operating Characteristic (ROC) analyses for predicting SAP by NLR

CTSI was found to have 93.1% (95% CI: 77.2-99.2) sensitivity, 100% (95% CI: 89.7-100) specificity, 100% (95% CI: 87.2-100) PPV, 94.4% (95% CI: 81.3-99.3) NPV and AUC was 0.97 (95% CI: 0.92-1.00). **[Figure 8]**

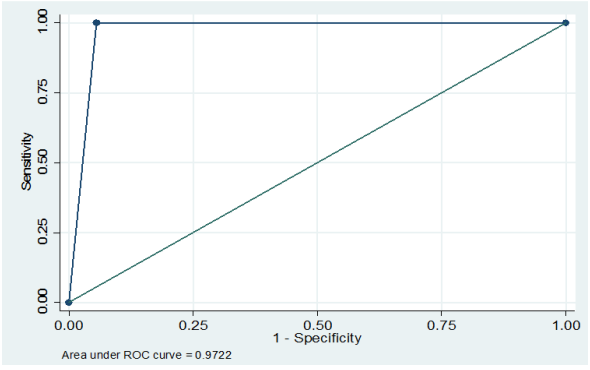

Figure 8: Receiver Operating Characteristic (ROC) analyses for predicting SAP by CTSI

BISAP score were found to be statistically significant (p value-<0.001) in predicting SAP early in ED as compared to NLR and CTSI. BISAP score were found to be statistically significant (p value-<0.001) in predicting SAP early in ED as compared to NLR and CTSI. **[Figure 9]**

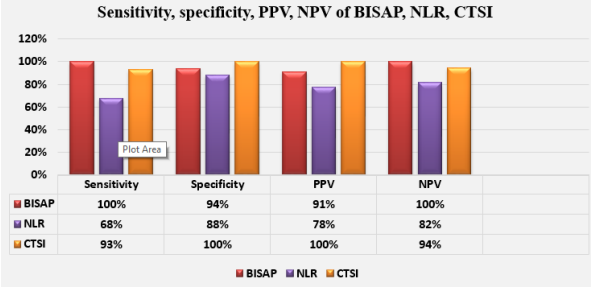

Figure 9: Specificity, PPV, NPV of BISAP, NLR, CTSI

4. Secondary Outcome

Mean ALOS of BISAP score was 8.6765 days and median was 7.37613 while mean ALOS of NLR was 8.9259 days and 6.2137 median and mean ALOS of CTSI was 9.8518 and median 7.7940. Mean ALOS of all severe acute pancreatitis patients were found similar in all scores and there were no statistically significant difference (p value->0.05%) between BISAP with NLR and CTSI. **[Table 5, Figure 10]**

Table 5: ALOS comparison of severe AP between BISAP, NLR and CTSI

ALOS (days)	Frequency of severe AP	Mean	SD	Median (IQR)	P-value
BISAP	34	8.6765	7.37613	7 (5 - 10.25)	0.889
NLR	27	8.9259	6.2137	7 (7- 11)	
BISAP	34	8.6765	7.37613	7 (5 - 10.25)	0.549
CTSI	27	9.8518	7.7940	8 (6 - 12)	

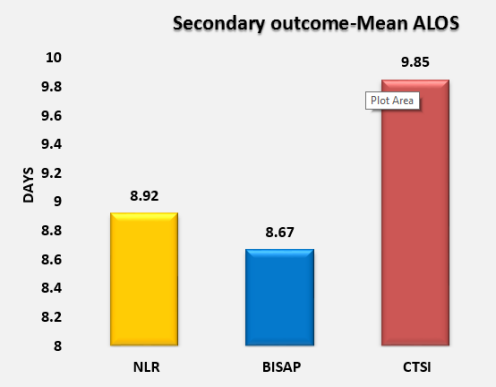

Figure 10: Mean ALOS of BISAP, NLR, CTSI

Taking into consideration, local and systemic complications as secondary outcome,in all severe acute pancreatitis BISAP found 97% local and 68% systemic complications while NLR found 96% local and 67% systemic complications and in CTSI had 100% local and 67%systemic complications. There was no statistically significant difference (p value->0.05%) between BISAP with NLR and CTSI in SAP for local and systemic complications. **[Table 6, 7 and Figure 11]**

Table 6: Comparison of Local and systemic complications in severe AP between BISAP and NLR

	Local Complication of Severe AP			Systemic Complication of Severe AP		
	YES	NO	P-Value	YES	NO	P-Value
BISAP	32	2	0.775	19	15	0.269
NLR	26	2		13	15	

Table 7: Comparison of local and systemic complications in severe AP between BISAP and CTSI

	Local Complication in Severe AP			Systemic Complication in Severe AP		
	YES	NO	P-Value			
BISAP	32	2	0.501	19	15	0.180
CTSI	26	1		12	15	

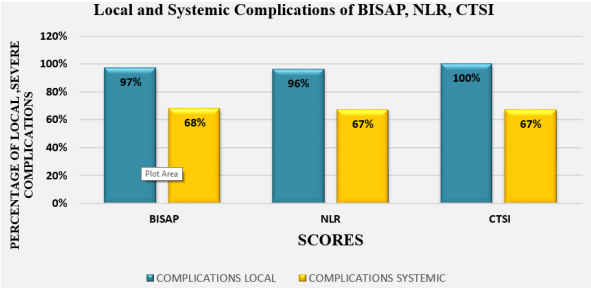

Figure 11: Local and systemic complications of BISAP, NLR, CTSI

Death of all SAP as secondary outcome, in BISAP it was 4, while in NLR was 4 and in CTSI it was 3. There was no statistically difference of (p value->0.05%) BISAP when compared with NLR and CTSI in terms of death as secondary outcome. **[Table 8, Figure 12]**

Table 8: Numbers of deaths in comparison between BISAP, NLR and CTSI

DEATH	YES	NO	P-Value
BISAP	4	0	Not possible
NLR	4	0	
SEVERE BISAP	4	0	>0.999
SEVERE CTSI	3	1	

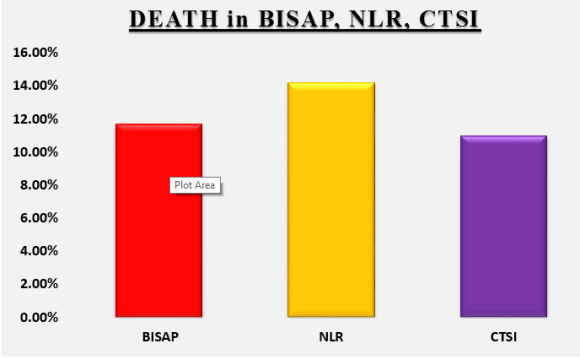

Figure 12: Percentage of death in BISAP, NLR, CTSI scores

DISCUSSION

In our study, we used standard Atlanta classification to diagnose the severity of pancreatitis. We compared BISAP, CTSI, and NLR to recognize and prognosticate the severity of AP in the emergency department. We enrolled 82 patients. Out of which, males were 56 (68.30 %), and the remaining 26 (31.7 %) were females. We found more male patients with acute pancreatitis as compared to females; this was in concordance with the study done by Chen et al. at Wuxi, China, in 2013 and Debadutta et al. at Cuttack, Odhisa in 2014, which showed a high prevalence of acute pancreatitis patients among males [2, 5].

In our study, the Mean age was 37.10 ± 11.73 years and the majority of patients were in the age group of 31-40 years of age. Chen et al reported their mean age to be 53 years ± 16 years [2]. Debadutta et al. reported mean age of 42 ±13 years and the majority age distribution was between 30- 50 years [5]. The difference in median age might be due to the selection criteria as there was no age limit in their study and we have limited the age group from 17 to 65 years of age to avoid bias.

We chose **the BISAP score** for our study because it carries several important advantages over other prognostic scoring systems in predicting the prognosis of acute pancreatitis. The most important advantage of this score is simple to calculate and requiring only those vital signs, laboratories, and imaging that are commonly obtained at the time of presentation in ED.

In our study, the BISAP score was applied at the time of presentation in ED. BISAP (n = 82), described 48 (58.5%) patients to develop mild acute pancreatitis and 34 (41.4%) as severe acute pancreatitis with cutoff score values of <3 and > 3 respectively. Sensitivity and Specificity were 100% and 94% respectively. NPV and PPV was 100 % and 91 % respectively.

Chen et al. (n = 497), reported at cutoff value for BISAP score of 2, Sensitivity , specificity , PPV and NPV as 61.4%, 83.1 % , 48.1 % and 89.4% respectively [2]. Cho et al. in South Korea, in 2015 (n = 299) did a retrospective study with cutoff values of 3, reported sensitivity, specificity, NPV, and PPV of SAP as 45.5 %, 98.9%, 95.8, and 76.9% respectively [4]. Results were not similar to our study because of different cutoff values used, different races, and ethnicity [2].

ALOS in our study was 8.67 days. Local (necrosis, peritonitis, pancreatic abscess, and pseudocyst) and systemic complications (respiratory failure, renal failure, circulatory shock, others) were 97% and 68% respectively. Deaths were 11.7 %. Values did not any reach statistical significance.

Yadav et al. (n=119) in Rachi, Jharkhand in November 2012 to October 2014 did a prospective observational study with cutoff value BISAP as 3.BISAP exhibited sensitivities of 97%, 89%, 100%, and specificity of 94.8%, 95.8%, 69.2% in predicting the severity of pancreatitis, pancreatic necrosis, and mortality respectively [6]. Results were similar to our study as higher sensitivity and specificity in predicting severity, pancreatic necrosis, and mortality.

Chen et al., BISAP exhibited sensitivities of 84.6%, 93.10%, and 83.3%, and specificities of 46.7%, 51.4%, and 67.4% in predicting pancreatic necrosis, organ failure, and mortality, respectively. BISAP showed a higher sensitivity but lower specificity in predicting pancreatic necrosis and organ failure [2]. The reason for discordance might be due to differences in the characteristics of study participants, such as race, lifestyle, and genetic basis [2]. A different cutoff value was used for the BISAP score for severity.

We chose **neutrophil-lymphocyte ratio (NLR)** for predicting the severity of acute pancreatitis patients because it is a simple, cheap, and routine part of a CBC done during the initial ER evaluation of patients. Although, only a few studies are showing the significance of NLR for predicting the severity of acute pancreatitis.

In our study (n=82), the NLR score was done at the initial presentation in ED and repeated after 48 hours of admission. We took NLR 4.7 as our cutoff value according to available data [7]. NLR described 55 cases (67.1%) as mild pancreatitis and 27 (32.9 %) as severe pancreatitis. Sensitivity and Specificity were 67.7% and 88.2%. PPV was 77.8 % and NPV was 81.8 %.

Azab et al. (n=283) in New York did an observational study between the year 2004 to 2007, reported NLR to be superior to the total WCC or individual neutrophil and lymphocyte counts in predicting ICU admission, length of stay, and death in patients with AP. He arranged the patients into 3 tertiles (first tertile NLR value 3.6, second between 3.6 to 7.6, and third tertile NLR value 7.6). They found that patients in 3rd tertile (NLR>7.6) had more ICU admission and longer length of stay compared with those in 1st tertiles (NLR<3.6) which was statistically significant. Whereas in the case of wbc tertiles, where compared 3rd tertiles with 1sttertiles, they did not reach statistical

significance. The authors recommend a cut-off value for NLR of ≥4.7 to identify severity in AP. NLR >4.7 predicted ICU admission and LOS >7days with sensitivity 85.2 and 75.2%, and specificity of 47.7% and 48.1%. Positive predictive values of 14.6% and 24.5% and Negative predictive values of 96.8% and 89.5% for ICU admission and length of stay respectively. NLR values (>4.7) were superior in predicting ICU admission compared to wbc values due to high sensitivity and high negative predictive valves [7].

Results were similar with our study as cutoff values were the same in predicting the severity of acute pancreatitis in terms of ICU admission as high sensitivity and high NPV.

Suppiah et al. at Cottingham in 2013, used different cutoff values of NLR on days 0, 1, 2. They reported with a cutoff value of NLR ≥4.7 with the highest (90.9 %) sensitivity but was the least accurate (33.1 %) due to low specificity (22.5 %) and PPV (17.7 %) [8]. Results did match with our study because they did not consider any optimal cutoff value for NLR in their study

ALOS in the NLR group was 8.6 days. Local (necrosis, peritonitis, pancreatic abscess, and pseudocyst) and systemic complications (respiratory failure, renal failure, and circulatory shock) were 96% and 67 % respectively. Deaths were 14.2 %. But values did not reach statistical significance. LOS (length of stay) in Azab et al. >7days with sensitivity 75.2% and 48.1% specificity. But did not reach any statistical significance.

CTSI (Computerized Tomography Severity Index)- Computed Tomography (CT) is highly accurate and sensitive than USG in both diagnosing as well as demonstrating the extent [9]. We used Balthazar CT Severity Index (CTSI) via grading system with the presence and extent of pancreatic necrosis. In our study contrast, CT was done. CTSI (n = 73) described 36 cases (57.1%) as Mild pancreatitis and 27(42.9%) as severe pancreatitis. Sensitivity and Specificity were 93% and 100 %.PPV was 100 % and NPV was 94 %.

Yadav et al. in Jharkhand in 2015, (n = 119) reported severe pancreatitis at cutoff value for CTSI score of 3, sensitivity, specificity, PPV, and NPV as 97.6%, 94.8%, 91.1%, and 88.6% respectively [6]. Discordance in results might be the reason for different sample sizes and cutoff values. Cho et al., did a retrospective study, (n = 161) reported severe pancreatitis at cutoff value 3, sensitivity, specificity, PPV and NPV as 66.7%,67.1%, 23.3% and 93.1% [10].

In our study, ALOS in the CTSI group was 9.88 days. Local (necrosis, peritonitis, pancreatic abscess, and pseudocyst) and systemic complications (respiratory failure, renal failure, and circulatory shock) were 100% and 67 % respectively. Deaths were 11%. Values did not reach statistical significance.

Yadav et al. in their study reported, 42 patients (35.2%) were classified as having SAP, 47 (39.5%) developed pancreatic necrosis and 12 (10.1%) died. There was no significant statistical difference (P>0.05), indicating that BISAP accurately estimates the outcomes [6]. We did not found similar results may be because Yadav et al. considered only one local complication that is pancreatic necrosis and did not consider any systemic complication parameter.

CONCLUSION

In our study, we have compared BISAP, NLR, and CTSI to recognize and prognosticate the severity of AP in ED. We conclude that BISAP scoring has 100% sensitivity and 100% NPV in comparison to NLR and CTSI. It can be used in day-to-day practice in ED along with the routine clinical approach to identify and prognosticate SAP.

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