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Comparative Study of BISAP and Ranson's Score in Assessing the Severity of Acute Pancreatitis

Dr. Nagaraj N[1*], Dr. Harish Sagar[2], Dr. Afsar Fatima[3], Dr. Y.J.V.Reddy[4]
[1]Associate Professor, Department of General Medicine
[2]Senior Resident, General Medicine at District Hospital, Nagarkurnool.
[3]Post Graduate Resident, Department of General Medicine
[4]Professor and Head of Department, Department of General Medicine
P.E.S. Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh India

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***Corresponding author**
Dr. Nagaraj N

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Abstract: Acute pancreatitis (AP) is an inflammatory process of pancreas and peripancreatic tissue, with a highly variable clinical course with high morbidity and mortality. It results from a complex etiological process, with a variable natural course, making it difficult for early identification. Most patients with AP have mild disease that resolves spontaneously, however, 10%-20% of patients experience a severe attack with high mortality of up to 30%. Early assessment and identification of patients at risk is important for initiating intensive therapy, which has shown to improve prognosis and survival. A new prognostic scoring system, the Bedside Index for Severity in Acute Pancreatitis (BISAP), is an accurate and simple method for early identification of patients at potential risk of in-hospital mortality. We aimed to assess the accuracy of BISAP score and to compare BISAP and Ranson's scoring system in predicting the severity of acute pancreatitis. A total of 100 patients diagnosed clinically as acute Pancreatitis were included in the study. BISAP and Ranson's scores were calculated in all patients based on data obtained within 48hours of hospitalization. Organ failure scores were calculated for all the patients during the first 72 hours of hospitalization. Duration of organ failure was graded as transient (≤ 48 hours) or persistent (>48 hours). BISAP and Ranson's scores were analyzed statistically. All patients were managed medically and monitored for development of any complications during the hospital stay. In our study blood urea emerged as a powerful predictor of organ failure. Ranson's and BISAP scores showed concordance on statistical analysis and BISAPs scoring system can be used to predict accurately, the severity and organ failure within hours of admission.

Keywords: Acute pancreatitis, Ranson's score, BISAP scores, pancreatic necrosis, marshall criteria, MODS.

INTRODUCTION

Acute pancreatitis (AP) is an inflammatory process of pancreas and peripancreatic tissue, with a highly variable clinical course with high morbidity and mortality. It results from a complex etiological process, with variable natural course, making it difficult for early identification. Most patients with AP have a mild disease, which resolves spontaneously without sequelae, however, approximately 10%-20% of patients experience a severe attack with high mortality of about 30%[1,2]. This high-risk group of patients may benefit from aggressive fluid resuscitation, close monitoring for development of organ failure, proper administration of antibiotics and specific therapeutic procedures, such as endoscopic sphincterotomy or radiologic intervention [3]. Therefore, early assessment of the severity and identification of patients at risk is important for early intensive therapy, and timely intervention, which has shown to improve prognosis and survival.

Multi-factorial scoring systems, including Ranson *et al*. [4] and Acute Physiology and Chronic Health Evaluation (APACHE)-II scores [5] have been used since 1970s for assessment of severity of AP. However, these scoring systems are complex and difficult to use routinely and have been shown to perform with high negative predictive value with only moderate overall sensitivity [3,6,7]. A new prognostic scoring system, the Bedside Index for Severity in Acute Pancreatitis (BISAP), has recently been proposed as an accurate and simple method for early identification of patients at potential risk of in-hospital mortality [8, 9].

AIMS AND OBJECTIVES

To assess the accuracy of BISAP scoring system in predicting severity in an attack of acute pancreatitis and its course. To compare severity prediction (organ failure) between BISAP system and Ranson's scoring system.

MATERIALS AND METHODS

All patients who presented to PES Institute of Medical Sciences and research Hospital, Kuppam, and diagnosed as acute pancreatitis, over a period of 18 months were included in the study. Clinical data with associated risk factors were collected and relevant laboratory investigations were done. Plain X Rays, CT /MRI / USG of the abdomen, was done to differentiate necrotizing from interstitial pancreatitis, within the first 7 days of hospitalization.

BISAP score and Ranson's score was calculated in all such patients based on data obtained within 48hours of Hospitalization. Organ failure was defined as a score of ≥ 2 in one or more of the three (respiratory, renal, and cardiovascular) as initially described in the Marshall score. Organ failure scores were calculated for all the patients during the first 72 hours of hospitalization based on the most extreme laboratory value or clinical assessment during each 24hours period. Duration of organ failure was graded as transient (≤ 48 hours) or persistent (>48 hours) from the time of presentation. All the patients were managed medically and monitored for development of any complications during the hospital stay. BISAP and Ranson's scores thus obtained were analyzed statistically.

Acute Pancreatitis was defined as presence of two of the following three features: 1) Abdominal pain consistent with acute pancreatitis (acute onset of persistent, severe, epigastric pain often radiating to the back); 2) Serum amylase and/or lipase at least three times greater than the upper limit of normal value; and 3) Characteristic manifestations of acute pancreatitis on CECT, less commonly MRI / USG.

Infected necrosis of pancreas was defined as lack of enhancement of parenchyma with abscess formation as assessed by CECT.

BISAP score components include:

1) Blood Urea Nitrogen (Bun) > 25 mg/dl
2) Impaired mental status (Glasgow coma scale score < 15)
3) SIRS (systemic inflammatory response syndrome) - defined as two or more of the following:
   - Temperature of < 36°C or > 38 °C
   - Respiratory rate > 20 breaths/min or paCO2 < 32 mm Hg
   - Pulse > 90 beats/min
   - WBC (white blood cell count) < 4,000 or >12,000 cells/mm3 or >10% immature bands
4) Age > 60 years
5) Pleural effusion detected on imaging

One point is assigned for each variable within 24 hrs of presentation.

Ranson's score:
For non-Gallstone pancreatitis:

At admission	During /within initial 48 hrs
1) Age> 55 years	1) fall in PCV > 10%
2) WBC count > 16,000/mm3	2) Increase in BUN > 5 mg/dl(or)
> 1.8 mmol after iv fluids	
3) Glucose> 200 mg/d (> 11mmol/l)	3) Serum calcium < 8 mg/dl (<2mmol/l)
4) LDH> 350 U/L	4) Arterial PO2 < 60 mm Hg
5) Aspartate aminotransferase >250 U/l	5) Base deficit > 4 mEq/L
6) Fluid sequestration > 6 L	

For Gallstone pancreatitis, the parameters are:

At admission	During /within initial 48 hrs
1) Age > 70 years	1) fall in PCV > 10%
2) WBC count > 18,000/mm3	2) Increase in BUN > 2 mg/dl (or)
> 0.7 mmol after IV fluids	
3) Glucose > 220 mg/d (> 12.2mmol/l)	3) Serum calcium < 8 mg/dl (<2mmol/l)
4) LDH> 400 U/L	4) Arterial PO2 < 60 mm Hg

5) Aspartate aminotransferase >250 U/l
6) Fluid sequestration > 4 L
5) Base deficit > 5 mEq/L

Table-1: Mortality increases with increase in Ranson's score

Score	2 or < 2	3–4	5 or > 5
Death rate	<1%	16%	> 40 %

Table-2: Organ failure is defined as any two of the following parameters according to Modified Marshall's criteria

Organ system	Score				
	0	1	2	3	4
Respiratory (PaO2/FIO2)	>400	301–400	201–300	101–200	≤101
Renal (serum Creatinine, mg/dL)	<1.4	1.4–1.8	1.9–3.6	3.6–4.9	>4.9
Cardiovascular (systolic blood pressure, mmHg)	>90	<90	<90	<90	<90

A score of 2 or more over a period of more than 48 hours for any one of the three organ systems is defined as persistent organ failure while if it is present for less than 48 hours, is known as transient organ failure.

Level of severity should be assessed during the disease process and hospital stay using this scoring system.

STATISTICAL ANALYSIS

The distributions of severity, pancreatic necrosis, organ failure, and mortality by BISAP score were assessed. Sensitivity, Specificity, Positive and Negative predictive values were calculated for BISAP and Ranson scoring systems. A *P* value of <0.05 was chosen to be significant for all tests, with Kendall's coefficient of concordance of 80%.

Inclusion criteria

Patients with history and clinical findings suggestive of acute pancreatitis with evidence of bulky edematous pancreas on USG/CT abdomen were included in our study.

Exclusion criteria

Chronic pancreatitis, recurrent pancreatitis and pancreatic carcinoma were excluded from the study.

RESULTS

A total of 100 patients, over a study period of 18 months were included in the study, all with clinical diagnosis of acute pancreatitis. Three patients were excluded from the final analysis as they left hospital against medical advice. Among the 97 patients in our study, 90 were male and 7 female. Clinical characteristics and outcomes of all patients are summarized in table (a).

The peak incidence was noted in the 4th decade of life. Pain abdomen was the most common presenting complaint and diabetes was the most common co morbidity associated with it. Alcohol was the predisposing etiology in 42 patients. In our study blood urea emerged as a significant predictor for organ failure in acute pancreatitis, and other parameters which also served as indicators for organ failure are - systolic blood pressure, respiratory rate, hemoglobin %, total leucocyte count, blood sugar, serum amylase, serum lipase, SGOT, serum calcium, serum creatinine, serum LDH, pH, pao2, pao2/fio2, HCo_3, BISAP score, Ranson score, GCS, pleural effusion.

Table-3: Demographic, clinical characteristics, and outcomes of patients (*n=97*)

Variables	data
Male / Female	90 / 7
Age (yr)	40 ± 26
CLINICAL FEATURES	(n, %)
Pain abdomen	92 (94.84)
Vomiting	40 (41.23)
Abdominal distention	18 (18.5)
Fever	7 (7.21)
Jaundice	7 (7.21)
COMORBIDITIES	(*n*,%)
Diabetes	31 (47)
Hypertension	28 (43)
Ischemic heart disease	5 (7)

Rheumatic heart disease	1 (1)
Hypothyroidism and others	2 (2)
ETIOLOGY	(%)
Alcohol	43
Biliary pancreatitis	19
Others	31
Post ERCP	2
Trauma	5
SIRS/ ORGAN FAILURE	(n, %)
Seen / absent	17(17.5) / 80(82.5)

Table-4: **Number of patients and their proportion of variables and mortality, stratified by the BISAP point score**

BISAP SCORE	NO. OF PATIENTS	MILD ACUTE PANCREATITIS	SEVERE ACUTE PANCREATITIS	PANCREATIC NECROSIS	MORTALITY
0	40	40	0	0	0
1	33	33	0	0	0
2	15	5	10	2	0
3	6	2	4	3	0
4	2	1	1	1	0
5	1	0	1	1	1

Table-5: Concordance between Ranson's and BISAPs Score. There was a significant concordance between Ransons score with BISAPs score with Kendall's coefficient of concordance being 80% with p<0.001.

93.3% who scored zero on ransons, scored zero on bisaps also
55.2% who scored one on ransons, scored one on bisap.
73.7% who scored two on ransons, scored one on bisap.
70% who scored three on ransons,scored two on bisap.
66.7% who scored four on ransons, scored two on bisap.
33.3% who scored four on ransons, scored three on bisap.
33.3% who scored five on ransons, scored two, three and four on bisap.
50%, who scored six on ransons, scored three and five on bisap.
100% who scored seven on ransons, scored four on bisap

Table-6: Ranson's and BISAP in predicting organ failure Organ failure by Ranson's Score

Increasing scores was related to increasing rates of organ failure $\chi 2=85.9$, $p<0.001$.
-A score of one and two had no organ failure
-A score of three had 80% organ failure
-A score of four and five had 100% organ failure.
Organ failure by BISAPs Score:
Increasing scores was related to increasing rates of organ failure $\chi 2=64.7$,$p<0.001$.
-A score of zero and one had a no organ failure
-A score of two and three had organ failure of 66.7%
-A score of four and five had 100% organ failure.

DISCUSSION

Early evaluation of the severity of AP is considered to be of critical concern in the prognosis and management of AP. An ideal prognostic scoring system should be simple, noninvasive, accurate, and quantitative, and the assessment methods should be easily applicable and available at the time of diagnosis [10]. Early in the course of AP, systemic inflammatory response syndrome (SIRS) or organ failure suggests potentially severe disease and poor prognosis[11]. Prognostic scores were created or adapted in acute pancreatitis to predict disease severity. In this context, Ranson's scores were the most accurate among those evaluated. This finding is concordant with several previous studies [1,15,16] We found a sensitivity of 91.2% and specificity of 74.4% related to degree of severity. The high negative predictive value (NPV), 95.7%, allows this score to exclude severe AP. There was significant correlation between disease severity and Ranson score 3 or above, with odds ratio of 30.131 (8.401-107.857, P < 0.001)[17].

Table-7: Sensitivity, specificity, positive predictive value, and negative predictive value of scoring systems in prediction of severe acute pancreatitis are as follows [14].

	Sensitivity (95%CI)	Specificity (95%CI)	Positive predictive value (PPV (95%CI)	Negative predictive value (NPV (95%CI)
Ranson	85.7 (63.7-97.0)	44.3 (35.9-52.9)	18.8 (11.5-28.0)	95.3 (87.1-99.0)
BISAP	61.9 (38.4-81.9)	72.1 (63.9-79.4)	25.0 (14.0-38.9)	92.7 (86.0-96.8)

Table-8: Majority of patients were in BISAP scores of 1,2& 3 as found in other studies [10]

BISAP score	Sidra Shabbir *et al*. [10] P <0.001	J. L.Pednekar *et al.* P <0.001	Present study. P value <0.001
0	20	79	40
1	29	8	33
2	16	6	15
3	15	4	6
4	0	4	2
5	0	0	1

Table-9: RANSON score: Majority of patients with Ranson scores of <4 similar to the Shandana Tarique *et al.* [11]

Ranson score	ShandanaTarique (11). P < 0.001	Present study.P <0.001
0-2	50	78
3-4	30	13
5-6	16.6	5
7-8	3.33	1
9-11	0	0

A study by Papachristou *et al*. [18] reported that with the cut off value set at 3, BISAP score had a sensitivity of 37.5%, a specificity of 92.4%, a PPV of 57.7%, and an NPV of 84.3% in predicting severity of acute pancreatitis. As per Kim BG *et al*. [12] BISAP is more accurate for predicting the severity of acute pancreatitis than the serum PCT, APACHE-II, Glasgow, and CTSI scores. Another study done by Villacis X, *et al*. [13] also concluded with correct prediction of severity of acute pancreatitis by BISAP score [9], with sensitivity and specificity of BISAP score to be 75% and 97.5%. Out of 5 parameters of score, BUN levels, presence of SIRS, impaired mental status and presence of bilateral pleural effusion had significant independent statistical correlation with outcome in the study.

In our study, amongst the severe AP patients, one had associated pancreatic necrosis, sepsis and developed multiorgan failure and had Ranson's score of more than 3 and BISAP score of >3 and died (overall 1.03% mortality). The easy availability of different radiological, endoscopic and surgical procedures, better intensive care facility and low complication rate, facilitated this study.

The most important determinant of the ultimate outcome is the presence or absence of local pancreatic complications like pancreatic necrosis and abscess, and systemic complications like multiorgan failure. In this study, the incidence of pancreatic necrosis was 7.2 %, which is similar to a study conducted in the USA[18]. In contrast, the studies from Germany and Turkey where the incidence of pancreatic necrosis was around 20%[19], and pancreatic necrosis was associated with increased severity and mortality. This was true in our patients as well, as seven patients had pancreatic necrosis and one patient expired.

The accuracy of the new BISAP system and Ranson's scoring system in patients with acute pancreatitis were compared in this study. The newly proposed BISAP index is an accurate means of stratifying patients with AP within 24-hour from admission. The BISAP score predictability outcome was similar to the Ranson's scoring system, thus there is agreement of BISAP score with Ranson's score in finding out frequency of severity and in turn mortality in patients with acute pancreatitis. The findings correlate well with the studies conducted in Pittsburgh, China and Korea[12].

The incidence of severe pancreatitis in this study was 19.6%, which was higher than reported elsewhere[20]. One possible reason for higher incidence of severe acute pancreatitis in this study is that it is a tertiary care hospital having better intensive care facility and it receives more referrals of patients from periphery with severe acute pancreatitis.

BISAP has several important advantages as a prognostic scoring system for acute pancreatitis. Firstly,

BISAP is simple to calculate, Ranson's criteria requires data not routinely collected at the time of hospitalization, and needs 48 hours to complete. BISAP, however, requires only physical examination, vital signs, laboratory data, and imaging for detection of pleural effusion that are commonly documented within 24 hours of presentation. Secondly, BISAP score can be used to predict in-hospital death in the early stages of disease.

CONCLUSION

Acute pancreatitis is a major medical challenge with unpredicted aggressive turn of events. All such candidates require a precise scoring system without any delay. Our study demonstrates the concordance between BISAP and Ranson's scoring systems. This concordance shows that prediction of severity and organ failure can be done at the time of admission itself when compared to Ranson's score, which takes 48 hours. BISAP scoring system can be used to predict severity and organ failure with equal efficacy to Ranson's score. BISAP has several advantages, as it requires only simple physical examination, vital signs, lab data, imaging that are commonly done within 24hours of admission. It helps in early evaluation and triage, thus averting major complications.

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