

A Comparative Study between Bedside Index of Severity in Acute Pancreatitis (BISAP) and Ranson's Score in Predicting Severity of Acute Pancreatitis in Correlation with Computerized Tomography Scan in Kumaun Region

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ABSTRACT

Introduction – Because of the variability and seeming unpredictability of acute pancreatitis, clinical scoring systems have been developed to predict the severity of acute pancreatitis and, as important, for patient stratification and enrolment in clinical trials. Ranson's criteria is the most commonly used scoring system and is based on 11 clinical and laboratory parameters measured within the first 48 hours of admission to the hospital. A new scoring system, the BISAP (Bedside Index for the Severity in Acute Pancreatitis) helps to identify the patient at risk of mortality prior to the development of multi-organ failure. BISAP scoring system is relatively simple and quick way to assess the severity of acute pancreatitis on admission and helps improving the management of the patient.

Methods - All confirmed cases of acute pancreatitis in 2 years of study period based on clinical, hematological, radiological findings were included in this study. All data concerning etiology, length of hospital stay, treatment, complications and deaths were recorded and analyzed in all patients forming study group. BISAP score and Ranson's score were calculated in all such patients. Special emphasis was made to collect data regarding organ failure, pancreatic necrosis and mortality and scoring systems was compared with them.

Results – Both Ranson and BISAP were almost equal in predicting the severity of acute pancreatitis. Both were efficacious in assessing

the predictability of organ failure but latter was much easier and can be preferred over former.

Conclusion - From this study, we can conclude that BISAP scoring system is not inferior to Ranson's scoring system in predicting the severity of acute pancreatitis. BISAP scoring system is very simple, cheap, easy to remember and calculate

Keywords: Acute Pancreatitis, Ranson's score, BISAP score

INTRODUCTION

Acute pancreatitis is defined as a pancreatic inflammatory process, with peripancreatic and multi-organ involvement causing multi-organ dysfunction syndrome (MODS), with increased mortality rate. Acute pancreatitis is the most terrible of all calamities that occur in connection with the abdominal viscera. The suddenness of its onset, the illimitable agony that accompanies it, and the mortality attendant upon it, all render it the most formidable of catastrophes. ^[1]

The first plausible explanations of the pathogenesis of acute pancreatitis were hypothesized by Halsted, Osler and Opie contemporaries at Johns Hopkins Hospital. In 1925, Sir Berkeley Moynihan declared that "acute pancreatitis is the most terrible of all the calamities occurring in

conjunction with the abdominal viscera," which still holds true today. [2,3]

Acute pancreatitis is a reversible pancreatic parenchymal injury associated with inflammation. [4] Gallstones are the most common cause of acute pancreatitis among many causes. Second most common cause is alcohol abuse. Other causes include ERCP induced, iatrogenic, hypercalcemic states (Hyperparathyroidism), hyperlipidemia, familial pancreatitis, trauma, drug induced pancreatitis (i.e. steroids, thiazide diuretics and azathioprine etc.), viral infections (mumps, coxsackievirus, cytomegalovirus) and rare causes like Sjogren's syndrome. Alcohol is known to be associated with a Higher incidence of acute fulminant pancreatitis is being found to be associated with alcohol abuse. Overall gallstone pancreatitis is more frequent in women (generally between 40 and 50 years). [5]

Severe acute pancreatitis develops in about 25% of patients with acute pancreatitis. Severity is linked to the presence of systemic organ dysfunction and pancreatic necrosis. Morbidity of severe acute pancreatitis is biphasic. In the 1st week it's powerfully associated with general inflammatory response whereas infection

because of infected exocrine gland mortification resulting in multiorgan failure syndrome happens within the later course after the first week. [6]

Because of the variability and seeming unpredictability of acute pancreatitis, clinical scoring systems have been developed to predict the severity of acute pancreatitis and, as important, for patient stratification and enrolment in clinical trials. These include the clinical scoring scales as Ranson's criteria, Glasgow scales, simplified acute physiology (SAP) score and acute physiology and chronic health evaluation II (APACHE II) score, BISAP score and MCTSI criteria etc. Ranson's criteria is the most commonly used scoring system and is based on 11 clinical and laboratory parameters measured within the first 48 hours of admission to the hospital. Patients with one or two criteria have a predicted mortality of less than 1% compared to patients with three criteria (10%) or four criteria (15%); with more than seven criteria, the predicted mortality approaches 50%. Although specific to acute pancreatitis, complete assessment with this one-time score may not be available until 48 hours after admission. One point is given for each positive parameter. [7]

Ranson's Criteria [7]

Ranson's Criteria	Non-biliary Acute Pancreatitis	Biliary Acute Pancreatitis
Admission		
Age (yr)	>55	>70
WBC count ($\times 1000/\text{mm}^3$)	>16	>18
Glucose (mg/dl)	>200	>220
AST (IU/L)	>250	>250
LDH (IU/L)	>350	>400
Within 48 Hours of Admission		
Hematocrit decrease (points)	>10	>10
BUN increase (mg/dl)	>5	>2
Base deficit (mEq/L)	>4	>5
Fluid replacement (L)	>6	>4
PaO ₂ (mm Hg)	<60	<60
Calcium (mg/dl)	<8	<8

It was the development of CT severity index by Balthazar and Ranson's in 1990 which revolutionized the assessment of acute pancreatitis and helped clinicians to discriminate between mild, moderate and severe pancreatitis. The CTSI is a 10 point scoring system, which is derived by

assessing the degree of pancreatic and peripancreatic inflammation, presence and number of peripancreatic fluid collections and the presence and degree of pancreatic necrosis. Patients with grade A-E pancreatitis are assigned zero to four points plus two points of upto 30%, four of 30-

50%, and six points for necrosis more than 50%. There was a significant correlation, with a continuous increasing incidence of mortality and morbidity in patients stratified according to CT severity index groups. It was found that patients who had a severity

index of 0-1 exhibited no mortality and morbidity, while patients with severity index of 2 had no mortality and a 4 % morbidity, while severity index of 7-10 exhibited 17% mortality and 92% complication rate. [8]

PROGNOSTIC INDICATOR	POINTS
Pancreatic Inflammation	
Normal pancreas	0
Focal or diffuse enlargement of the pancreas	1
Intrinsic Pancreatic abnormalities with inflammatory changes in peripancreatic fat	2
Single ill defined fluid collection or phlegmon	3
Two or more poorly defined collections or presence of gas in or adjacent to the pancreas	4
Pancreatic Necrosis	
None	0
<30%	2
30-50%	4
>50%	6

In 2008, the Bedside Index for Severity in Acute pancreatitis (BISAP) score was proposed for the early recognition of patients at risk of mortality. BISAP score compared with traditional scoring systems, BISAP is more convenient to use with fewer items. Several studies have been conducted to validate the BISAP score. However, they differed in many aspects, such as population, cutoffs, and clinical endpoints, which result in a broad range of predictive accuracy. A new scoring system, the BISAP (Bedside Index for the Severity in Acute Pancreatitis) helps to identify the patient at risk of mortality prior to the development of multi-organ failure. BISAP scoring system is relatively simple and quick way to assess the severity of acute pancreatitis on admission and helps improving the management of the patient. The purpose of this study was to find out the prognostic significance of BISAP scoring system and its accuracy in predicting the severity of disease in comparison with Ranson score. [9]

Individual components of the BISAP scoring system [9]

- "BUN > 25 mg/dl
- Impaired mental status (Glasgow Coma Scale Score < 15)
- SIRS-SIRS is defined as two or more of the following:
 - 1) Temperature of < 36 or > 38 ° C

- 2) Respiratory rate > 20 breaths/min or PaCO₂ < 32 mm Hg
- 3) Pulse > 90 beats/min
- 4) WBC < 4,000 or >12,000 cells/mm³ or >10% immature bands
 - Age > 60 years
 - Pleural effusion detected on imaging"

AIM & OBJECTIVES

To assess the accuracy of BISAP scoring system Vs Ranson's scoring system in predicting severity in an attack of acute pancreatitis in Kumaun region.

OBJECTIVE

To compare the predictability of organ failure, necrosis and mortality between BISAP scoring and Ranson's scoring system in patients admitted in surgery department.

MATERIAL & METHODS

- Study design:** A cross-sectional study.
- Place of study:** Susheela Tewari Government Hospital Haldwani.
- Sample size:** All the confirmed cases of acute pancreatitis in study period.
- Period of study:** 20 months, January 2018-Sept 2019
- Inclusion criteria:** All confirmed cases of acute pancreatitis based on hematological and radiological investigations admitted in Susheela Tewari Government Hospital Haldwani in the study period were included.

Exclusion criteria:

1. Patients with chronic pancreatitis or acute or chronic pancreatitis.
2. Patients who have undergone previous surgery for any pancreatic pathology.
3. Old treated cases of acute pancreatitis.
4. Sequelae of Acute Pancreatitis.
5. Patients not willing for informed consent.

PROTOCOL FOR CASE SELECTION

All confirmed cases of acute pancreatitis in 2 years of study period based on clinical, hematological, radiological findings, as follows:

- Characteristic abdominal pain of acute pancreatitis.
- Serum amylase or lipase level 3 or more times the upper limit of normal.
- Changes consistent with acute pancreatitis on cross sectional imaging.
- Thorough history taking and clinical examination of each patient carried out as per the prepared Performa.
- Complete blood count, renal function test, liver function test, electrolytes (Na^+ , K^+ , Ca^{++} and total Calcium levels), ABG, coagulation profile, serum amylase, serum lipase, C reactive protein levels.
- X ray chest and abdomen, USG whole abdomen, Contrast Enhanced Computed Tomography of the whole abdomen.

BISAP score and Ranson's score were calculated in all such patients based on data obtained within 24 hours of hospitalization and at 48 hours.

BISAP SCORE

Bedside index of severity in acute pancreatitis (BISAP) score

- ✓ BUN >25 mg/dl (8.9 mmol/L)
- ✓ Impaired mental status with a Glasgow coma score <15 .
- ✓ Evidence of SIRS (systemic inflammatory response syndrome).
- ✓ Patient Age >60 years old.
- ✓ Imaging study reveals Pleural effusion.

Systemic inflammatory response syndrome is defined as two or more of the following:

- ✓ Temperature of $<36^\circ\text{C}$ or $>38^\circ\text{C}$,
- ✓ $\text{PaCO}_2 < 32$ mmHg or RR >20 breaths/min,
- ✓ Pulse >90 beats/min and
- ✓ White blood cell count <4000 cells/ mm^3 , >12000 cells/ mm^3 or $>10\%$ immature bands

Interpretation of scores:

Patients are assigned a score out of 5 and that score is used to predict mortality.

Score

- 0-2 - lower mortality ($<2\%$)
- 3-5 - higher mortality ($>15\%$)

Ranson's criteria

❖ For **non-gallstone pancreatitis**, the parameters are:

At admission:

1. Age in years >55 years
2. White blood cell count >16000 cells/ mm^3
3. Blood glucose >11 mmol/L (>200 mg/dL)
4. Serum AST >250 IU/L
5. Serum LDH >350 IU/L

Within 48 hours:

1. Serum calcium <2.0 mmol/L (<8.0 mg/dL)
2. Hematocrit fall $>10\%$
3. Oxygen (hypoxemia $\text{PaO}_2 < 60$ mmHg)
4. BUN increased by 1.8 or more mmol/L (5 or more mg/dL) after i/v fluid hydration
5. Base deficit (negative base excess) >4 mEq/L
6. Sequestration of fluids >6 L

❖ For **gallstone pancreatitis**, the parameters are:

At admission:

1. Age in years >70 years
2. White blood cell count >18000 cells/ mm^3

3. Blood glucose > 12.2 mmol/L (> 220 mg/dL)
4. Serum AST > 250 IU/L
5. Serum LDH > 400 IU/L

Within 48 hours:

1. Serum calcium < 2.0 mmol/L (< 8.0 mg/dL)
2. Hematocrit fall > 10%
3. Oxygen (hypoxemia PaO₂ < 60 mmHg)
4. BUN increased by 0.7 or more mmol/L (2 or more mg/dL) after IV fluid hydration
5. Base deficit (negative base excess) >5 mEq/L
6. Sequestration of fluids > 4 L

Interpretation of scores:

- If the score ≥ 3 , severe pancreatitis likely.
- If the score < 3, severe pancreatitis is unlikely
- Score 0 - 2: 2% mortality
- Score 3 - 4: 15% mortality
- Score 5 - 6: 40% mortality
- Score 7 - 8: 100% mortality

Acute pancreatitis was classified as mild or severe on the basis of organ failure (transient or persistent) and/or local complications.

Organ failure criteria including:

- Shock (systolic blood pressure <90 mmHg)
- Pulmonary insufficiency (arterial po₂ <60 mmHg in room air or the need for mechanical ventilation)
- Renal failure (serum creatinine level >2 mg/dl after rehydration or hemodialysis).

Revised Atlanta Classification

A. Mild acute pancreatitis:

- (i) No organ failure
- (ii) No local or systemic complications

B. Moderately severe acute pancreatitis:

- (i) Organ failure that resolves within 48 (transient organ failure) and/ or
- (ii) Local or systemic complications without persistent organ failure

C. Severe acute pancreatitis : Persistent organ failure (> 48 h)

- (i) Single organ failure
- (ii) Multiple organ failure

Mild **local complication** was peripancreatic fluid collection and **severe local complications** were necrosis, abscess and pseudocysts formation.

All data concerning etiology, length of hospital stay, treatment, complications and deaths were recorded and analyzed in all patients forming study group. BISAP score and Ranson's score were calculated in all such patients. Special emphasis was made to collect data regarding organ failure, pancreatic necrosis and mortality and scoring systems was compared with them.

Method of statistical analysis

Independent t test was used to examine differences in age and sex; and chi square test for etiology were used. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated. A "p" value of less than 0.05 was considered to be statistically significant. Data analysis was performed using SPSS software.

OBSERVATION AND RESULTS

This study was conducted in Susheela Tewari Government Hospital Haldwani. Total numbers of patients studied were 147. According to Atlanta Revised criteria, 87 patients had mild pancreatitis, 28 patients had moderately severe pancreatitis, 32 patients had severe pancreatitis. Of the 147 patients, 64 patients had Ranson's score less than or equal to 3. 83 patients had a score of more than 3. Of the 147 patients, 97 patients had a BISAP score less than or equal to 3, 50 patients had a score more than 3.

Majority of the patients belonged to the age group of 18-40 years (n=72; 49.0%). Out of 147 patients, 82 were male and 65 were female. Most common cause was found to be gallstone induced pancreatitis followed by alcohol induced pancreatitis.

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Table 1: Distribution of study participants according to age.

Age Group	No.	Percentage
18 – 40 years	72	49.0
41 – 60 years	56	38.1
>60 years	19	12.9
Total	147	100.0

Table 2: Distribution of study participants according to Sex.

Sex	No.	Percentage
Male	82	55.8
Female	65	44.2
Total	147	100.0

Table 3.1: Distribution of study participants according to etiology of pancreatitis.

Etiology	No.	Percentage
Alcohol	32	21.8
Gall stones	94	63.9
Idiopathic	21	14.3
Total	147	100.0

Table 3.2: Distribution of etiology according to sex of study subjects

Etiology	Sex		No.
	Male No. (%)	Female No. (%)	
Alcohol	32 (100.0)	0 (0.0)	32
Gall stones	38 (40.4)	56 (59.6)	94
Idiopathic	12 (57.1)	9 (42.9)	21
Total	82 (55.8)	65 (44.2)	147

Gallstones were the most common cause among both male and female patients. However, alcohol was also a significant cause among male patients (n=32).

Table 4: Distribution of study participants according to BISAP Scoring.

BISAP Score	No.	Percentage
1	28	19.0
2	33	22.4
3	36	24.5
4	41	27.9
5	9	6.1
Total	147	100.0

According to BISAP Scoring, majority of patients had a scoring of 4 (n=41; 27.9%). Least common score of 5 was observed in 9 patients (6.1%).

Table 8: Distribution of complication according to RANSON's score grading.

RANSON's Scoring	Complication				Total
	MODS No.(%)	Necrosis No.(%)	Pseudocyst No.(%)	None No.(%)	
≤3	0(0.0)	4(6.3)	1(1.6)	59(92.2)	64
>3	25(30.1)	16(19.3)	14(16.9)	28(33.7)	83
Total	25(17.0)	20(13.6)	15(10.2)	87(59.2)	147

Most patients above Ranson's score >3 developed complications (n=55). Most common complication observed was MODS (n=25; 30.1%).

Table 5: Distribution of study participants according to Ranson's score.

Ranson's score	No.	Percentage
1	4	2.7
2	20	13.6
3	40	27.2
4	31	21.1
5	25	17.0
6	16	10.9
7	8	5.4
8	1	0.7
9	2	1.4
Total	147	100.0

According to Ranson's Scoring, majority of patients had a scoring of 3 (n=40; 27.2%). Least common score of 8 was observed in 1 patient (0.7%).

Table 6: Distribution of study participants according to Atlanta scoring.

Atlanta	No.	Percentage
Mild	87	59.2
Moderate	28	19.0
Severe	32	21.8
Total	147	100.0

According to Atlanta Revised criteria, 87 patients had mild pancreatitis, 28 patients had moderately severe pancreatitis, 32 patients had severe pancreatitis

Table 7: Distribution of complication according to BISAP score grading.

BISAP Scoring	Complication				Total
	MODS No.(%)	Necrosis No.(%)	Pseudocyst No.(%)	None No.(%)	
≤3	0(0.0)	4(4.1)	8(8.2)	85(87.6)	97
>3	25(50.0)	16(32.0)	7(14.0)	2(4.0)	50
Total	25(17.0)	20(13.6)	15(10.2)	87(59.2)	147

Most patients above BISAP score >3 developed complications (n=48). Most common complication observed was MODS (n=25; 50.0%).

Table 9: Distribution of complication according to Atlanta grading.

Atlanta Grading	Complication				Total
	MODS No.(%)	Necrosis No.(%)	Pseudocyst No.(%)	None No.(%)	
Mild	0(0.0)	0(0.0)	0(0.0)	87(100.0)	87
Moderate	1(3.6)	14(50.0)	13(46.5)	0(0.0)	28
Severe	24(75.0)	6(18.8)	2(6.3)	0(0.0)	32
Total	25(17.0)	20(13.6)	15(10.2)	87(59.2)	147

Most patients with severe Atlanta grading developed complications (n=32). Most common complication observed was MODS (n=25; 17.0%).

Table 10: Mortality among the patients with pancreatitis.

Outcome	No.	Percentage
Died	6	4.1
Recovered	141	95.9
Total	147	100.0

Out of 147 patients enrolled in the study, 6 patients died (4.3%) and 141 patients recovered (95.9%). All 6 patients who died had a BISAP score >3, Ranson's score >3 and severe Atlanta grading.

Table 11: Distribution of outcome according to BISAP score grading.

BISAP Scoring	Outcome		Total
	Died No.(%)	Recovered No.(%)	
≤3	0(0.0)	97(100.0)	97
>3	6(12.0)	44(88.0)	50
Total	6(4.1)	141(95.9)	147

Table 12: Distribution of Outcome according to RANSON's score grading.

RANSON's Scoring	Complication		Total
	Died No.(%)	Recovered No.(%)	
≤3	0(0.0)	64(100.0)	64
>3	6(7.2)	77(92.8)	83
Total	6(4.1)	141(95.9)	147

Table 13: Distribution of outcome according to Atlanta grading.

Atlanta Grading	Complication		Total
	Died No.(%)	Recovered No.(%)	
Mild	0(0.0)	87(100.0)	87
Moderate	0(0.0)	28(100.0)	28
Severe	6(18.8)	26(81.3)	32
Total	6(4.1)	141(95.9)	147

Table 14: Accuracy of BISAP scoring in assessing severity of pancreatitis as compared to Atlanta scoring.

		Atlanta Scoring		Total
		Mild + Moderate	Severe	
BISAP Scoring	≤3	97	0	97
	>3	18	32	50
Total		115	32	147

Sensitivity – 84.35%
Specificity – 100.0%

PPV – 100.0%
NPV – 64.0%

Table 15: Accuracy of RANSON's scoring (cut off – 3) in assessing severity of pancreatitis as compared to Atlanta scoring.

		Atlanta Scoring		Total
		Mild + Moderate	Severe	
RANSON's Scoring	≤3	64	0	64
	>3	51	32	83
Total		115	32	147

Sensitivity – 55.65%
Specificity – 100.0%
PPV – 100.0%
NPV – 38.55%

Table 16: Accuracy of RANSON's scoring (cut off – 4) in assessing severity of pancreatitis as compared to Atlanta scoring.

		Atlanta Scoring		Total
		Mild + Moderate	Severe	
RANSON's Scoring	≤4	92	3	95
	>4	23	29	52
Total		115	32	147

Sensitivity – 80.00%
Specificity – 90.63%
PPV – 96.84%
NPV – 55.79%

Table 17: Accuracy of RANSON's scoring (cut off – 5) in assessing severity of pancreatitis as compared to Atlanta scoring.

		Atlanta Scoring		Total
		Mild + Moderate	Severe	
RANSON's Scoring	≤5	104	16	120
	>5	11	16	27
Total		115	32	147

Sensitivity – 90.43%
Specificity – 50.0%
PPV – 86.67%
NPV – 59.26%

Table 18: Comparison of accuracy of Ranson's scoring in assessing severity of pancreatitis at different cut off.

Cut Off	Sensitivity	Specificity	PPV	NPV
>3	55.65%	100.0%	100.0%	38.55%
>4	80.0%	90.63%	96.84%	55.79%
>5	90.43%	50.0%	86.67%	59.26%

DISCUSSION

Acute pancreatitis is a common disorder with wide spectrum of illness. Severe acute pancreatitis having high morbidity and mortality rate, multiple interventions have been tried to prevent this. Early hospitalization may be beneficial to identify those who require aggressive interventions to prevent the severe attack of pancreatitis. In this study, the two different scoring systems (BISAP and RANSON'S) were compared and analyzed to assess the severity in patients with acute pancreatitis. An attempt also made to compare this study with previous similar studies done by others. The majority of patients of acute pancreatitis present with a mild disease, however approximately 21.8% runs severe course and require appropriate management in an intensive care unit. On account of differences in outcome between patients with mild and severe disease, it is important to define that group of patients who will develop severe pancreatitis, predicting which still represents challenge for the clinician. Interestingly, when seeking medical attention (usually 12 to 24 hours after the onset of pain) most patients do not exhibit irreversible multiple organ dysfunction.

In our study 82(55.8%) patients were males and 65 patients (44.2%) were females. In present study biliary calculi was the most common causative factor for acute pancreatitis with 63.9%, alcohol abuse was responsible for 21.8% and However in the remaining 14.3%, etiology was idiopathic i.e. no cause could be established.

In our study out of 147, 32 (21.8%) patients had severe acute pancreatitis. In our study the mortality was 4.1% (6 patients), who presented with persistent organ failure.

BISAP scoring system used for stratifying patients according to their risk of hospital mortality and is able to identify patients at increased risk of mortality prior to the onset of organ failure. Data or BISAP score collected within the first 24hr of hospitalization. Ranson score was calculated within 48hours. The ability to stratify

patients early in their course is a major step to improving management strategies in acute pancreatitis.

Both Ranson and BISAP were almost equal in predicting the severity of acute pancreatitis. Both were efficacious in assessing the predictability of organ failure but later were much easier and can be preferred over former.

CONCLUSION

From this study, we can conclude that BISAP scoring system is not inferior to Ranson's scoring system in predicting the severity of acute pancreatitis. BISAP scoring system is very simple, cheap, easy to remember and calculate. BISAP scoring system accurately predicts the outcome in patients with acute pancreatitis. Moreover, the values in BISAP score are instantaneous and there is no time delay. Ranson's score takes a minimum of 24 hours.

Thus, BISAP score has proved to be a powerful tool in predicting the severity of acute pancreatitis in par with Ranson's score.

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