Original Article

Performance of Glasgow, BISAP & Ranson Scores in Predicting Organ Failure in Acute Pancreatitis

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Abstract

Background: *Different modalities are available for predicting development of organ failure in acute pancreatitis. Several scoring systems like Glasgow, BISAP (Bedside Index for Severity in Acute Pancreatitis) and Ranson scores have been developed to predict the development of organ failure in acute pancreatitis. This study aims at comparing the performance of these scores in predicting the development of organ failure in acute pancreatitis.* ***Methods:*** *A total of 117 patients admitted with acute pancreatitis were included. A predesigned structured questionnaire was used for recording data. Clinical parameters and biochemical tests were recorded on admission and on day 3 & day 5 of admission. Glasgow, BISAP and Ranson scores were calculated using these data. CT scan was performed in all patients. Every patient was followed regularly for identification of organ failure or any other complication. Statistical analysis was done with SPSS version 22.* ***Results:*** *Among 117 patients, 67 (57.3%) were male and 50 (42.73%) were female with a mean age of 47.99±15. Among the patients the etiology was found to be biliary, hypertriglyceridemia, alcohol, malignancy and post-ERCP complications in 25 (21.4%), 23 (19.7%), 8 (6.8%), 3 (2.6%), 2 (1.7%) cases respectively. In 53 (45.3%) cases no definite etiology could be found. 83 (70.9%) patients had mild, 15 (12.8%) had moderately severe and 19 (16.2%) had severe acute pancreatitis. The mean CRP (mg/L), Hematocrit (HCT) (%) and Blood Urea Nitrogen (BUN) (mg/dl) were 60.61±81.2, 37.23±4.8 and 17.40±9.61 respectively. Receiver operating characteristic (ROC) curve evaluating the role of Glasgow score predicting development of organ failure in acute pancreatitis showed an AUC of 0.886. A cut off point of 3 showed highest sensitivity (76.5%), specificity (80.7%), positive predictive value (PPV) (61.9%) and negative predictive value (NPV) (89.3%). ROC curve evaluating the role of BISAP score in predicting development of organ failure in acute pancreatitis showed an Area Under the Curve (AUC) of 0.860. A cut off point of 2 showed highest sensitivity (67.6%), specificity (94%), positive predictive value (PPV) (82.1%) and negative predictive value (NPV) (87.6%). ROC curve evaluating the role of Ranson in predicting development of organ failure in acute pancreatitis showed an AUC of 0.857. A cut off point of 3 showed highest sensitivity (50%), specificity (94%), positive predictive value (PPV) (77.3%) and negative predictive value (NPV) (82.1%).* ***Conclusion:*** *ROC curve showed effectiveness of Glasgow, BISAP & Ranson scores in predicting development of organ failure in acute pancreatitis. Glasgow & BISAP scores showed better performance than Ranson score on ROC. Glasgow & BISAP scores showed highest sensitivity of 76.5% & 67.6% respectively, on the other hand Ranson score & BISAP score showed highest specificity (94%) for predicting development of organ failure in acute pancreatitis. BISAP score was the best among all the scoring systems, followed by Glasgow score which also performed well. Ranson score did not perform up to the mark.*

Key words: Glasgow score, BISAP score, Ranson score, Predictor, Acute pancreatitis

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Introduction

Acute pancreatitis accounts for 3% of all cases of abdominal pain admitted to hospital[1]. The incidence of acute pancreatitis appears to be increasing[2]. As the population is becoming increasingly overweight, the incidence of gallstones, the most common cause of acute pancreatitis, is rising. Whereas gallstones and alcohol appear to be the cause of acute pancreatitis in the majority of cases, many other conditions like hypertriglyceridemia predispose to acute pancreatitis to varying degrees[3].

About 80% of all cases are mild and have a favorable outcome. Of the rest 20% of patients with severe disease, almost all (98%) die within the first week, usually from multiorgan failure. After this time the majority of deaths result from sepsis, especially that complicating infected necrosis. On admission it is possible to predict patients at risk of this complication[1]. Predicting severity of pancreatitis early in the course of disease is critical to maximize therapy and to prevent and minimize organ

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dysfunction and complications. Unfortunately, the management of patients with acute pancreatitis is complicated by the inability to distinguish mild from severe disease during the early stages[3].

Severe acute pancreatitis has a poor prognosis and early prediction of the severity helps us in taking appropriate steps to halt the disease progression and to reduce development of complications. Several predictors (biochemical parameters, clinico-biochemical scores and radiological scores) have been used to predict the severity of acute pancreatitis.

Glasgow score proposed by Imrie uses 8 laboratory factors within the first 48 hours of admission to calculate it[4], and more than three positive criteria indicate severe acute pancreatitis.

Ranson score is composed of 11 measures that are recorded on admission and at 48 hours. A composite score of 3 or more is commonly used to classify a patient as having severe disease[5].

BISAP (Bedside Index for Severity in Acute Pancreatitis) score is a prognostic scoring system containing data that are frequently evaluated at the time of admission[6]. BISAP score has the advantage over Ranson and Glasgow scores of being calculated within 24 hours of admission.

Several studies have been conducted to compare their performance in the early prediction of development of organ failure in acute pancreatitis. But no such study is done in our country till now[5,6]. This study aims at comparing the role of Glasgow, BISAP & Ranson scores in the prediction of development of organ failure in acute pancreatitis.

Materials and Methods

This prospective and observational study was done in the department of Gastrointestinal, Hepatobiliary and Pancreatic Disorders (GHPD), Square Hospitals Ltd, Dhaka, Bangladesh from January, 2018 to June, 2019. Total 117 patients were included in this study.

Patients aged more than 18 years, admitted with abdominal pain and fulfilling the diagnostic criteria of acute pancreatitis by clinical history, physical examination, biochemical tests and different imaging modalities were included in this study.

Patients attending after 72 hours after the onset of abdominal pain, patients having chronic pancreatitis, chronic kidney disease, serious co-morbid conditions like COPD, heart failure and patients suffering from severe infection or inflammation of any other organ system were excluded from the study. Patients unwilling to give voluntary consent to participate in the study were also excluded. Consecutive type of non-probability sampling technique was applied to enroll the patients. Prior to the commencement of this study, the research protocol was approved by the Ethical Review Committee (ERC) of the institution.

The aims and objective of the study along with its procedure, alternative diagnostic methods, risk and benefits were explained to the patients in easily understandable local language and then informed consent was taken from each patient.

A predesigned structured questionnaire was used for recording all the data. To detect etiology of acute pancreatitis, liver function test, fasting lipid profile, USG of abdomen were done in all cases.

Demographic data like age, sex, BMI; clinical data like presence of abdominal pain, severity and radiation of abdominal pain, abdominal lump, anemia, fever, GCS score, vital parameters were recorded.

Laboratory data like CBC with HCT, CRP, BUN, serum creatinine, FBS, HbA1c, serum amylase, serum lipase, serum bilirubin, serum albumin, AST, ALT, alkaline phosphatase, serum LDH, fasting lipid profile, ABG, CA 19.9, USG and CT scan of upper abdomen findings were recorded.

Laboratory tests were done on admission and CBC with HCT, CRP, BUN, serum creatinine, ABG were repeated on day 3 and on day 5 of admission to follow up the patient. Glasgow, BISAP & Ranson scores were calculated using these data. Computed tomography (CT) scan was performed in all patients after 72 hours of admission for detection of the development of fluid collections, the extent of inflammation, and necrotic changes.

Attacks of acute pancreatitis were classified as mild, moderately severe and severe according to revised Atlanta criteria and with the help of modified Marshall scoring system for organ failure. Every patient was followed regularly for identification of organ failure or any other complication.

Statistical analyses were carried out by using the Statistical Package for Social Sciences version 22.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean, standard deviation and categorical variables as frequencies and percentages.

Receiver operating characteristic (ROC) curves were plotted for evaluating the performance of Glasgow, BISAP & Ranson scores as predictors of development of organ failure in acute pancreatitis. On the basis of the highest sensitivity and specificity values generated from the ROC curves, the

following cut-offs were selected for further analysis. Glasgow ≥3, BISAP ≥2 & Ranson ≥3. These cutoffs were further evaluated by chi-square (X^2) test. A p-value of <0.05 was considered as significant.

Results

The result of this study is presented in following tables and diagrams.

Table-I: Demographic, clinical and biochemical characteristics of the study population (n=117)

Parameters	Result
Age (years)	47.99±15.90
Sex	
Male	67 (57.3%)
Female	50 (42.73%)
Contributing factors	
Smoking	36 (30.8%)
Alcohol	10 (8.5%)
Tea/ coffee	93 (79.5%)
OCP	3 (2.6%)
DM	82 (70.1%)
BMI	25.36±3.4
Clinical features & investigation findings	
Abdominal pain	117 (100.0%)
Nausea &/or vomiting	109 (93.2%)
Fever	24 (20.5%)
Hospital stay duration	8.04±4.26
HCT	37.23±4.80
Blood urea nitrogen	17.40±9.61
CRP	60.61± 81.2

Values are expressed as mean±SD. Values within the bracket are expressed as percentage.

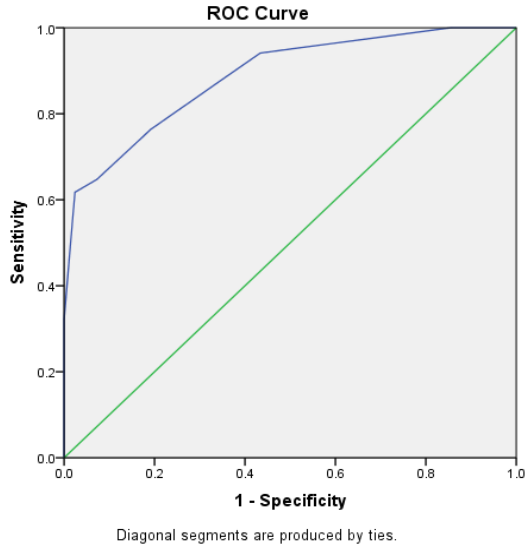

Figure-1: ROC curve showing test accuracy of Glasgow score in the prediction of development of organ failure in acute pancreatitis (AUC=0.886, p<0.001)

Table-II: Performance test of Glasgow score as a predictor of organ failure in acute pancreatitis (n=117)

Glasgow score	Organ failure		Total	p-value
	Present	Absent		
≥3	26 (76.5)	16 (19.3)	42 (35.9)	<0.001
<3	8 (23.5)	67 (80.7)	75 (64.1)	
Total	34 (100.0)	83 (100.0)	117 (100.0)	

Chi-square test was done to measure the level of significance. Values within the bracket are expressed as percentage.

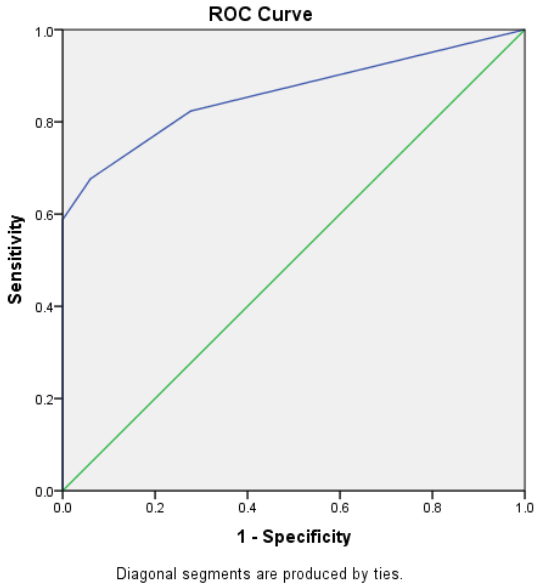

Figure-2: ROC curve showing test accuracy of BISAP score in the prediction of development of organ failure in acute pancreatitis (AUC=0.860, p<0.001)

Table-III: Performance test of BISAP score as a predictor of organ failure in acute pancreatitis (n=117)

BISAP score	Organ failure		Total	p-value
	Present	Absent		
≥2	23 (67.6)	5 (6.0)	28 (23.9)	<0.001
<2	11 (32.4)	78 (94.0)	89 (76.1)	
Total	34 (100.0)	83 (100.0)	117 (100.0)	

Chi-square test was done to measure the level of significance. Values within the bracket are expressed as percentage.

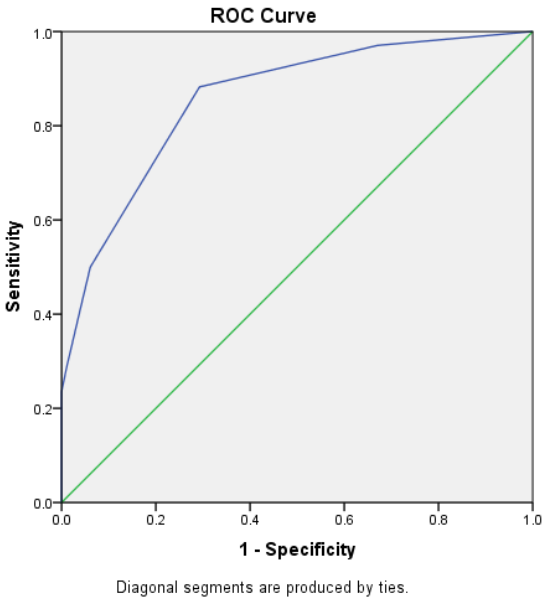

Figure-3: ROC curve showing test accuracy of Ranson score in the prediction of development of organ failure in acute pancreatitis (AUC=0.857, p<0.001)

Table-IV: Performance test of Ranson score as a predictor of organ failure in acute pancreatitis (n=117)

Ranson score	Organ failure		Total	p-value
	Present	Absent		
≥3	17 (50.0)	5 (6.0)	22 (18.8)	<0.001
<3	17 (50.0)	78 (94.0)	95 (81.2)	
Total	34 (100.0)	83 (100.0)	117 (100.0)	

Chi-square test was done to measure the level of significance. Values within the bracket are expressed as percentage.

Discussion

Among the 117 patients, 67 (57.3%) patients were male and 50 (42.73%) patients were female (Table-I). Mean age of the study population was 47.99±15.90 (mean±SD) with minimum age 18 years and maximum age 95 years. In a study by Albulushi et al.[7] found the mean age of acute pancreatitis of 47 years among which 55% were male and 45% were female. The mean age and sex difference of the above study correlate with this study.

Out of 117 patients, 36 (30.8%) were smoker and 10 (8.5%) were alcoholic. 55 (47%) patients were overweight and 12 (10.3%) patients were obese. Mean BMI was 25.36±3.4. Haque MM[8] found that mean BMI was 25.88±2.95. The mean CRP (mg/L), Hematocrit (HCT) (%) & Blood Urea Nitrogen (BUN) (mg/dl) were 60.61±81.2, 37.23±4.8 & 17.40±9.61 respectively. Average duration of hospital stay was 8.04±4.26 days. Haque MM[8], in his study also found that mean HCT was 32.9±7.5, mean BUN was 21.7±7.2 and average duration of hospital stay was 7.8±2.5 days. All of which is almost similar to these study results.

In this study, 25 (21.4%) cases were gall stone pancreatitis, 23 (19.7%) cases were due to hypertriglyceridemia, 8 (6.8%) cases were due to alcohol, 3 (2.6%) cases were due to malignancy, 2 (1.7%) cases due to post ERCP complications, 2 (1.7%) cases were due to gall stones and hypertriglyceridemia and 1 (0.9%) cases were due to hypertriglyceridemia and alcohol (Figure-1). In 53 (45.3%) cases no definite etiology could be found. Al-Karawi et al.[9] found that 67.5% cases of acute pancreatitis were due to biliary cause; alcohol was responsible in 1.8% of cases and 17% cases were due to unknown cause. In another study, Chang et al.[10] found gall stone as etiology in 34.1% of cases and alcohol in 33.6% of the cases and hypertriglyceridemia in 12.3% of cases.

High prevalence of hypertriglyceridemia in this study could be explained by increased prevalence of DM, obesity and metabolic syndrome among the study population. And the low prevalence of alcohol as etiology of acute pancreatitis could be due to social custom as well as religious belief.

Out of 117 patients 83 (70.9%) had mild acute pancreatitis according to revised Atlanta criteria, 15 (12.8%) patients had moderately severe acute pancreatitis and 19 (16.2%) patients had severe acute pancreatitis (Figure-2). Cho et al.[11] found 13% cases as severe acute pancreatitis, 8% cases as moderately severe and 79% cases as mild acute pancreatitis in their study which is similar to the present study.

Glasgow score proposed by Imrie uses 8 laboratory factors within the first 48 hours of admission to calculate it[4], and more than three positive criteria indicate severe acute pancreatitis. Ranson and colleagues identified 11 signs that had prognostic significance during the first 48 hours. Higher Ranson scores predict more severe disease. In mild pancreatitis (scores <2), the mortality is 2.5% and in severe pancreatitis (scores >3) the mortality is 62%[12]. Also, the higher the Ranson score, the higher the incidence of systemic complications, necrosis and infected necrosis. These criteria are still widely used in both the United States and Europe[13]. The overall sensitivity of the Ranson criteria (using 3 signs as the cutoff for diagnosing severe disease) is only 40% to 88% and the specificity is only 43% to 90%. The positive predictive value is approximately

50% and the negative predictive value around 90%[14]. Therefore, the better use of Ranson score is to exclude severe disease. Ranson score is typically not achieved until 48 hours. By this time, it is usually apparent that the patient has developed severe disease as manifested by organ failure.

In order to develop a simpler scoring system for patients with acute pancreatitis that would be useful within the first 12 hours from admission, the Pancreas Center at Brigham and Women's Hospital performed a series of studies retrospectively and prospectively[15-17]. The studies were performed on a large database including almost 37,000 patients from more than 200 hospitals. After careful analysis, including a validation study, they determined that a simple system that included 5 variables could accurately determine severity early in the course of the disease. The scoring system, referred to as BISAP, also assigns the first letter of each parameter 1 point. Thus, the BISAP score provides 1 point for 5 parameters: BUN greater than 25 mg/dL, impaired mental status, SIRS, age older than 60 years, and pleural effusion, for a possible total of 5 points. A BISAP score of 4 or 5 is associated with a 7 to 12 fold increased risk of developing organ failure. Accurate, yet much easier to use, this new simple scoring system appears to be useful in the early identification of patients who are at risk of developing complications and mortality.

In this study the aim was to compare the performances of these scoring systems in predicting development of organ failure in acute pancreatitis. ROC curves were plotted for evaluating the performance of Glasgow, BISAP & Ranson scores. ROC curve evaluating the role of Glasgow score predicting development of organ failure in acute pancreatitis showed an AUC of 0.886. A cut off point of 3 showed highest sensitivity (76.5%), specificity (80.7%), positive predictive value (PPV) (61.9%) and negative predictive value (NPV) (89.3%). Khanna et al.[18] in his study found a cutoff of 3 had a sensitivity of 76%, specificity of 74.5% with a positive predictive value (PPV) of 61.3% and a negative predictive value (NPV) of 85.4%, which is similar with our study.

ROC curve evaluating the role of BISAP score in predicting development of organ failure in acute pancreatitis showed an AUC of 0.860. A cut off point of 2 showed highest sensitivity (67.6%), specificity (94%), positive predictive value (PPV) (82.1%) and negative predictive value (NPV) (87.6%). Whereas Khanna et al.[18] found a cutoff of 2 had a sensitivity of 80%, specificity of 66% with a positive predictive value (PPV) of 55.6% and a negative predictive value (NPV) of 86.1% in their study. These results are also quite similar with this study. ROC curve evaluating the role of Ranson in predicting development of organ failure in acute pancreatitis showed an AUC of 0.857. A cut off point of 3 showed highest sensitivity (50%), specificity (94%), positive predictive value (PPV) (77.3%) and negative predictive value (NPV) (82.1%). Khanna et al.[18] in his study found a cut off of 3 had a sensitivity of 92%, specificity of 74.5% with a positive predictive value (PPV) of 65.7% and a negative predictive value (NPV) of 94.6%.

Conclusion

ROC curve showed effectiveness of Glasgow, BISAP & Ranson scores in predicting development of organ failure in acute pancreatitis. Glasgow & BISAP scores showed better performance than Ranson score on ROC. Glasgow & BISAP scores showed highest sensitivity of 76.5% and 67.6% respectively, on the other hand Ranson score & BISAP score showed highest specificity (94%) for predicting development of organ failure in acute pancreatitis. BISAP score was the best among all the scoring systems, followed by Glasgow score which also performed well. Ranson score did not perform up to the mark.

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