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Original Research Article

COMPARATIVE EVALUATION OF RANSON, GLASGOW, APACHE II, AND BISAP SCORES IN PREDICTING SEVERITY AND OUTCOMES OF ACUTE PANCREATITIS IN DIABETIC PATIENTS: A PROSPECTIVE STUDY

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ABSTRACT

Background: Acute pancreatitis (AP) in diabetic patients poses unique diagnostic as well as prognostic challenges due to altered metabolic and inflammatory responses. While several clinical scoring systems such as Ranson, Glasgow, APACHE II and BISAP scores are widely used to assess AP severity their reliability in diabetic populations remains uncertain. This study prospectively evaluates the predictive accuracy of these scoring systems in diabetic patients with AP. **Materials and Methods:** A prospective observational study was conducted from April 2022 to December 2024 at Government Stanley Medical College, Chennai. A total of 45 diabetic patients diagnosed with AP based on clinical, biochemical and radiological criteria were included. Ranson and Glasgow scores were determined at admission and at 48 hours of admission. BISAP and APACHE II were calculated within the first 24 hours of admission. Outcome measures included development of complications and in-hospital mortality. Sensitivity, specificity, PPV, and NPV of each of the score was also determined. **Result:** Among 45 cases 91.1% were male with a mean age of 41 years. Alcohol was the predominant etiological cause (73.3%). Most patients (97.8%) were managed conservatively. Complications were seen in 26.7% and mortality was found to be 4.4%. BISAP demonstrated the highest predictive accuracy for complications (AUC 0.883, $p<0.0001$) and high sensitivity (91.7%), specificity (84.8%) and accuracy (86.7%). APACHE II showed high specificity (100%) however its sensitivity was low (50%). Glasgow score was found to have moderate accuracy (AUC 0.686). Ranson score was least predictive of complications (AUC 0.504, $p=0.969$). None of the scores showed statistically significant association with mortality. **Conclusion:** In diabetic patients with AP, the BISAP score provides the most effective early prediction of complications, combining high sensitivity and specificity. APACHE II, while highly specific, lacks sensitivity. Glasgow may aid mortality prediction, whereas Ranson is poorly predictive in this subgroup. Patient specific scoring approaches may enhance prognostication in diabetic AP patients.

INTRODUCTION

Acute pancreatitis is one of the most common gastrointestinal conditions that causes hospitalization.[1] Over the past decade there has been a large increase in admissions worldwide. About 80% of acute pancreatitis cases are mild and self-limited with no sequelae. The remaining cases deteriorate and necrosis arises in parts of the pancreas and surrounding tissues. Acute pancreatitis (AP) is a

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sudden inflammation of the pancreas, which is characterized by the activation of pancreatic enzymes to cause self-digestion of the pancreas. It is an acute inflammatory process presenting as mild discomfort with local inflammation to severe disease with multi-organ failure.[2] Overall mortality among all AP cases is approximately 1%, but it rises dramatically to 20%–30% in those with severe acute pancreatitis (SAP), where there is involvement of regional tissues or organ systems. Despite continuous improvements in critical care, the overall mortality of AP remains between 2% and 8%, with severe cases still accounting for the highest proportion of deaths.[3]

Various scoring systems are available for early risk stratification in AP. The Ranson criteria, was the first to differentiate biliary from non-biliary pancreatitis and to identify patients at risk for severe disease. The Glasgow scoring system operates on a similar principle however it requires completion of six clinical and biochemical parameters within the first 48 hours of admission.[4] The Acute Physiology and Chronic Health Evaluation (APACHE) II score was originally developed for general ICU populations but eventually was also used in cases of AP to provide a more comprehensive assessment of physiologic derangement.[5] The bedside index of severity in acute pancreatitis (BISAP) was proposed as a simpler tool that could rapidly estimate risk based on five readily available clinical variables.[6] Each of these scoring systems has strengths as well as weaknesses but none of these criteria is universally accepted as the gold standard. Their combined use with ongoing clinician assessment is expected to improve diagnostic speed and accuracy. However, several questions remain unanswered about their relative performance in different patient subgroups.

Diabetes mellitus represents one such subgroup in which AP may take a more sinister course. Hyperglycemia and long-standing microvascular changes in diabetic patients could exacerbate pancreatic ischemia and impair healing. Moreover uncontrolled diabetes may amplify systemic inflammatory responses.[7] Some retrospective studies have suggested that diabetic patients with AP exhibit high rates of necrosis, prolonged hospitalization, and increased complications. It is unclear whether the established AP scoring systems maintain their predictive power in a diabetic cohort, or whether they systematically under- or overestimate risk. For example, APACHE II may be inflated by chronic diabetic complications, and the influence of hyperglycemia itself may confound Ranson or Glasgow criteria that include blood glucose levels. Conversely, BISAP's emphasis on early detection may prove particularly valuable in diabetics if it captures hyperglycemia-driven severity.[8]

Various studies of AP scoring systems have usually focused on general or elderly populations with only a few studies examining patients with specific comorbidities such as diabetes.[0] These studies often suffer from relatively smaller sample sizes and retrospective design,making it difficult to draw definitive conclusions. Therefore, a rigorously designed prospective study was needed to clarify whether the predictive accuracy of Ranson, Glasgow, APACHE II, and BISAP scores holds true in diabetic patients.[10]

The aim of this study was to evaluate the effectiveness of these four scoring systems in predicting severity and mortality from acute pancreatitis specifically in patients with diabetes.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery of Government Stanley Medical College, Chennai. The study was conducted over a period from April 2022 to December 2024. The study was aimed to evaluate the prognostic accuracy of four clinical scoring systems namely Ranson criteria, Glasgow score, APACHE II and BISAP score in diabetic patients diagnosed to be having acute pancreatitis. Based on preliminary data from previous similar studies and using an anticipated effect size of 0.5, a power of 80%, and a significance level of 5%, the minimum sample size required was calculated to be 40. To make up of drop out cases we included a total of 45 cases in this study. All eligible patients were consecutively recruited until the desired sample size was achieved.

The study was undertaken after obtaining due approval from the institutional ethics committee. All the participants were informed in detail about the aims and objectives of the study and a written informed consent was secured from each participant prior to inclusion in the study. Patients presenting with clinical symptoms pointing towards the diagnosis of acute pancreatitis such as persistent abdominal pain along with serum amylase or serum lipase levels exceeding three times the upper limit of the normal range were initially short listed. Imaging study such as ultrasound abdomen was done in all cases. Diagnosis of acute pancreatitis was confirmed if radiological features consistent with acute pancreatitis were found. Computed tomography (CT) was done in cases where ultrasound couldn't conclusively diagnose or rule out acute pancreatitis.Only those patients who had a known diagnosis of diabetes mellitus were included in the final analysis to assess the severity scoring.

For each included patient BISAP and APACHE II scores were calculated within the first 24 hours of admission on the basis of clinical and laboratory data available. Ranson and Glasgow scores were assessed at the time of admission and were re-evaluated at 48 hours.The most extreme values of vital signs and biochemical parameters during these respective periods were used in score computations, in accordance with the specific scoring criteria of each system. Patients were closely monitored throughout their hospital stay for the development of

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complications or mortality, which served as the primary outcomes of interest.

Data was entered as well as analyzed using statistical software SSPS 23.0. The diagnostic accuracy of each scoring system in predicting complications and mortality among acute pancreatitis patients having diabetes was evaluated using receiver operating characteristic (ROC) curve analysis. The area under the ROC curve (AUC) was calculated for each scoring system.Comparative analysis was done to assess differences in AUCs of various scoring systems. A p-value less than 0.05 was taken as statistically significant. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were also calculated for each scoring system.

Inclusion Criteria

- Patients Above age of 18 years.
- Patients who provided written informed consent to participate.
- Patients with a diagnosis of acute pancreatitis confirmed by clinical, radiological, and biochemical findings.
- Known diagnosis of diabetes mellitus.

Exclusion Criteria

- Patients with concurrent serious medical conditions such as chronic pancreatitis, NYHA class IV heart failure, chronic obstructive pulmonary disease (COPD), chronic renal failure requiring Hemodialysis, liver cirrhosis, or active malignancy.
- Patients who expired within 48 hours of hospital admission, as complete scoring assessments would not be feasible.

RESULTS

The analysis of the gender distribution of the studied cases showed that the majority were males, comprising 91.1% (41 out of 45 cases), while females accounted for only 8.9% (4 out of 45 cases), with a male to female ratio of 10:1 [Figure 1].

The analysis of the age distribution of the studied cases showed that the most common age group was 36–45 years, comprising 42.2% (19 out of 45 cases), followed by 46–55 years with 26.7% (12 cases), and less than 35 years with 24.4% (11 cases). Only a small proportion, 6.7% (3 cases), were above 55 years of age, with the mean age being approximately 41 ± 8 years [Table 1].

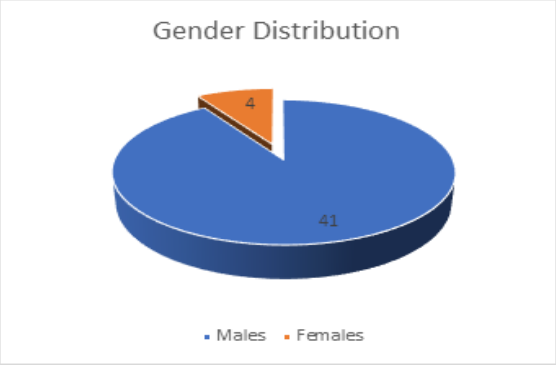

Figure 1: Gender Distribution of studied cases.

The analysis of the etiological distribution of the studied cases showed that the most common cause was alcoholic pancreatitis (73.3%) followed by gallstone-related pancreatitis (22.2%) and idiopathic causes were identified in only 2 (4.4%) cases [Figure 2].

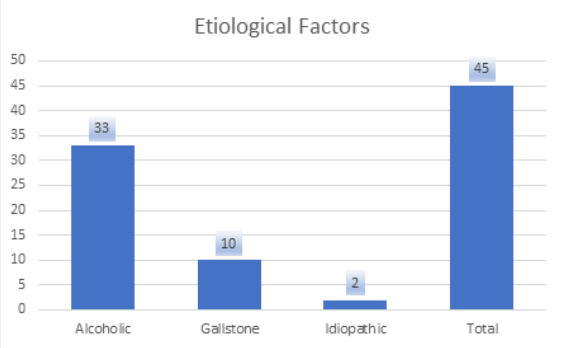

Figure 2: Etiological Factors in cases of Acute pancreatitis.

Table 1: Age Distribution of studied cases.

Age distribution in years	Frequency	Percent
Less than 35 yrs	11	24.44%
36 - 45 yrs	19	42.22%
46 - 55 yrs	12	26.67%
Above 55 yrs	3	6.67%
Total	45	11.11%
Mean Age : - 41 ± 8 years.		

The analysis of the treatment distribution of the studied cases showed that the vast majority were managed conservatively, accounting for 97.8% (44 out of 45 cases), while only 2.2% (1 case) required operative intervention [Table 2].

Table 2: Surgical Vs Conservative management in studied cases.

Treatment	Frequency	Percent
Conservative	44	97.8
Operative	1	2.2
Total	45	100.0

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The analysis of the severity scoring distribution among the studied cases showed that the majority of the cases (91.1%) had a Ranson score ≥3. Only 4 (8.9%) had a score <3. For the BISAP score,16 (35.6%) cases had scores ≥3, whereas 29 (64.4%) cases had scores less than 3. Similarly, 31.1% (14 cases) had a Glasgow score ≥3 and 68.9% (31 cases) had scores <3. The APACHE II score ≥8 was seen in 13.3% (6 cases) while 86.7% (39 cases) had scores below 8 [Table 3].

Table 3: Severity Scoring Distribution Among the studied cases.

Score	Threshold	Frequency ≥ Threshold	Percent (%) ≥	Frequency < Threshold	Percent (%) <
Ranson	≥ 3	41	91.1	4	8.9
BISAP	≥ 3	16	35.6	29	64.4
Glasgow	≥ 3	14	31.1	31	68.9
APACHE II	≥ 8	6	13.3	39	86.7

The analysis of clinical outcomes among the studied cases showed that complications were present in 12 (26.7%) cases while 33 cases (73.3%) had no complications. Regarding in hospital mortality 2 (4.4%) of the patients died, whereas 43 (95.6%) cases survived [Table 4].

Table 4:- Outcome of studied cases.

Outcome	Frequency	Percent (%)
Complications	12	26.7
No Complications	33	73.3
Total	45	100.0
Mortality	2	4.4
Survival	43	95.6

The analysis of the predictive value of various scoring systems for complications using the receiver operating characteristic (ROC) curve showed that the BISAP score had the highest area under the curve at 0.883 (6.0%), with a 95% confidence interval of 0.766 to 0.999 and a p-value of < 0.0001, indicating a highly statistically significant association ($p < 0.01$). The APACHE II score demonstrated an area under the curve of 0.750 (9.7%), with a 95% confidence interval of 0.559 to 0.941 and a p-value of 0.011, which is statistically significant ($p < 0.05$). The Glasgow score showed an area under the curve of 0.686 (9.5%), with a 95% confidence interval of 0.499 to 0.872 and a p-value of 0.059, which is not statistically significant. The Ranson score had the lowest area under the curve at 0.504 (9.8%), with a 95% confidence interval of 0.312 to 0.696 and a p-value of 0.969. Only the BISAP and APACHE II scores showed statistically significant predictive ability for complications [Table 5].

Table 5:- predictive value of various scoring systems for complications using the receiver operating characteristic

Score	AUC	Std. Error	p-value	95% CI	Significance
Ranson	0.504	0.098	0.969	0.312–0.696	ns ($p > 0.05$)
BISAP	0.883	0.060	< 0.0001	0.766–0.999	** ($p < 0.01$)
Glasgow	0.686	0.095	0.059	0.499–0.872	ns
APACHE II	0.750	0.097	0.011	0.559–0.941	* ($p < 0.05$)

The analysis of the predictive value of various scoring systems for mortality was done using the receiver operating characteristic curve. This analysis showed that the Glasgow score had the highest area under the curve at 0.860 with a standard error of 0.074 and a p-value of 0.088. It was followed by the BISAP score with an area under the curve of 0.837, standard error of 0.083 and a p-value of 0.110. The APACHE II score had an area under the curve of 0.692, standard error of 0.223 and a p-value of 0.363. Ranson score showed the lowest area under the curve at 0.547, standard error of 0.194 and a p-value of 0.826. None of the scores demonstrated a statistically significant association with mortality [Table 6].

Table 6: predictive value of various scoring systems for mortality using the receiver operating characteristic curve

Score	AUC	Std. Error	p-value	95% CI	Significance
Ranson	0.547	0.194	0.826	0.167–0.926	ns
BISAP	0.837	0.083	0.110	0.675–0.999	ns
Glasgow	0.860	0.074	0.088	0.716–1.000	ns
APACHE II	0.692	0.223	0.363	0.255–1.000	ns

The evaluation of the predictive accuracy of various severity scores for complications showed that the BISAP score (threshold ≥3) demonstrated the highest overall performance (sensitivity of 91.7%, specificity of 84.8%, positive predictive value of 68.8%, negative predictive value of 96.6% and an accuracy of 86.7%). The APACHE II score (threshold ≥8) also showed strong predictive power with a specificity and positive predictive value of 100% although its sensitivity was lower at 50.0%. It was found to have

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a negative predictive value of 84.6% and the same overall accuracy of 86.7%. The Glasgow score (threshold ≥3) had moderate sensitivity and specificity at 58.3% and 78.8% respectively, with an accuracy of 73.3%. The Ranson score (threshold ≥3), despite having a high sensitivity of 91.7%, showed poor specificity at 9.1%, resulting in a low positive predictive value of 26.8% and overall accuracy of only 31.1% [Table 7].

Table 7: Predictive accuracy of various severity scores for complications

Score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Ranson ≥ 3	91.7	9.1	26.8	75.0	31.1
BISAP ≥ 3	91.7	84.8	68.8	96.6	86.7
Glasgow ≥ 3	58.3	78.8	50.0	83.9	73.3
APACHE II ≥ 8	50.0	100.0	100.0	84.6	86.7

The assessment of various severity scores in predicting mortality revealed that the Glasgow score (threshold ≥3) showed a sensitivity of 100.0%, specificity of 72.1%, positive predictive value of 14.3%, negative predictive value of 100.0% and an overall accuracy of 73.3%. The BISAP score (threshold ≥3) also demonstrated high sensitivity at 100.0%, with specificity of 67.4%, positive predictive value of 12.5%, negative predictive value of 100.0% and accuracy of 68.9%. The APACHE II score (threshold ≥8) had a lower sensitivity at 50.0% but showed good specificity at 88.4%, positive predictive value of 16.7%, negative predictive value of 97.4% and the highest overall accuracy at 86.7%. The Ranson score (threshold ≥3), while having perfect sensitivity and negative predictive value (both 100.0%), exhibited very poor specificity at 9.3%, an extremely low positive predictive value of 4.9%, and the lowest accuracy at 13.3% [Table 8].

Table 8: Assessment of various severity scores in predicting mortality.

Score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Ranson ≥ 3	100.0	9.3	4.9	100.0	13.3
BISAP ≥ 3	100.0	67.4	12.5	100.0	68.9
Glasgow ≥ 3	100.0	72.1	14.3	100.0	73.3
APACHE II ≥ 8	50.0	88.4	16.7	97.4	86.7

DISCUSSION

This was a prospective study undertaken to analyse the predictive performance of Ranson, Glasgow, APACHE II, and BISAP scoring systems in diabetic patients with acute pancreatitis (AP). Both BISAP and APACHE II demonstrated superior prognostic accuracy for predicting complications with BISAP showing the highest area under the curve (AUC 0.883, $p<0.0001$). In contrast the Ranson score failed to yield statistically significant predictive value in our diabetic cohort despite its historical relevance in general AP populations. These findings are similar to the findings of Cho et al who in their 2015 retrospective study also found that BISAP had a better predictive value for severe AP than Ranson in a Korean population.[11] Similarly, Wu et al in the original validation study of BISAP highlighted its simplicity and efficacy in early stratification of severity of acute pancreatitis.[12] The authors reported an AUC of 0.82 for predicting mortality. Our findings confirm the utility of BISAP in diabetic patients where early glucose derangements may already exist. These findings suggest that this tool remains effective despite potential confounding from baseline hyperglycemia.

Interestingly, while APACHE II demonstrated a lower sensitivity (50%) than BISAP (91.7%) for predicting complications it had an excellent specificity and positive predictive value (100%). These findings indicate that a high score is strongly indicative of poor outcomes though many at-risk patients may be missed. These findings are similar to the findings of Mounzer et al who reported that APACHE II had excellent specificity but suboptimal sensitivity when used in early risk stratification for severe AP across heterogeneous cohorts.[13] In contrast Papachristou et al found that APACHE II outperformed BISAP in general ICU populations with better AUCs for both complications and mortality.[14] Our data suggest that while APACHE II remains a strong predictor its reliance on a broad physiologic framework might dilute its sensitivity.

The Glasgow score exhibited moderate performance in predicting complications (AUC 0.686) and the highest AUC for mortality prediction (0.860). Although the association did not reach statistical significance. Its performance was consistent with prior work by Khanna et al who reported that the Glasgow score had moderate sensitivity and specificity in the Indian AP population and was less accurate than BISAP and APACHE II in early mortality prediction.[15] Moreover, Chatzicostas et al suggested that while the Glasgow score offers reasonable predictive ability, its delayed utility requiring up to 48 hours limits its early clinical applicability.[16] In our diabetic cohort, Glasgow's dependence on variables such as glucose and calcium may be affected by preexisting metabolic disturbances, diminishing its predictive clarity. However, its ability to identify both mortality cases in our study (100% sensitivity and NPV) indicates that it should not be dismissed outright, particularly as a secondary validation tool.

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The Ranson score, once a gold standard, demonstrated the weakest overall performance in our study with AUCs near 0.5 for both complications and mortality. Despite a high sensitivity (91.7% for complications, 100% for mortality), it's extremely poor specificity (9.1% and 9.3%, respectively) and low predictive accuracy render it unsuitable for current use in diabetic populations. These findings parallel those of Kaya et al who reported that the Ranson score generally overestimated severity in comorbid population.[17] In diabetics it was prone to false positives due to hyperglycemia and leucocytosis thresholds. Yeung YP undertook a study to compare the accuracy of Ranson, APACHE-II and APACHE-O systems in assessing severity of acute pancreatitis.[18] The study concluded that The APACHE-II scoring system is more accurate than the Ranson scoring system of the prediction of severity in acute pancreatitis. Given its two-day timeline for full scoring and poor specificity in diabetics likely driven by elevated baseline glucose and hematologic markers it appears Ranson's clinical relevance is now largely historical.

It is also important to note that the demographics and etiology in our study skewed heavily toward alcoholic pancreatitis (73.3%) and a relatively young male population. This factor might be responsible for influencing generalizability. The finding that only BISAP and APACHE II scores achieved statistical significance in predicting the complications suggests that there is a possible interaction between diabetes-specific pathophysiology and scoring system design. A retrospective study by Chen et al highlighted that AP in diabetic patients often presents with more systemic complications as compared to non-diabetic individuals.[19] This may be due to exacerbated inflammatory cascades and impaired vascular response . Additionally, Xu J also reported that diabetic patients show delayed organ recovery and prolonged hospitalization.[20] This may be better assessed by real-time scoring systems like BISAP or APACHE II rather than static threshold-based systems like Ranson or Glasgow.

CONCLUSION

Among diabetic patients with acute pancreatitis the BISAP score offers the best balance of sensitivity, specificity, and practicality for predicting complications. On the other hand, APACHE II offers high specificity but reduced sensitivity. The Glasgow score has utility in mortality prediction but lacks statistical strength in this setting. Ranson score is markedly inferior in predictive performance for diabetic cohorts. These results suggest that tailored risk stratification tools or recalibrated thresholds within existing tools may be necessary for optimal management of AP in diabetic populations.

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