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A comparative study of ranson's score, APACHE II and BISAP score in predicting severity of acute pancreatitis

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Abstract

Background: Acute pancreatitis is a prevalent ailment that is distinguished by inflammation and pancreatic damage. The intrapancreatic activation, release, and digesting of the organ by its own enzymes causes acute pancreatitis. The management and prompt intervention of an acute attack are significantly affected by the early prediction of its severity. Acute Physiology and Chronic Health Evaluation (APACHE) II scoring systems, Ranson, modified Glasgow, Bedside index for severity in acute pancreatitis (BISAP), CT severity index, and biochemical markers such as C-reactive protein (CRP), IL 6, and serum prolactin level are among the prognostic indicators used to predict the severity of acute pancreatitis.

Aim: To compare Ranson, APACHE II and BISAP scoring systems in predicting the severity of acute pancreatitis.

Materials and Method: This prospective study was conducted in Department of General surgery, Sree Mookambika Institute of Medical sciences, with 52 consecutive cases of acute pancreatitis admitted, between January 2023 to December 2023. Abdominal pain, serum lipase and amylase levels, and results from imaging examinations are the three aspects that must be present for the diagnosis to be made. Each patient was split into two groups: APACHE II ≥8 and <8 and BISAP Ranson ≥3 and <3. The data was then statistically examined. Chi square testing was used to assess the

association and SPSS 20.0 version was used for data analysis.

Results: The mean age at diagnosis was 43.6±7.64 years, with a range of ages between 32 and 72. The majority of the 23 patients (44.22%) belonged to the 41–50 age range. Alcoholism was the most common aetiological cause in 30 cases (57.49%), followed by gallstones in 16 cases (30.77%). Of the 52 patients, 24 patients (46.15%) had MAP, 19 patients (36.55%) had MSAP, and 9 patients (17.3%) had SAP. There was a significant difference in the mean scores between patients with mild acute pancreatitis and those with severe disease. A total of 15 patients (28.85%) developed complications during the course of the illness, and three patients died during treatment, yielding a mortality rate of 5.77%. It was observed that among the 3 scoring systems, BISAP system showed high sensitivity, specificity, PPV, NPV and diagnostic accuracy compared to other 2 systems in predicting severity and local complications.

Conclusion: The BISAP scoring system is a practical and easy to use clinical bedside scoring method for predicting the severity of acute pancreatitis. Identification of patients who may need intensive care during their illness is important.

Keywords: APACHE II, BISAP, Pancreatitis, Predicting systems, Ranson.

Introduction

Acute pancreatitis (AP) is one of the most prevalent gastrointestinal disorders that require hospitalization.[1] Acute pancreatitis is clinically defined by at least two of the following three criteria, according to the new Atlanta classification: (a) abdominal discomfort suggestive of pancreatitis; (b) serum lipase and amylase levels three or more times normal; and (c) distinctive findings on imaging studies.[2]

The severity of acute pancreatitis is categorized into three categories: mild acute pancreatitis (MAP), which is defined by the absence of organ failure and systemic or local complications; moderately severe acute pancreatitis (MASP), which is defined by the absence of organ failure; transient organ failure less than 48 hours with or without local complications; and severe acute pancreatitis (SAP), which is defined by persistent organ failure involving one or more organs for more than 48 hours.[3]

Gallstones, alcohol use, the status following endoscopic retrograde cholangiopancreatography (ERCP), hypertriglyceridemia, hypercalcemia, medications, abdominal trauma, malfunctioning of the sphincter of Oddi, pancreatic divisum, pancreatic neoplasms, and other conditions are among the causes of acute pancreatitis. However, the reason is uncertain in about 20% of the patients.[4]

Admissions for AP have increased dramatically during the last decade around the world. Approximately 10–20% of patients with AP present with systemic complications that require treatment in an intensive care unit or surgery, and in these cases, mortality can reach 30–40%. AP is an inflammatory process with a variable clinical course. Most patients with AP present with a mild disease that can resolve spontaneously.[5] The ability to predict the severity and prognosis of AP can help with patient triage and expert care for those who are most likely to require it.

While early identification of severe cases greatly lowers morbidity and mortality in AP patients in emergency rooms, identifying the mechanisms causing the transition from moderate to severe AP and when it happens

appears to be the biggest obstacle.[6] In order to assess the severity and forecast consequences associated with AP, a number of radiologic and clinical scoring systems have been proposed. These include single parameters such as the presence of pleural effusion, age, obesity, serum BUN, creatinine, haematocrit, levels of procalcitonin, and C-reactive protein, as well as multi-parameter scores such as the 1981 Acute Physiology and Chronic Health Evaluation (APACHE)-II score, the systemic inflammatory response syndrome (SIRS), the Bedside Index of Severity in AP (BISAP), and Ranson's score from the 1970s.[7]

The biggest disadvantage of the Ranson score is that it cannot be completed until 48 hours after admission. The main disadvantage of APACHE is its complexity, which makes it difficult to determine the severity of the condition on the day of admission. Recently, the BISAP, a novel prognostic scoring system, was presented as a precise and user-friendly technique for early patient identification at risk of in-hospital death.[8] Surgeons choose several methods for prognostic assessment of AP since there are multiple scoring models available to clinically evaluate the severity of AP and organ failure; nevertheless, no single system has been considered perfect up to this point.

Several research have been undertaken in the past to identify the best predictor of severity in AP, but the results have been contradicting, and hence there is no ideal single technique for grading AP severity. The purpose of this research study was to identify a scoring system that can reliably and early forecast the disease severity.

Aims and Objectives

To compare the accuracy of Ranson's criteria, BISAPs and APACHE II scoring systems in predicting the severity of Acute Pancreatitis.

Materials and Methods

The present study was a prospective study conducted in Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of one year from January 2023 to December 2023. The consecutive patients who were diagnosed and treated for acute pancreatitis during this period formed the pool for the present study. The diagnosis of Acute pancreatitis was made based on history, clinical examination, laboratory values of serum amylase and lipase, and imaging study – ultrasound of abdomen, to study the pancreas as well as to rule out or confirm biliary cause for pancreatitis. The presence of any 2 of the 3 criteria was diagnostic of pancreatitis.

Patients aged 18 years and older with AP (either first or recurring attacks), acute onset of persistent severe epigastric pain, with or without radiation, and elevated serum amylase and lipase levels were included. Patients with preexisting chronic pancreatitis, heart failure, liver failure, renal failure, or any lung pathology, were not included in the study. A total of 52 patients were included in the present study.

Patients were classified as MAP, MSAP and SAP based on the presence of organ failure and local complications. Patient's demographic data, history and clinical features and complications were recorded along with serum amylase and lipase levels. BISAP and APACHE II score were calculated in 24 hours after admission. Ranson score was calculated in 48 hours.

Three scoring systems - Ranson's (11 criteria), APACHE-II (14 criteria), and BISAP (5 criteria)—were

applied for both groups. Within 24 hours of the patient's admission, the BISAP and APACHE II scores were evaluated based on the available data, and the Ranson scores were determined both at the time of admission and 48 hours later. Patients were separated into two groups: BISAP and Ranson ≥ 3 and <3, and APACHE II ≥ 8 and <8.

All the statistical methods were done using the SPSS 21.0 version for windows. *P*<0.05 was considered statistically significant. When comparing two or more independent proportions, the chi square test and the Fisher exact test are employed. To compare means between mutually exclusive and independent groups, the independent t test was employed. Sensitivity, specificity, positive predictor value, negative predictor value and accuracy were calculated.

Observation and Results

The age at diagnosis ranged between 32 -72 years with mean age of 43.6±7.64 years. Most of the patients, 23(44.22%) patients were in the age group of 41 to 50 years, followed by 51 to 60 years in 15(28.85%), 31 to 40 years in 12(23.08%) and more than 60 in 2(3.85%) patients. Out of the total of 52 patients included in the present study, 38(73.08%) were men while 14(26.92%) were women.

The majority of cases 30 (57.49%) patients had acute pancreatitis caused by alcohol, whereas 16 (30.77%) had gallstones, with 1(1.92%) ERCP. The etiology could not be determined in 5 (9.62%) of the patients; they were classified as idiopathic. Whereas the majority of patients with gallstone-induced pancreatitis were female, the majority of patients with alcohol-induced acute pancreatitis were male.

The mean duration of the stay for 52 patients was 10.52±2.73 days, with a 3.62 standard deviation. Of the 52 patients, 24 patients (46.15%) had MAP, 19 patients (36.55%) had MSAP, and 9 patients (17.3%) had SAP. A total of 15 patients (28.85%) developed complications during the course of the illness, and three patients died during treatment, yielding a mortality rate of 5.77%.

Table 1 shows comparative analysis of Ranson, APACHE II and BISAP scores in predicting severity based on Atlanta classification. It shows that the patients with mild acute pancreatitis had significantly lower mean scores while with severe disease had significantly higher mean scores.

Scoring System	Atlanta Classification			p value
	Mild	Moderate	Severe	
Ranson	0.56±0.74	1.95±1.12	3.46±1.72	<0.001
APACHE II	3.78±1.71	6.78±2.78	8.31±4.97	<0.001
BISAP	0.49±0.53	1.47±0.81	3.08±0.69	<0.001

Table 1: Comparative analysis of Ranson, APACHE II and BISAP scores in predicting severity based on Atlanta classification.

Table 2 shows comparative analysis of BISAP, Ranson and APACHE II scores in predicting complications. It shows that the patients who had complications had significantly higher scores compared to those who had no complications. Table 3 shows comparative analysis of BISAP, Ranson and APACHE II scores in predicting mortality. It shows that the patients who did not survive had significantly higher scores compared to those who survived.

Scoring System		Complications		p value
		Present (n=15)	Absent (n=37)	
Ranson	≥3	9(60%)	8(21.62%)	0.005
	<3	6(40%)	29(78.38%)	
APACHE II	≥8	8(53.33%)	7(32.43%)	0.001
	<8	7(46.67%)	30(67.57%)	
BISAP	≥3	10(66.67%)	6(40.54%)	0.002
	<3	5(33.33%)	31(59.46%)	

Table 2: Comparative analysis of Ranson, APACHE II, and BISAP scores in predicting complications

Scoring System		Total	Mortality	Survival	p value
Ranson	<3	35	1	34	0.001
	≥3	17	2	15	
APACHE II	<8	37	0	37	0.001
	≥8	15	3	12	
BISAP	<3	36	1	35	0.001
	≥3	16	2	14	

Table 3: Comparative analysis of Ranson, APACHE II, and BISAP scores in predicting mortality.

Table 4 shows statistical analysis of Ranson, APACHE II and BISAP scores. All of the scoring systems used in this study were quite similar in terms of predicting severity and local complications. It was discovered that the BISAP system exceeded the other two scoring systems in terms of sensitivity, specificity, PPV, NPV, and diagnostic accuracy in predicting severe and local problems.

Scoring System	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
Ranson	60%	78.38%	52.94%	82.86%	72.08%
APACHE II	53.33%	81.08%	53.33%	81.08%	73.07%
BISAP	66.67%	83.78%	62.5	86.11	78.85%

Table 4: Prediction of severity by the 3 scoring systems

Discussion

The age at diagnosis ranged between 32 -72 years with mean age of 43.6±7.64 years and 23(44.22%) patients were in the age group of 41 to 50 years. This was comparable to the studies done by Bardakcı O et al.[9] Singh RK et al.[10] Aydin H et al.[11] and Chauhan R et al.[12]where the mean age was 68.6±15.9, 39.04, 55.2±18.7 and 41.6 years respectively. The majority of the patients in the Janjua SS et al.[13] study were 24 (22.6%) in the age group of 21–30, 22 (20.8%) in the age group of 41–50, and 20 (18.9%) in the age group of 31–40.

In the present study, acute pancreatitis was shown to be more common in males 38 (73.08%) than in females 14 (26.92%). In their study, Singh RK et al.[10] found that 183 people (91%) were men and 18 people (9%). In contrast to the current study, the study by Aydin H et al.[11] had 55.7% females and 44.3% male patients. Chauhan R et al.[12] similarly observed female preponderance with a 1.41:1 ratio, namely 58.6% females (n = 41) and 41.4% males (n = 29).

Majority of the cases 30(57.49%) patients were of alcohol induced acute pancreatitis, while 16(30.77%) patients were gallstone induced. The study also observed that the predominant cause of acute pancreatitis in women was gallstones, while alcohol was the leading cause of acute pancreatitis in men. Studied conducted by Singh RK et al.[10] and Ekka NM et al.[14] found that 48.75 % and 57.89% patients presented with AP had alcoholism as the most common etiological factor. In the study conducted by Bardakcı O et al.[9] Chauhan R et al.[12] and Janjua SS et al.[13] most common cause of AP was gallstones in 78%, 77.14% and 68.9% patients respectively. This was in contrast to the present study.

In 2012, the Atlanta Classification was revised with an emphasis on persistent organ failure. In this study, the severity of AP was determined according to this revised Atlanta Classification. In the present study most of the patients had MAP. Comparison with other studies was given in table 5.

Studies	MAP	MSAP	SAP
Bardakcı O et al.[9]	83 (52.2%)	52 (32.7%)	24 (15.1%)
Chauhan R et al.[12]	46(65.71%)	0(0%)	24(34.3%)
Das PC et al.[15]	38(63.5%)	0(0%)	22(36.5%)
Present study	24(46.15%)	19(36.55%)	9(17.3%)

Table 5: Comparison of acute pancreatitis based on Atlanta Classification with other studies

Compared to previous scoring methods, BISAP, a recently created prognostic scoring system, has been recommended as a straightforward way for predicting severe AP. One way to choose patients for therapy in AP trials has been to use the APACHE II score, which is a reliable indicator of severity in AP patients. For the APACHE II score, there are, nevertheless, a few contentious situations. The twelve factors in APACHE II are complicated, and the 24-hour score has limited use, making it one of the most controversial features of the system.[16]

It has been noted that the APACHE II score has several limitations when it comes to categorizing AP patients according to the severity of their conditions. Additionally, some of the parameters it contains might not be able to accurately forecast how severe AP will be. When it comes to predicting the result in AP, the BİSAP score and the APACHE II score function similarly. Its calculation is also far simpler than that of the APACHE II score system. As an early indication of severity and mortality in AP, the European Society for Gastrointestinal Endoscopy advises utilizing the BİSAP score during the first 24 hours of presentation.[17]

Out of the patients with a Ransons score higher than 3, complications related to acute pancreatitis occurred in 15 of them, while mortality occurred in 2 (8.5%) of the patients. Of the 52 patients, 11 had an APACHE score higher than 8, 15 experienced complications, and 3 died. Patients with BISAP score greater 03, 16 developed complications and mortality of 2 patients occurred.

In the present study patients who had complications and who did not survive had significantly higher scores compared to those who had no complications and those who survived ($p<0.05$). The BISAP score was found to have a higher prediction of severity and local complications than the other two scoring systems, despite the three systems having nearly comparable sensitivity, specificity, PPV, NPV, and diagnostic accuracy. Furthermore, there was no time lag and the BISAP score data are instantaneous. This was similar to the research conducted by Ekka NM et al.[14] who found that the three grading systems had similar predictive power for severity, local complications, and mortality. The severity was predicted by all three systems with sensitivity ranging from 52.71 to 90.28% and specificity from 86.11 to 90.28% (P value <0.0001). The local complications were predicted with sensitivity ranging from 57.14 to 71.43% and specificity from 81.82% to 84.33% (p value < 0.05).

Kathula RP et al.[18] in their study found that APACHE-TM had the best accuracy for predicting severe AP cases; nevertheless, there were no statistically significant pairwise differences between APACHE-TM and the other rating systems. Additionally, it was discovered by Mahajan O et al. (19) that the Modified Glasgow Score and APACHE II had been proven to have superior accuracy for the diagnosis of AP.

In the study done by Li M et al.[20]Pairwise AUC comparisons showed that Ranson's, MMS, BISAP, and SOFA were more accurate than SIRS; Ranson's and MMS were more accurate in predicting SAP than APACHE-II; Ranson's was more accurate in predicting PNec than the other four criteria; and APACHE-II was more accurate than SIRS. In their study, Kumar A et al.[21] observed that the four grading systems they investigated were identical in terms of predicting severity, complications, and mortality. In terms of predicting complications, all four scoring systems have sensitivity

ranging from 51.28% to 92.31% and specificity ranging from 50 to 79.12% (p value <0.0001).

According to the study by Li Y et al.[22] BISAP can be used to predict the severity, pancreatic necrosis, and death in AP for older patients extremely effectively. When it comes to severity, younger patients are more suited for APACHE II. Most of the time, Ranson and Glasgow can be used to evaluate all AP patients; however, Ranson works better for younger patients when determining severity.

Conclusion

The prevalence of acute pancreatitis caused by alcohol is increasing. Nowadays, the mean age is also lower. In terms of predicting severity, local complications, and mortality, all of the grading methods used in this study were rather similar. In patients with acute pancreatitis, the BISAP score system predicts the prognosis with high accuracy. Furthermore, there is no time lag and the BISAP score readings are instantaneous. Ranson requires at least a full day to complete. The BISAP scoring system can accurately predict the severity and mortality of acute pancreatitis. It is a quick, easy, and dependable method that can be used as a preliminary screening tool for accurate risk stratification and the start of appropriate management in community, secondary, and tertiary hospitals.

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