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Original research article

A Comparative Study of Accuracy between BISAP and APACHE-II Scoring System in Acute Pancreatitis

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Abstract
Background: Severe acute pancreatitis is characterized by short course, progressive multi-organ dysfunctions (MODS), early hypoxemia, necrosis, infection, sepsis, and abdominal compartment syndrome which are the major determinants of mortality in acute pancreatitis. The current study aims to assess the severity of acute pancreatitis by using BISAP (Bedside Index for Severity in Acute Pancreatitis) and APACHE-II (Acute Physiology and Chronic Health Evaluation) scoring systems.
Methods: After the admission of the patient data was collected by history taking, complete physical examination. Appropriate radiological investigations were X-ray Abdomen, USG abdomen, CT scan, Balthazar and CT Severity Index (CTSI), Chest X-ray PA view, and MRI if required. Laboratory investigations included Complete blood count, serum electrolytes, renal function tests, liver function tests PT-INR, HbsAg, HIV, serum amylase, serum lipase, serum calcium, and Arterial blood gas analysis.
Results: When the cutoff values of APACHE II were taken at 10 the sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) calculations were 88.56%, 95.51%, 88.64% and 92.32%. Similarly, for the BISAP Scoring system when the cutoff values of 3 were taken the sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) were 91.25%, 82.31%, 72.52% and 94.03%.
Conclusion: The comparison between BISAP and APACHE II scores in our study did not reveal the superiority of any scoring system over the other statistically. However, there are several advantages and disadvantages of each. The APACHE II has advantages like being able to assess the condition accurately on admission and scores of > 10 indicate mortality risk. Whereas the BISAP is better since it uses clinical findings and imaging to derive five-point scores and values of > 3 indicate increased mortality risk.
Keywords: Pancreatitis, Severity, Prediction, APACHE II and BISAP

Introduction

Acute pancreatitis is an inflammatory condition of the pancreas caused by the organ's enzymes activating, releasing, and digesting the organ. [1] A patient with threefold high blood levels of amylase or lipase, stomach discomfort, and vomiting can be diagnosed with acute pancreatitis. Although acute pancreatitis is a benign condition in 75% to 80% of instances, 20% to 25% of patients are likely to develop a severe version of the disease and might benefit from early intensive care monitoring and treatment. 4 Although acute pancreatitis is a benign condition in 75% to 80% of instances, 20% to 25% of patients are likely to develop a severe version of the disease and might benefit from early intensive care monitoring and treatment. [2] Gallstones, alcohol intake, post-ERCP status, hypertriglyceridemia, hypercalcemia, medications, sphincter of Oddi dysfunction, abdominal trauma, pancreatic neoplasms, pancreatic divisum, and other factors can all induce acute pancreatitis. However, the reason for around 20% of the cases remains unclear. Resuscitation with intravenous fluids, appropriate analgesia, nasogastric tube drainage in chosen instances, enteral feeding or parenteral hyperalimentation depending on the severity of the disease, antibiotics in severe disease, and ERCP in selected cases are all common treatments for this condition. Surgery is only used to treat disease-related complications such as infected necrosis. The severity of acute pancreatitis (AP) determines the prognosis, which is defined as mild, moderate, or severe in the most recent Atlanta classification. [3] The majority of individuals have mild to moderate acute pancreatitis, with approximately 15–20 percent having severe AP (SAP). [4] Notably, mild to moderate AP has a lower death rate than SAP. The death rate for all AP patients is under 1%, but it can rise as high as 20% to 30% in those who have a severe course. [4] It's crucial to identify the individuals who are most likely to develop SAP following admission since this will help with triage and the start of vigorous early therapy. [5] For the early identification of SAP, several severity score methods have been developed. In clinical practice, the Ranson criteria and the Acute Physiology and Chronic Health Examination (APACHE)II system are now the most extensively utilized. [6, 7] However, they are too time-consuming and complicated to be evaluated quickly. The Bedside Index for Severity in Acute Pancreatitis (BISAP) score was suggested in 2008 to identify individuals who are at risk of dying. Blood urea nitrogen level > 25 mg/dl altered mental status, development of systemic inflammatory response syndrome (SIRS), age > 60 years, and presence of pleural effusion are the five characteristics that make up this 5-point scoring system. [8, 9] BISAP is more convenient to utilize with fewer items than standard scoring systems. The BISAP score has been validated through several studies. They vary in several ways, including demographic, cutoffs, and clinical objectives, resulting in a wide range of prediction accuracy. As a result, we undertook this research to see how accurate the BISAP and APACHE-II scoring systems are at determining the severity of acute pancreatitis.

Material and methods

This prospective study was conducted in the Department of General Surgery, Prathima Institute of Medical Sciences, Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion criteria

1. Aged 18 years and above
2. Males and females
3. Acute onset abdominal pain with suspicion of pancreatitis
4. Elevated serum amylase or lipase levels at least three times the normal levels
5. Characteristic presentation of acute pancreatitis on radiological investigations.

Exclusion criteria

1. Patients who do not fit as per inclusion criteria
2. Patients diagnosed with pancreatic carcinoma
3. Those not willing to participate in the study voluntarily

After the admission of the patient data was collected by history taking, complete physical examination. Appropriate radiological investigations were X-ray Abdomen, USG abdomen, CT scan, Balthazar and CT Severity Index (CTSI), Chest X-ray PA view, and MRI if required. Laboratory investigations included Complete blood count, serum electrolytes, renal function tests, liver function tests PT-INR, HbsAg, HIV, serum amylase, serum lipase, serum calcium, and Arterial blood gas analysis.

Individual components of the BISAP scoring system [10]

1. Blood Urea Nitrogen > 25 mg/dl
2. Impaired mental status (Glasgow Coma Scale Score < 15)
3. Systemic Inflammatory Response Syndrome is defined as two or more of the following:
    a. Temperature of < 36 or > 38 ° C
    b. Respiratory rate > 20 breaths/min or $PaCO_2$ < 32 mm Hg
    c. Pulse > 90 beats/min
    d. WBC < 4,000 or >12,000 cells/mm^3 or >10% immature bands
4. Age > 60 years
5. Pleural effusion detected on imaging

Note: One point is assigned for each variable within 24 hrs of presentation. A modified Marshall scoring system was used for organ dysfunction for assessing organ failure.

The APACHE II scoring system considers 12 variables which include: (1) Body temperature, (2) Mean Arterial Pressure (mmHg), (3) Heart Rate (HR), (4) Respiratory Rate (RR/min), (5) Oxygenation (mmHg), (6) pH, (7) Na^+ (mmol/L), (8) K^+ (mmol/L), (9) Creatinine (mg/100 ml), (10) Hematocrit, (11) Total Leucocyte Count and (12) Glasgow Coma Score (GCS). To eliminate the problem of the missing values and concerns about the assumption that an unmeasured variable was normal, the measurement of all the 12 variables was made mandatory for the usage of APACHE II. The recorded values of the variables are based on the most deranged values during the past 24 hours. [11, 12] Age and chronic health problems are associated with a decreased physiological reserve they have been incorporated in APACHE II. Emergency surgery and non-operative patients with severe chronic organ system dysfunction have been allotted 5 additional points in comparison to elective surgical patients who were given 2 points. [12] Statistical analysis was done by uploading the data on MS Excel spreadsheet and for continuous variables mean and standard deviations were used for categorical variables number and percentages were measured and to determine the significance between two groups Chi-square test/Fisher's extraction test was used.

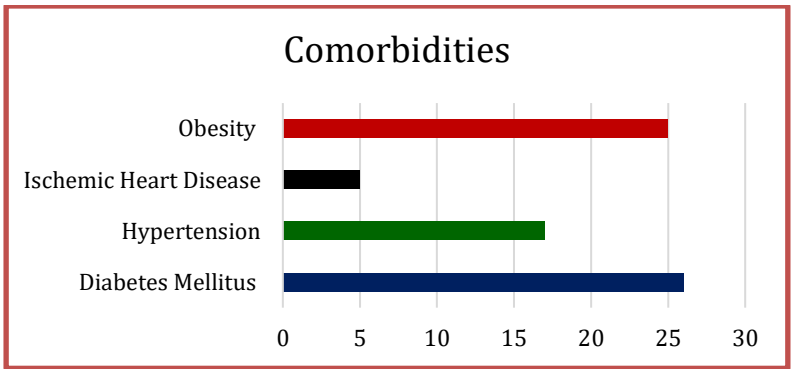
Results

In this study based on the inclusion and exclusion criteria, n=90 consecutive cases of acute pancreatitis were selected. Out of these cases, n=11(12.22%) were females and n=79(87.78%) were males. The male to female ratio was approximately 8:1. The age-wise distribution of cases in the study has been depicted in table 1. The mean age of the study population was 41.50 ± 8.5 years.

Table 1: Age-wise distribution of patients included in the study

Age group in years	*Male*	*Female*	*Total (%)*
18 – 20	03	00	03 (03.33)
21 – 30	28	04	32 (35.56)
31 – 40	19	03	22 (24.44)
41 – 50	13	01	14 (15.56)
51 – 60	07	00	07 (07.78)
61 – 70	05	01	06 (06.67)
> 70	04	01	05 (05.56)
Total	79	11	90 (100.0)

The commonest symptom reported on presentation was acute pain in the abdomen which was found in 100% cases of the study followed by vomiting in 82.22% of cases, Nausea in 33.33% cases, Fever in 16.67% cases. The common signs were abdominal tenderness on palpation in 100% of cases and tachycardia in 41.11% of cases. History of alcohol consumption was found in 50% of cases and history of smoking was found in 21.11% of cases. The number of cases with comorbidities has been depicted in graph 1.



Graph 1: Comorbidities recorded in the cases of the study

The APACHE II scores of more >10 was used to differentiate between mild pancreatitis and severe pancreatitis based on the study by R Suvarna et al., [authors 2253] where they found the APACHE II score of more than 10 had the best sensitivity, specificity, and predictive value. The APACHE II values of > 10 were observed in 30% of cases of the study. The BISAP score of > 3 was used to label severe acute pancreatitis. In our study, 27.78% were found severe acute pancreatitis details depicted in table 2.

Table 2: Severe Acute Pancreatitis as defined by scoring systems

Scoring system	*Frequency*	*Percentage*
APACHE II score		
Mild Acute Pancreatitis	63	70.00
Severe Acute Pancreatitis	27	30.00
BISAP score		
Mild Acute Pancreatitis	65	72.22
Severe Acute Pancreatitis	25	27.78

When the cutoff values of APACHE II were taken at 10 the sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) calculations are depicted in table 3. Similarly, for the BISAP Scoring system when the cutoff values of 3 were taken the

sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) are given in table 3.

Table 3: Severity prediction of BISAP and Apache II grading in AP

Scoring system	*Cutoff point*	*Sensitivity*	*Specificity*	*Positive predictive value*	*Negative predictive value*
APACHE II	10	88.56%	95.51%	88.64%	92.32%
BISAP	3	91.25%	82.31%	75.22%	94.03%

Out of the n=90 cases studied n=86 cases improved and n=4(4.44%) patients died, and all these cases had APACHE scores of >10 the sensitivity, specificity, positive predictive values, and negative predictive values were 100%, 95.66%, 48.35%, and 100% respectively. For BISAP score of >3 n=4(4.44%) patients died the sensitivity, specificity, positive predictive values, and negative predictive values were 100%, 84.16%, 29.47%, and 100%.

Discussion

In this prospective study, n=90 patients with acute pancreatitis were studied. Comparison of severity of AP respectively BISAP score and APACHE II Score. The two scoring systems were compared by the ability to predict the severity and prognosis. Out of the n=90 cases studied n=86 cases improved and n=4(4.44%) patients died. In the study, we found the larger the rating score, the higher the proportion of severe pancreatitis and mortality risk. The comparison of rating scores BISAP and APACHE II scores found the APACHE scores of > 10 sensitivity, specificity, positive predictive values, and negative predictive values were 100%, 95.66%, 48.35%, and 100% respectively. There is a variety of scoring systems developed for acute pancreatitis. The score systems such as Ranson criteria, Acute Physiology and Chronic Health Evaluation (APACHE) II, and computed tomography severity index (CTSI). But these systems have their distinct pros and cons. Ranson‘s score [13] is relatively accurate at classifying the severity of AP, but the evaluation cannot be completed until 48 hours, which will miss the potential for early treatment and increase mortality. Knaus et al., [14] were the first to develop APACHE original score type, including the duration within which the patient was hospitalized, and termed it as acute physiological score mainly used for ICU patient severity and prognosis assessment. However, since the parameters were cumbersome, difficult in 1985 its revised form to monitor 15 indicators (including acute physiological indicators 12 Item, the age factor, Glasgow Coma Scale, and chronic health evaluation, all quantify, become APACHE II Grading. The APACHE II [15] system allows the determination of disease on the first day of admission and is more accurate than Ranson‘s score but it is a little complicated. Also, there are many inflammation markers such as C-reactive protein (CRP), Interleukin-6 (IL-6), etc. Several studies show that cytokines play an important role in the cascading inflammatory responses and they may act as mediators of distant organ complications in SAP. So, the levels of cytokine in serum may also reflect the degree of the inflammatory response. The new mortality-based prognostic scoring system for use in acute pancreatitis has been derived and validated which was named the Bedside Index of Severity in Acute Pancreatitis (BISAP). The BISAP score uses clinical findings and imaging to derive a five-point score. It includes five points of SIRS criteria, making a total of eight variables VK. Singh et al., [16] evaluated the ability of the BISAP score to predict mortality using trend and discrimination analysis. They found among n=397 cases mortality rate was 3.5% the BISAP score greater than or equal to 3 was associated with increased organ failure (odds ratio=7.4, 95% confidence interval: 2.8, 19.5). Papachritou et al., [17] in their study found a BISAP score of > or =3 was n=26 cases. Ranson's > or =3 was in n=47, APACHE-II > or =8 was n=66, and CTSI > or =3

was in n=59. They observed that APACHE II Grading within 24-hour admission results can be obtained rapidly. Continuous observation of the dynamic changes in their scores can contribute to a more accurate assessment of prognosis. Studies have shown that it is evidence-based, APACHE II Score in predicting organ dysfunction better sensitivity and specificity highest. Singh V. K et al., [16] found in the study, BISAP Scoring system in predicting severe acute pancreatitis mortality sensitivity, specificity, positive predictive value, negative predictive value was 73%, 92%, 57% with 84%. Papachristou et al., [17] study confirm BISAP Score mortality forecast in AP accuracy with the traditional APACHE II and Ranson Scoring system was not statistically significant difference, the operation is simple, readily available indicators, the calculation is a simple high accuracy, easy to remember, comprehensive evaluation index of vital signs, laboratory tests, imaging findings, and less subjective indicators, Predictable within 24 hours of acute pancreatitis. The severity and risk of death can dynamically observe the patient's condition changes.

Conclusion

Acute pancreatitis is one of the common conditions presented in surgery clinics. The prediction of severity and assessment of prognosis is an important factor. The comparison between BISAP and APACHE II scores in our study did not reveal the superiority of any scoring system over the other statistically. However, there are several advantages and disadvantages of each. The APACHE II has advantages like being able to assess the condition accurately on admission and scores of > 10 indicate mortality risk. Yet its disadvantages are 12 variables with various scores values are included and sometimes values may not be remembered. Whereas the BISAP is better since it uses clinical findings and imaging to derive five-point scores and values of > 3 indicate increased mortality risk it is easy to remember and fewer chances of missing values. Therefore, whatever scoring system is used if applied accurately is likely to indicate mortality risk and help in planning the treatment accordingly.

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