Original Research Article

Comparison of Different Scoring Systems in Predicting the Severity of Acute Pancreatitis

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Abstract

Background: Acute pancreatitis (AP) is an inflammatory process with a highly variable clinical course. Most patients with AP have a mild disease that resolves spontaneously without sequelae, however, 10%-20% of patients experience a severe attack with high mortality up to 30%.
Objectives: To examine the prognostic usefulness of several existing scoring systems in predicting the severity of acute pancreatitis.
Materials and methods: It was a record based prospectively analyzed study was data was collected on clinical database from consecutive patients with AP from January 2019 to December 2019. Ranson, Acute Physiology and Chronic Health Evaluation (APACHE)-II, and bedside index for severity in acute pancreatitis (BISAP) scores, and computed tomography severity index (CTSI) of all patients were calculated. Serum C-reactive protein (CRP) levels were measured at admission (CRPi) and after 24h (CRP 24). SPSS 21 was used for analysis.
Results: Out of total 160 patients, 20 (12.5%) were classified as severe AP. Predictive values for Ranson, BISAP, APACHE-II, CTSI, and CRP 24 in predicting severe AP were 0.68 (95%CI: 0.60-0.74), 0.72 (95%CI: 0.64-0.82), 0.76 (95%CI: 0.72-0.82), 0.67 (95%CI: 0.60-0.74), and 0.66 (95%CI: 0.55-0.76), respectively. APACHE-II demonstrated the highest accuracy for prediction of severe AP, however, not statistically significant pairwise differences were observed between APACHE-II and the other scoring systems, including CRP 24.
Conclusion: Various scoring systems showed similar predictive accuracy for severity of AP. Unique models are needed in order to achieve further improvement of prognostic accuracy.

Key words

Severe acute pancreatitis, Acute pancreatitis, Ranson, APACHE, C-reactive protein.

Introduction

Acute pancreatitis (AP) is an inflammatory process with an extremely variable clinical course. Most patients with AP have a mild disease that subsidies spontaneously without sequelae, however, 10%-20% of patients experience a severe attack with high mortality up to 30% [1, 2]. This high-risk group of patients may benefit from belligerent fluid resuscitation, close monitoring for development of organ failure, proper administration of antibiotics and specific therapeutic procedures, such as endoscopic sphincterotomy and radiologic intervention [3]. Therefore, early valuation of the severity and identification of patients at risk is important for early intensive therapy and timely intervention and has been shown to improve prognosis and survival. In 2012, the Atlanta classification was revised with a stress on persistent organ failure [4]. Multi-factorial scoring systems, including Ranson, et al. [5] and Acute Physiology and Chronic Health Evaluation (APACHE)- II scores [6] have been used since the 1970s for assessment of the severity of AP. Balthazar computed tomography severity index (CTSI) was developed in 1990 [7]. These prognostic methods have been established as an important tool for assessment of the severity of AP. However, these multi-factorial scoring systems, which are complex and difficult to use in clinical bases, have been shown to perform with high negative predictive value but only moderate overall sensitivity [8]. A novel prognostic scoring system, the Bedside Index for Severity in Acute Pancreatitis (BISAP), has recently been proposed as an accurate and simple method for early identification of patients at risk of in-hospital mortality [9]. There have been a few studies concerning the comparison of various scoring systems including BISAP in predicting the severity of AP based on the revised Atlanta Classification. This study was directed for assessment and comparison of the early probability of various parameters most widely used in AP, such as multi-factorial scoring systems (Ranson, APACHE- II , and BISAP), CTSI and one single laboratory parameter [C-reactive protein (CRP)] in a tertiary care center.

Materials and methods

Demographic, radiographic, and laboratory data from 160 consecutive patients with AP who were admitted or transferred to our tertiary care institute were prospectively collected during a one -year-period between January 2019 and December 2019. Analysis of this clinical database was performed retrospectively. Laboratory tests were performed upon arrival at the hospital and at 48 hours after admission. Computed tomography (CT) scan was completed in all patients within 48 hours after arrival at the hospital for detection of the development of fluid collections, the level of inflammation, and necrotic changes. Oral feeding was allowed when abdominal pain subsided, and patients felt hunger sensation. When patients remained asymptomatic with oral intake, patients were discharged or underwent cholecystectomy if indicated the following parameters for each episode of AP were collected: length of hospital stay, in-hospital mortality, duration of nil per oral (NPO), presence of organ failure and local complications such as peripancreatic fluid collections, pseudocyst and necrosis. APACHE- II and BISAP scores were calculated using data from the first 24 hours after admission and the Ranson score using data from the first 48 hours. Serum CRP levels were measured at admission (CRPi) and after 24 hours (CRP 24). CTSI was calculated in patients who underwent contrast-enhanced computed tomography (CECT) within 48 hours after admission. All CT scans were studied by radiologists, who were blinded to laboratory data and clinical course.

The diagnosis of AP was based on the presence of two or more of the following three features:

(1) abdominal pain consistent with AP (acute onset of a persistent and severe epigastric pain often radiating to the back); (2) elevation of serum amylase and/or lipase levels three or more times of the upper limit of normal; and (3) characteristic findings of AP on CECT [4]. Pancreatic fluid collections and pseudocysts were defined according to the Atlanta Classification. Alcoholic AP was defined when patients had a history of alcohol consumption within 48 hours before symptom onset with no signs of other possible causes. Biliary pancreatitis was defined when there was a gallstone or biliary sludge on ultrasonogram or CT. The etiology was idiopathic when causative factors could not be identified from a detailed clinical and drug history or after initial investigations. Severity of AP was determined according to the most recently revised Atlanta Classification. Mild AP was defined by the absence of organ failure and the absence of local or systemic complications. Moderately severe AP was defined by the presence of transient organ failure, local complications, or exacerbation of co-morbid diseases. Severe AP was defined by persistent organ failure for more than 48 hours. Organ failure was defined as a score of 2 or more for one of the three systems (respiratory, cardiovascular, and renal) using the modified Marshall scoring system [10]. The major difference between the new and former definition of clinical severity is that the presence of local complications or transient organ failure is no longer regarded as clinically severe disease, unless organ failure exceeds 48 hours in duration. The study was approved by institutional ethics committee.

Statistical analysis

The above date was compared using a scientific approach, as to how much an X –ray Nasopharynx was reliable when compared to the other diagnostic modality. Continuous variables were expressed as mean with standard deviation (SD). Categorical variables were expressed as absolute numbers and proportions. Bivariate relationship for categorical variables was assessed using Pearson's $\chi 2$ test or Fisher's exact test. Spearman rank correlation analysis was used for evaluation of the correlation between each pair of scoring systems, and between each scoring system and length of hospital stay. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for individual scoring systems and biochemical markers (CRPi, CRP 24). SPSS - VERSION 21 SOFTWARE was used for analysis. A P value of < 0.05 was considered statistically significant.

Table – 1: Demographic and clinical characteristics of study participants (N=160).

Variables	Mild to moderate AP (N=140)	Severe AP (N=20)	p-value
Age (mean±SD)	61.4±15.5	62.4±12.5	0.11
Sex			
Male	92	16	0.002*
Female	48	4	
Hospital stay (days)	8.6±4.6	11.6±6.4	0.001*
Etiology			
Biliary	100	9	0.11
Alcoholic	16	10	0.01*
Idiopathic	24	1	0.22
Scoring system			
Ranson	2.6±1.2	3.8±1.4	0.001*
APACHE-II	6.4±3.2	10.6±4.2	0.001*
BISAP	1±0.7	1.8±0.8	0.001*
CTSI	2.1±1.2	3.4±1.9	0.001*

Table – 2: Correlation matrix between scoring system.

Scoring system	Ranson	APACHE-II	BISAP	CTSI	CRPi	CRP24
Ranson	1	0.55*	0.60*	-0.01	0.22*	0.28*
APACHE-II		1	0.52*	-0.03	0.32*	0.37*
BISAP			1	-0.02	0.24*	0.42*
CTSI				1	0.11*	0.16*
CRPi					1	0.32*
CRP24						1

*p<0.05 was statistically significant

Table – 3: Sensitivity, Specificity, Positive Predictive value (PPV), Negative Predictive value (NPV) of different scoring system.

Scoring system	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Ranson	84.4	45.4	18.6	94.6
APACHE-II	81.3	64.7	26.4	95.4
BISAP	62.7	73.2	24.7	92.4
CTSI	66.4	65.4	22.4	94.2
CRP24	52.2	95.2	68.4	92.4

Results

As per **Table – 1**, according to definitions around 12.5 % patients has severe acute pancreatitis. Age was comparable in both groups. The study was male preponderance and it was significant (p<0.05). Duration of stay in hospital in severe AP patients was 3 days extra then mild to moderate AP and it was significant. Overall most common cause was Biliary, but alcoholic was significant (p<0.05). Among the scoring system Ranson, BISAP, and APACHE- II scores, and CTSI were significantly higher in the severe AP group, compared with the mild to moderately.

As per **Table – 2**, According to Spearman ranked correlations, Ranson, BISAP, and APACHE- II scores, and CRPi, and CRP 24 levels showed positive correlation with each pair of them, whereas CTSI showed positive correlation with CRP 24 level (correlation coefficient; but not with other scores. CRPi and CRP 24 levels did not show correlation with length of hospital stay.

According to **Table – 3**, the negative predictive value of all scoring system was on higher side which clearly distinguishes the causes depicting severe acute pancreatitis. Among the scoring system sensitivity of ranson was the highest and lowest for CRP24. Specificity was lowest in ranson (45.4%) and was highest in CRP24 (95.2%) along with positive predictive value.

Discussion

AP is a disease with variable severity and an evolving process that may involve multiple organ systems. Although approximately 80% of patients have mild disease that resolves spontaneously with little morbidity, the remaining 20% suffer from severe attack with mortality rates as high as 30% [1, 2]. In this study, 20 patients (12.5%) were classified as severe AP. Some studies have reported that the cause of AP was not related to disease severity [11, 12]. However, in this study, among the etiologies of AP, alcohol showed a significant association with patients with severe AP (P<0.05). Severe AP is usually observed at the initial stage of AP and slow progression from mild to severe disease is uncommon [13]. Therefore, early evaluation of its severity is a critical concern in the prognosis and management of AP. Since the 1970s, many studies for development of a widely available prognostic scoring system in AP for prediction of which patients are at the highest risk of developing clinically severe AP and require

aggressive therapy have been reported [14]. Early in the course of AP, systemic inflammatory response syndrome or organ failure suggests potentially severe disease and poor prognosis [4]. In 2012, the Atlanta Classification was revised with an emphasis on persistent organ failure [4]. In this study, the severity of AP was determined according to this revised Atlanta Classification. The Ranson score represented a major advancement in evaluation of disease severity in AP and has been used clinically for more than three decades [5, 15]. In the previous study, the degree of correlation between the length of hospital stay and APACHE- II and modified Glasgow scores was larger than that between the length of hospital stay and Ranson score [16]. Results of this study demonstrated significant correlation of Ranson, BISAP, and APACHE- II scores, and CTSI with the length of hospital stay, however, CRPi and CRP 24 did not show correlation with the length of hospital stay. In this study, correlations of different scoring systems were evaluated. The Ranson, BISAP, and APACHE- II scores showed positive correlation with each pair of them, whereas CTSI did not show correlation with any scoring system. These results may be related to the fact that pancreatic parenchymal necrosis on CECT may not appear within 48 hours [17]. In one meta-analysis, including 1300 patients with AP, Ranson score had an overall sensitivity of 75%, specificity of 77%, PPV of 49%, and NPV of 91% [3]. In this study, sensitivity and NPV of Ranson score was 85.7% and 95.3%, respectively, however, specificity and PPV were low (44.4% and 18.8%, respectively). Based on this result, there was a high false positive rate of severe AP with Ranson score, and approximately 80% of patients with a Ranson score of more than 3 were not severe AP. BISAP, a recently developed prognostic scoring system, has been proposed as a simple method for prediction of severe AP compared to traditional scoring systems. Results of this study demonstrated that predictive accuracy of severe AP was like that of the other scoring systems, however, against expectations, the process of calculation of the BISAP score was not simple compared to Ranson and CTSI. The CTSI was reported to be useful in identification of patients with severe AP and poor prognosis in selected patients in 1990 [7]. However, only a few studies have investigated whether CTSI is superior to the APACHE- II or Ranson score in prediction of severe AP [18]. Although pancreatic parenchymal necrosis has been shown to correlate with development of organ failure and local complications that require intervention [19], major limitation of CTSI is that pancreatic parenchymal necrosis may be unrecognized on an early CT performed within 24 hours after admission and development of local complications, such as abscess or hemorrhage, usually occur late in the course of AP [20].

Conclusion

Present study demonstrated that the APACHE- II scoring system seems to have the highest accuracy in assessment of the severity and outcome of AP, although the predictive accuracy of APACHE- II was not significantly different compared to that of the other scoring systems, including CRP. No simple scoring system capable of reaching maximal utility is available, and unique models are needed in order to achieve further improvement of predictive accuracy.

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