

Original study

## Simplified admission criteria for predicting the severity and prognosis of acute pancreatitis

### Akut pankreatitin ciddiyetini ve prognozunu tahmin etmek için basitleştirilmiş kabul kriterleri

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#### ABSTRACT

Acute pancreatitis has been recognized since time primeval and has been described as the most terrible of all affliction that occurs in connection with the abdominal viscera. Early diagnosis and accurate staging of disease severity are important aims in the initial assessment and management of acute pancreatitis.

To assess and the severity prediction of acute pancreatitis based on the evaluation of simplified entry criteria (Pulse > 100 beats/min, WBC>14.5 x 10<sup>3</sup> /dL, BUN>12 mg/dL, RBS>150 mg/dL) and compared it with the BISAP and Apache II scores for prediction of acute pancreatitis severity and prognosis.

Patients with acute pancreatitis admitted over a period of 12 months at the Department of Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun were the subjects of the study.

The distribution of the study subjects according to risk assessment of AP concerning Simplified Admission Criteria showed that more than 50% of the cases were at lower risk followed by 37 (38.5%) cases were at higher risk. According to the APACHE II Score in this study, 57.3% of the total cases were at lower risk while 42.7% were at higher risk. Moreover, according to BISAP Score, 86.5% of the total cases were at lower risk while 13.5% were at higher risk.

A significant association was observed between Simplified admission criteria and the APACHE II Score. Compared with the APACHE II score and BISAP Score, the Simplified admission criteria showed relatable specificity and sensitivity for mortality. Mortality of 7.3% was recorded of the total cases recruited. In this study, results confirmed that Simplified Admission criteria were a useful tool for predicting mortality.

**Keywords:** Acute pancreatitis; prognosis; simplified admission criteria; BISAP score; APACHE II

#### ÖZET

Akut pankreatit ilkel zamanlardan beri bilinmektedir ve karın iç organlarıyla bağlantılı olarak ortaya çıkan tüm rahatsızlıkların en korkunç olanı olarak tanımlanmıştır. Akut pankreatitin ilk değerlendirmesinde ve tedavisinde erken tanı ve hastalık şiddetinin doğru evrelenmesi önemli amaçlardır.

Basitleştirilmiş giriş kriterlerinin (Nabız>100 atım/dk, WBC>14,5 x 10<sup>3</sup>/dL, BUN>12 mg/dL, RBS>150 mg/dL) değerlendirilmesine dayalı olarak akut pankreatitin değerlendirilmesi ve şiddet tahmini Akut pankreatit şiddetinin ve prognozunu tahmini için BISAP ve Apache II skorları ile birlikte.

Çalışmaya, Himalaya Tıp Bilimleri Enstitüsü (HIMS), Swami Ram Nagar, Dehradun Cerrahi Bölümü'nde 12 ay boyunca başvuran akut pankreatitli hastalar dahil edildi.

Çalışma deneklerinin AP'nin Basitleştirilmiş Kabul Kriterlerine ilişkin risk değerlendirmesine göre dağılımı, vakaların %50'den fazlasının daha düşük risk altında olduğunu, ardından 37 (%38,5) vakanın daha yüksek risk altında olduğunu gösterdi. Bu çalışmada APACHE II Skoruna göre toplam vakaların %57,3'ü daha düşük, %42,7'si daha yüksek risk altındaydı. Ayrıca BISAP Skoruna göre toplam vakaların %86,5'i daha düşük, %13,5'i ise daha yüksek risk altındaydı.

Basitleştirilmiş kabul kriterleri ile APACHE II Puanı arasında anlamlı bir ilişki gözlemlendi. APACHE II skoru ve BISAP Skoru ile karşılaştırıldığında, Basitleştirilmiş kabul kriterleri mortalite için ilişkilendirilebilir özgülük ve duyarlılık gösterdi. Çalışmaya alınan toplam vakaların %7,3'ünün ölüm oranı kaydedildi. Bu çalışmada sonuçlar, basitleştirilmiş kabul kriterlerinin ölüm oranını tahmin etmek için yararlı bir araç olduğunu doğruladı.

**Anahtar kelimeler:** Akut pankreatit; prognoz; basit kabul kriterleri; BISAP skoru; APACHE II

## INTRODUCTION

Acute pancreatitis is defined as “a common and frequent inflammatory disorder of the pancreas with variable involvement of other regional tissues or remote organ systems” (1). Acute pancreatitis has growingly become one of the most important acute gastrointestinal disarrays throughout much of the world, together with Europe, Asia, and North America (2). Recently, the burden of pancreatitis has been exhibited in several studies considering only zonal/national factors; though, the burden of pancreatitis has not been analysed across all countries (3). It is the most persistent gastrointestinal cause of hospitalization in the United States, with an annual charge of over 2.5 billion dollars (4). The risk factors for acute pancreatitis include alcohol abuse, smoking, gall stones, hyper triglycerides, Endoscopic procedures (ERCP), abdominal trauma, Drugs, Autoimmune diseases, Dominant PRSS1 mutations, Predisposing genetic mutations, and infections. The peak extent of alcoholic acute pancreatitis in women is between 25 and 34 years and in men 10 years later (5).

On the ground of revised Atlanta classification, acute pancreatitis is defined by two of three norm – typical belt-like abdominal pain elevated serum amylase level three times above the normal threshold or radiological imaging signs of pancreatitis (6). The effect of acute pancreatitis (AP) at 20 to 80 per 100,000 per annum is substantial, with varying incidence rates reported from different countries, all increasing over the last 40 years. Though, the incidence of AP ranges from 13 to 45 per 100,000 population-years while the incidence of chronic pancreatitis ranges from 5 to 12 per 100,000 population-years (7). Early diagnosis and accurate staging of disease severity are important aims in the initial assessment and management of acute pancreatitis. The occurrence of pancreatitis differs with geographical location but usually, it involves factors like consumption of alcohol, gallstones, metabolic factor, and drugs (8).

In 1930, Tillett and Francis, who discovered C- Reactive Protein Index, Initially thought that CRP might be a pathogenic secretion since it was elevated in a variety of illnesses, together with cancer (9). Initially, CRP was measured using the quellung reaction which gave a positive or a negative result. More

precise methods nowadays use dynamic light scattering after reaction with CRP-specific antibodies (10). Among the multiple biochemical markers, the C-reactive protein (CRP) is presumably the most appropriate (5,11). The majority of authors/guidelines consider that a CRP level at 48 h after onset of symptoms  $\geq 150$ mg/L is a bad prognostic augur (12).

Many scoring systems have been propounded to prophesy the severity of the disease and the overall prognosis (13). The Ranson criteria (14), was the first AP scoring system that can be used to assess biliary and non-biliary pancreatitis. Since then, 8 other clinical scoring systems have been evolved: the Glasgow criteria (also known as the Imrie score) (15-17). Acute Physiology and Chronic Health Evaluation (APACHE)-II (18). Systemic Inflammatory Response Syndrome (SIRS) (19). Pani 3 (20), Pancreatitis Outcome Prediction (POP) (21). Bedside Index for Severity in Acute Pancreatitis (BISAP), (22) the revised Japanese severity score (JSS), (23) and Harmless Acute Pancreatitis Score (HAPS) (29). These scoring systems incorporate physiologic, laboratory, and occasionally radiographic parameters by using cut-off values and converting continuous variables into binary values.

The Ranson score represented a major advancement in the evaluation of disease severity in acute pancreatitis and has been used clinically for more than 3 decades (14). APACHE-II score was developed for patients in intensive care units. It has 12 physiologic measures and extra points based upon age and the presence of chronic disease. Some restrictions of the APACHE II score are that is complex and cumbersome to use, it does not differentiate between interstitial and necrotizing pancreatitis, and it does not differentiate between sterile and infected necrosis” (24). The optimum score to prophesy unfavourable prognosis in AP is still lacking as each of these scoring systems has its restriction including the low sensitivity and specificity, the complexity of the scoring system as well as inability to obtain a final score until 48 hours after admission (25).

In the present study, we assessed and compared the severity prediction of acute pancreatitis based on the evaluation of simplified entry criteria (Pulse>100 beats/min, WBC>14.5x10<sup>3</sup>/dL, BUN>12 mg/dL, RBS>150 mg/dL) and compared it with

the BISAP and Apache II scores for prediction of acute pancreatitis severity and prognosis.

### **MATERIAL and METHOD**

In this observational study, all the patients with acute pancreatitis admitted to the Department of Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, were studied. "Subjects were recruited from patients presenting in Emergency/Surgery OPD, HIMS, and Dehradun. Written informed consent was taken from all the patients. The study was undertaken after ethical clearance from the ethics committee.

All patients with acute pancreatitis admitted to the Department of General Surgery and General Medicine were included in the study. Patients with age less than 18 years, Known cases of Diabetes mellitus, History of allergy to intravenous contrast medium, History of pancreatic carcinoma, Known case of Pregnancy and Chronic pancreatitis were excluded from the study.

#### *Sample size*

All consecutive patients with acute pancreatitis presented to the surgery department and medicine department over a period of 12 months. Those patients were selected who presented up to 48 hours of the onset of disease and blood samples were taken up to 72 hours of the onset of disease.

The sample size was calculated with a 95% confidence interval by using the formula as:

$$N = Z^2_{\alpha/2} PQ / d^2$$

Where,

N is the required minimum sample size

Z = 1.96 at 0.05 level of significance

P = Proportion of acute pancreatitis patients are unknown. So, we assume it as 50%

Q = 1 - P = 50%

d = 20% (relative precision or error) i.e. 20% of 50 %

Then, n=96, Hence sample size was 96.

Initial management of all patients included fluid resuscitation, bowel rest, and parenteral analgesia. The diagnosis of acute pancreatitis was based on the presence of the following:

1. Upper abdominal pain and tenderness,
2. An elevated serum amylase level,
3. Lipase.

Radiological evidence of the abdomen demonstrating changes consistent with acute pancreatitis. White blood cell count, lymphocyte count, platelet count, hematocrit level, prothrombin time, calcium level, PaO<sub>2</sub> level, blood sugar level, total protein level, alanine aminotransferase levels, total bilirubin level, creatinine level, BUN level, amylase level, lipase level, CRP level, and plain chest radiograph were measured. Samples were obtained at the time of admission (within the initial 72 hours of the

onset of disease), the time interval between onset of disease and admission will be up to 48 hours.

Revised ATLANTA severity scoring was applied to classify the severity of acute pancreatitis. Physiological factors and laboratory data was collected on admission and recorded in case reporting form and score calculated. Patients were monitored daily for evidence of severe systemic and local complications, including pulmonary, cardiovascular, infectious, renal, hematologic, neurologic, and gastrointestinal tract. For this study, a complication was considered to be severe if the patient required ICU care beyond the initial 24 hours. The patient was followed till discharge/death and the outcome was noted. Simple admission criterion components were compared to BISAP, APACHE II.

#### *Statistical analysis*

Interpretation and analysis of obtained results was carried out using software SPSS version 22 and MS Excel by application of descriptive methods" (e.g. Ratio, proportion and mean). Data thus collected was analyzed and presented in the form of tables/ charts.

### **RESULTS**

The study recruited a total of 96 cases consisting of 48 female and 48 male cases. The age of the cases in our study ranged from 18-80 years. Moreover, the majority of the cases with Acute Pancreatitis "were recorded in the age group <60 years accounting for 78.1% of the total cases followed by the number of cases" in the age group >60 years (21.9%). The most common cause of pancreatitis was gallstone that was recorded in more than 50% of the total study subjects followed by the patients who consumed alcohol (31.3%). However, in 7 cases of the total study subjects, the cause of pancreatitis was found to be idiopathic.

The distribution of the study subjects according to risk assessment of AP concerning Simplified Admission Criteria showed that more than 50% of the cases were at lower risk followed by 37 (38.5%) cases were at higher risk. According to the APACHE II Score in this study, 57.3% of the total cases were at lower risk while 42.7% were at higher risk. Moreover, according to BISAP Score, 86.5% of the total cases were at lower risk while 13.5% were at higher risk. Most of the patients (59.4%) had mild pancreatitis followed by 29 (30.2%) patients with moderate pancreatitis whereas there were 10 patients (10.4) suffering from severe pancreatitis according to modified Atlanta Criteria. According to sensitivity and agreement analysis for Simplified Admission Criteria for mortality prediction, the present study recorded a sensitivity of 89.09% and 67.47% and specificity of 75.61% and 76.92% for APACHE II and BISAP respectively. The positive predictive value, negative predictive value, and accuracy were also recorded as shown in Table 3.

Moreover, the accuracy of Simplified Admission criteria was 83.33% (CI: 74.35% - 90.16%) with a kappa value of 0.65 for APACHE II and 68.75% (95% CI: 58.48% to 77.82%) with a kappa

value of 0.25 for BISAP (Table 4). This shows simplified admission criteria can be employed equivalently to APACHE II and BISAP for severity prediction of AP (Figure 1 and 2).

Variables		Frequency (n)	Percent (%)
Gender	-Female	48	50.0
	-Male	48	50.0
Age group	-<60 years	75	78.1
	-> 60years	21	21.9
Cause of pancreatitis	-Gallstone	59	61.4
	-Alcohol	30	31.3
	-Idiopathic	7	7.30

Variables		Frequency (n)	Percent (%)
Prognostic by Simplified Admission Criterias	-Low risk	59	61.5
	-High risk	37	38.5
Prognostic by APACHE II	-Low risk	55	57.3
	-High risk	41	42.7
Prognostic by BISAP	-Low risk	83	86.5
	-High risk	13	13.5
Prognostic by Modified Atlanta Criterias	-Mild	57	59.4
	-Moderate	29	30.2
	-Severe	10	10.4

	APACHE II		BISAP	
	Value	95% CI (%)	Value	95% CI (%)
Sensitivity	89.09%	77.75 to 89.09	67.47%	56.30 to 77.35
Specificity	75.61%	59.70 to 87.64	76.92%	46.19 to 94.96
Positive Likelihood Ratio	3.65	2.11 to 6.31	2.92	1.07 to 7.98
Negative Likelihood Ratio	0.14	0.07 to 0.31	0.42	0.28 to 0.65
Positive Predictive Value (*)	83.05%	73.93 to 89.44	94.92%	87.25 to 98.07
Negative Predictive Value (*)	83.78%	70.42 to 91.81	27.03%	19.42 to 36.27
Accuracy (*)	83.33%	74.35 to 90.16	68.75%	58.48 to 77.82

	APACHE II	BISAP
Number of observed agreements	83.33%	68.75%
Number of agreements expected by chance	51.67%	58.36%
Kappa	0.655	0.250
SE of kappa	0.078	0.087
95% confidence interval	0.502 to 0.808	0.079 to 0.421



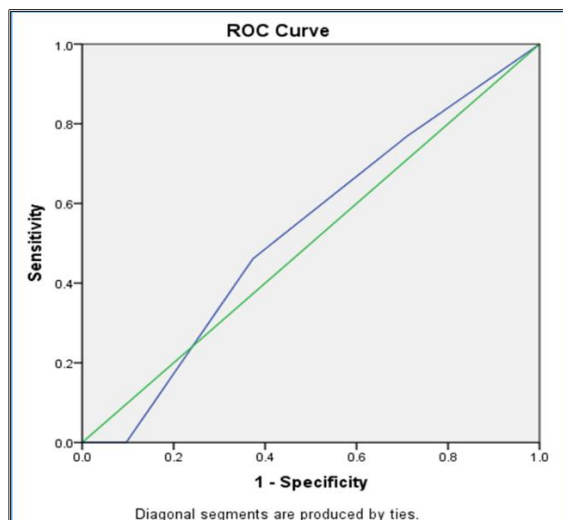


Figure 1

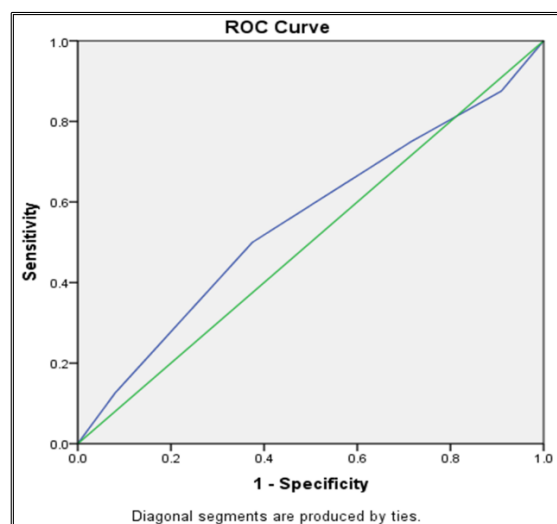


Figure 2

## DISCUSSION

Acute pancreatitis is common ail confronted by physicians in emergency departments all over the world. It is critical to recognize patients with severe acute pancreatitis who will benefit from early intensive care therapy. In most cases, it is difficult to assess the severity on clinical grounds only. Prophecy of the severity of acute pancreatitis is vital because those with severe diseases could be selected for and maybe benefit from immediate intensive treatment. Those with mild diseases could be saved from costly and invading protocols (26). This study aimed at assessing the simplified admission criteria for the prediction of severity and prognosis of acute pancreatitis.

This study recruited a total of 96 patients with acute pancreatitis. The age group of the study subjects ranged from 18-80 years, with a mean age of 47.2 years. Patients with acute pancreatitis were more in the age group <60 years (78.1%), followed by the age group >60 years (21.9%). However, the

mean age of the study subjects in the findings by Kumar and Griwan was 48.2 years (27). González-Gasch et al. (28) their findings showed that advanced age (N= 65 years) “was a risk factor for complicated AP. Moreover, Robers et al. in their study reported the incidence of gallstone acute pancreatitis was highest in older people, and alcohol acute pancreatitis was often among young/ middle age groups around 35-44 years (29).

According to the gender-wise distribution of the study in our study, of the total patients, 50% were female cases and 50% male cases. On the other hand, the study conducted by Kumar and Griwan reported female predominance in their findings. The study indicated that gallstone was the most common etiology of acute pancreatitis (68.8%) followed by the number of patients who consume alcohol (31.3%). Similar results were depicted by Khanna et al. and Yadav et al (30).

In the present study, as per the simplified admission criteria, it was observed that 61.5% of the study subjects had a lower risk of mortality whereas 38.5% of the study subjects had a higher risk of mortality. The risk assessment according to APACHE II Score showed that there were 42.7% of the study subjects with higher risk and in BISAP Score there were 13.5% of the study subjects with higher risk. However, the current findings on comparison suggested that Simplified Admission criteria had a similar percentage of cases with higher risk as that of APACHE-II Score.

As per the sensitivity and agreement analysis, the present study showed that Simplified Admission criteria had a sensitivity of 89.09% and specificity of 75.61%. In comparison, it was recorded that the sensitivity of Simplified Admission criteria for predicting severity in acute pancreatitis patients was higher as compared to the sensitivity of the BISAP Score. According to Wu et al. (31), a BISAP score of > 3 had a sensitivity of 50%, specificity of 91%, the positive predictive value of 6%, and negative predictive value of 99.2% for mortality, whereas the study by Singh et al. showed a BISAP score of >3 had a sensitivity of 71%, specificity of 83%, a positive predictive value of 17.5%, and a negative predictive value of 99% for mortality.

## Conclusion

The present study was proposed to examine the performance of simplified admission criteria for predicting the severity of acute pancreatitis. A total of 96 cases of AP were recruited with a male: female of 1:1. More than 50% of the total cases were recorded in the age group < 60 years. The most common cause of AP in the present study was gall stones. As per the APACHE Score and Simple Admission Criteria, it was reported in the current study that there were 34 cases and 31 cases respectively with severe

AP. However, according to BISAP Score none of the cases had severe AP.

For mortality prediction, this study recorded a significant difference between mortality prediction among cases of Acute Pancreatitis concerning APACHE –II Score, BISAP Score, and Simplified Admission Criteria. In this study, results confirmed that Simplified Admission criteria were a useful tool for predicting mortality. Compared with the APACHE II score and BISAP Score, the Simplified admission criteria showed relatable specificity and sensitivity for mortality and SAP. Hence Simplified Admission criteria can also be employed equivalent to BISAP and APACHE II Score for predicting severity in AP cases. Simplified Admission Criteria might not be accurate for predicting severity and mortality in the case of patients more than 60 years of age.

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