Original Article

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Comparison of Apache II And CT Scoring System In Predicting Early Outcome of Acute Pancreatitis

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ABSTRACT

Acute pancreatitis (AP) is a common and frequent inflammatory disorder of the pancreas with variable involvement of other regional tissues or remote organ systems. Early diagnosis and precise staging of disease severity are important goals in the initial evaluation and management of AP.APACHE II is the most accurate predictor of mortality, CTSI is a good predictor of bothmortality and AP severity, therefore, we compared APACHE II and CT scoring system in predicting early outcome of AP.Patient's demographic and clinical data/Laboratory /Radiological diagnosis of Acute pancreatitis were analysed. The patients were graded according to Balthazar grading and modified CT severity index. The patients were given a score according APACHE II scoring system. Based on APACHE II scoring and CT grading, the severity, complications and prognosis of the patients was assessed. Data was analyzed and found that, alcohol is the major cause of acute pancreatitis in the regional population, with gallstones being the second most common cause. Overall, APACHE II score is an effective tool for risk stratification and management of patients with AP. As APACHE II is a clinical study and calculated at the time of admission, clinically it can be valued higher than the CTSI which is usually done after 48 hours. APACHE II score of >8 or =8 in predicting severity of acute pancreatitis had sensitivity of 93.75% and negative predictive value of 97.6%. Mild pancreatitis as evidenced by CT score < 4 and APACHE II score < 8 have better prognosis. Oral diet is tolerated faster, sepsis is minimal and local complications are lesser. Severe pancreatitis as evidenced by CT scores > 4 and APACHE II score of $\geq$ 8 have severe metabolic and electrolyte disturbances. Prognosis is guarded, especially those who have acute respiratory distress syndrome and features of multi organ dysfunction syndrome. In conclusion, this study suggests that the use of APACHE II score is very useful in predicting the severity of acute pancreatitis in patients. This can help in determining the appropriate level of care and management for the patients, ultimately improving their outcomes and reducing the burden on healthcare facilities.

Key Words: *Acute pancreatitis, Acute Physiology and Chronic Health Examination II, computed tomography severity index, Receiver operating characteristic curves*

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INTRODUCTION

Acute pancreatitis (AP) is the usual gastrointestinal inflammatory disorder of pancreas whose mortality ranges from 3% in patients suffering with mild edematous pancreatitis to 20% in patients with pancreatic necrosis.[1]As this condition involves presence of gallstone migration and alcohol abuse[2]which are reversible, a potential diagnostic tool significantly specify the precise staging of disease severity in the initial evaluation and management of acute pancreatitis.

Guidelines for the diagnosis and treatment of acute pancreatitis were published by the American College of Gastroenterology in 1997. In the majority of patients, acute pancreatitis is mild. In 10–20%, the various pathways that contribute to increased intrapancreatic and extrapancreatic inflammation results in what is generally termed systemic inflammatory response syndrome (SIRS).[3]

Several multi-factorial scoring systems based on clinical and biochemical data have been used over the past few decades. These include Ranson's score described in 1974 and others. Each of these scoring systems has its own limitations including the low sensitivity and specificity, complexity of the scoring system as well as inability to obtain a final score until 48 hours after admission. However, majority of AP cases remain mild, but, treatment of patients with moderate and severe AP may be with necrosis and multiorgan failures have always left a challenge to physician. The prognosis of the severe form is poor, it occurs in 8.8% of AP[4] and the mortality of severe AP (SAP) may reach 28%.[4]

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Therefore, it is necessary to predict the severity of the disease because the early escalation of care and aggressive therapy may prevent complications and adverse outcomes of AP in high-risk patients. Keeping this in mind, the present study was designed to evaluate pancreatitis clinically, biochemically and radiologically and use it to understand management and prognosis.[5]

Recently, an improved prediction and outcome of APACHE-II showed to have the highest accuracy for prediction of severe AP.[6] In another study, APACHE II was the best in predicting severity of HLAP, but it had shortcoming in predicting local complications. MCTSI had outstanding performance in predicting local complications, but it was poor in predicting severity and mortality.[7, 8] APACHE II is the most accurate predictor of mortality, CTSI is a good predictor of both mortality and AP severity.[9]

Therefore, we compared APACHE II and CT scoring system in predicting early outcome of acute pancreatitis.

Methodology

This is a prospective observational study designed and carried out in the department of general surgery at a rural central Indian Medical College Maharashtra from MARCH 2021 to AUGUST 2022. The study was approved by ethical committee and consent was signed by all the 60 patients included in the study.

Data Collection

Patient's demographic and clinical data was obtained in a structured proforma including age, sex, presenting complaints, onset and duration of AP, history of other underlying co-morbidities; physical examination including vital signs, laboratory data including pathological parameters and sonological reports, evaluation and management approach etc.

Inclusion and exclusion criteria

All patients admitted with clinical/Laboratory /Radiological diagnosis of Acute pancreatitis were analysed and considered for study. Patients having diagnostic evidence of Chronic pancreatitis patients and Acute exacerbation of chronic pancreatitis were excluded from the study.

Screening procedure

Patients with acute onset of epigastric pain and vomiting who were suspected to have acute pancreatitis underwent serum amylase test. Those patients with elevated levels of serum amylase and with acute abdomen underwent plain or contrast CT abdomen. Simultaneously blood investigations namely complete blood count, liver function test, renal function test, blood sugar, serum electrolytes and arterial blood gas analysis were done on the first day. The patients were graded according to Balthazar grading and modified CT severity index. The patients were given a score according APACHE II scoring system. Based on APACHE II scoring and CT grading, the severity, complications and prognosis of the patients was assessed.

Statistical Analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Receiver operating characteristic curves (ROCs) was constructed for APACHE II and CT severity. Comparison of APACHE II with MCTSI score was done. Receiver operating characteristic (ROC) and optimal cut-off points was chosen for the calculation of sensitivity, specificity, positive and negative predictive values. A test that predicts an outcome no better than chance has an area under the ROC curve of 0.5. An area under the ROC curve above 0.8 indicated fairly good prediction.

Sensitivity: Defined as ability of a test to identify correctly all those who have the disease i.e. true positive. **Specificity:** It is the ability of test to identify correctly those who do not have the disease i.e. true negative.

Positive predictive value (PPV): The proportion of patients who test positive who actually have the disease.
Negative predictive value (NPV): The proportion of patients who test negative who are actually free of the disease.
Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs
P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.
Statistical software: MS Excel**,** SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

Results

Present study included 60 AP patients, most of the patients (43.3%) were in the age group of 31-40 years. 11.7% of patients were above 60 years and 23.3% of patients were below 30 years of age. 85% of patients were males and 15% were females. Etiological causes revealed that, 58.3% were habituated to alcohol and 21.7% had gallstones and 20.0% of patients had idiopathic reasons of disease causation.

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Table 1: Demographic details of AP patients

Age (Years)	Frequency/Subjects	Percent (%)
31-40yrs	26/60	43.3%
Female	9/60	15.0%
Male	51/60	85.0%
Alcohol	35/60	58.3%
Gallstone	13/60	21.7%
Idiopathic	12/60	20.0%

Clinical symptoms in all patients presented with abdominal pain which was radiating to back in 70% of cases. The pain was associated with vomiting in 60% of cases. On examination, guarding was present in 31.7% of cases. Chest X-ray showed 58.3% patients had normal reports but, 41.7% had Pleural effusion. Further, majority of patients 56.7% were USG diagnosed of having Peripancreatic collection and 43.3% had Pancreas Bulky. Majority of patients 48.3% stayed in hospital for 6 to 10 days, followed by, 43.3% of patients stayed in hospital for 1 to 5 days and minimum of patients 8.3% stayed more than 10 days.

Table 2: Clinical details of AP patients

Signs and symptoms	Frequency/Subjects	Percent (%)
Pain	60/60	100.0%
Vomiting	36/60	60.0%
Guarding	19/60	31.7%
Chest X-ray -Normal	35/60	58.3%
Pleural effusion	25/60	41.7%
USG-Pancreas Bulky	26/60	43.3%
Peripancreatic collection	34/60	56.7%
Hospital stay- 6-10days	29/60	48.3%
1-5days	26/60	43.3%
>10 days	5/60	8.3%

Patients were further categorized according to the Atlanta classification and observed that 73.3% of patients were considered of having mild AP and 26.7% were considered of having severe AP.This was taken as the standard to compare APACHE II score and MCTSI.

Graph 1: Distribution of subjects according to severity by Atlanta classification
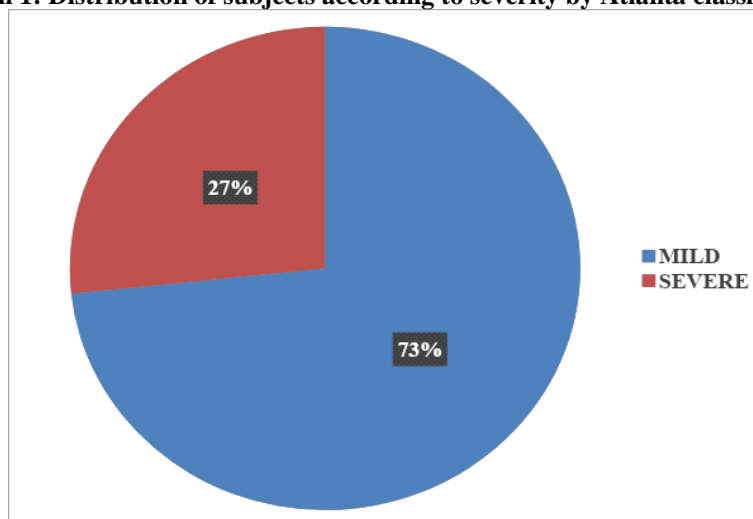
Organ failure cases were also screened and observed that 15 cases of SAP diagnosed to have organ failure that persisted more than 48 hours. Majority (46.7%) was found to have Cardiovascular System failure which presented as

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shock and hypotension. 26.7% of patients had renal failure and Respiratory failure was found in 33.3% of patients.According to APACHE II score, 50.0% of patients score was 6-10 and 6.7% of patients showed APACHE II score was 16-20. According to MCSTI score, 33.3% of patients scored 6 and 3.3% scored each 0 and 10.Extra pancreatic complications like Ascites pleural effusion was diagnosed in 55% of subjects.

Table 3: Distribution of subjects according to AP severity by Organ failure, APACHE II score, MCSTI scoreandextrapancreatic complications

AP severity	Frequency/Subjects	Percent (%)
Renal Failure	4/15	26.7%
Cardiac Failure	7/15	46.7%
Respiratory Failure	5/15	33.3%
APACHE II score- 6-10	30/60	50.0%
16-20	4/60	6.7%
MCSTI score- 6	20/60	33.3%
0	2/60	3.3%
10	2/60	3.3%
Extrapancreatic complications	33/60	55.0%

Receiver Operator Characteristic Curves of APACHE II and CTSI scores in predicting severity were plotted and pairwise comparison was done. The AUC for APACHE II and CTSI was 0.952 (95% CI 0.863 - 0.990) and 0.844 (95% CI 0.728 -0.925), respectively.

Graph 2: Comparison of Receiver Operating Characteristic curve for APACHE II score and MCSTI score in predicting severity
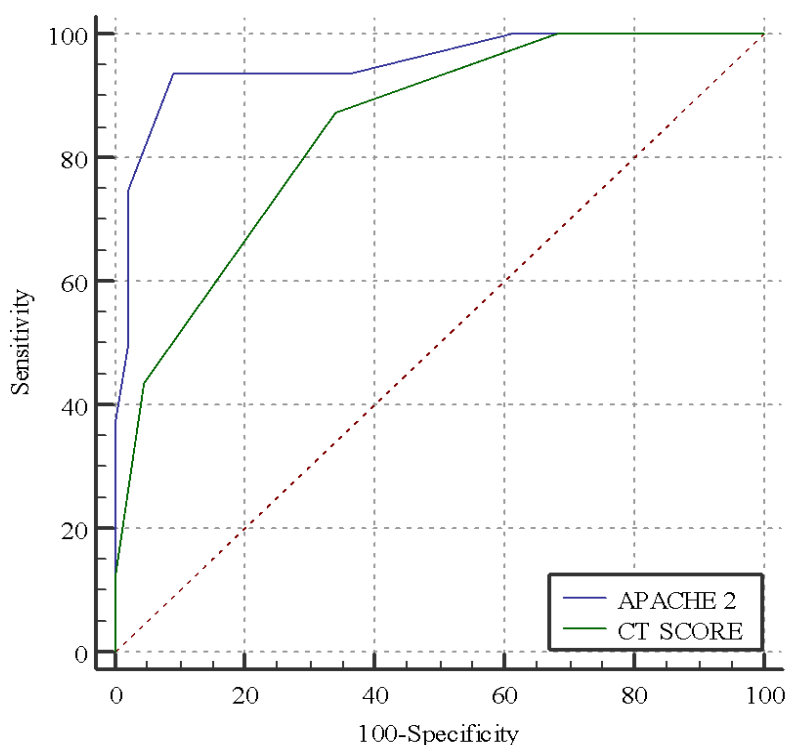

Receiver Operating Characteristic curve >8 APACHE II score in predicting severity showed sensitivity as 93.75 (95% CI 69.8 - 99.8), specificity as 90.91(95% CI78.3 - 97.5), +PV to be 78.9(95% CI54.4 - 93.9) and –PV to be 97.6(95% CI87.1 - 99.9). Similarly, Receiver Operating Characteristic curve for CT score >4 in predicting severity showed sensitivity as 87.50 (95% CI 61.7 - 98.4), specificity as 65.91(95% CI 50.1 - 79.5), +PV to be 48.3 (95% CI 29.4 - 67.5) and –PV to be 93.5 (95% CI 78.6 - 99.2).

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Table 4: Best possible Cut off was APACHE II score >8 and CT score >4 in predicting severity

| Cut off	Sensitivity	95% CI	Specificity	95% CI	+PV	95% CI	-PV	95% CI
>8	93.75	69.8 - 99.8	90.91	78.3 - 97.5	78.9	54.4 - 93.9	97.6	87.1 - 99.9
>4	87.50	61.7 - 98.4	65.91	50.1 - 79.5	48.3	29.4 - 67.5	93.5	78.6 - 99.2

Among the total 16 cases of severe acute pancreatitis, 15 cases were found to have APACHE II score > 8 and 1 cases had a score≤8 and 14 cases were found to have MCSTI >4 and 2 cases had a score ≤4.The ROC analysis for severity showed APACHE II score had AUC of 0.952 which was more than MCTSI score which had AUC of 0.844. Hence the APACHE II score is better in predicting the severity of acute pancreatitis when compared with MCTSI.

Graph 3: Distribution of subjects according to APACHE II andMCSTIscore severity
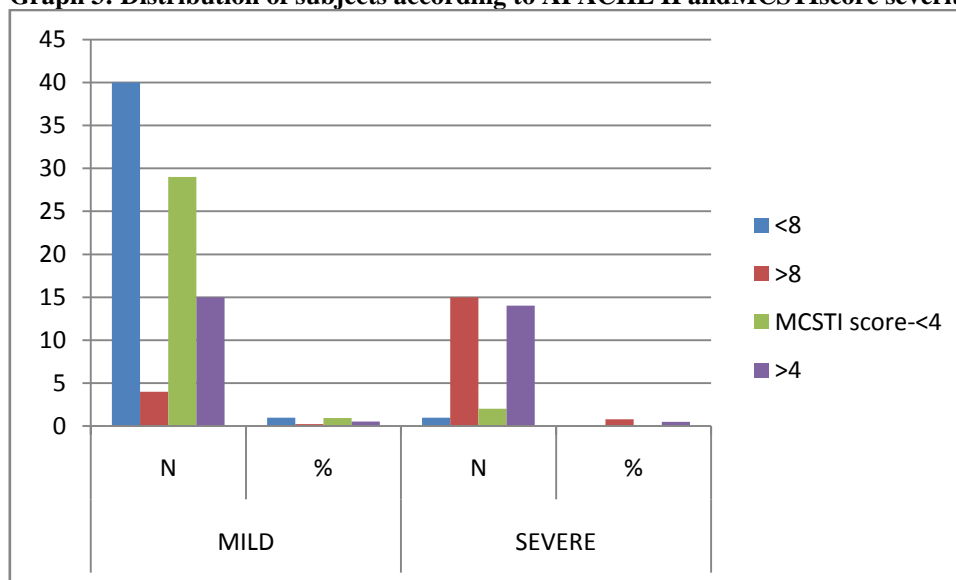
The Specificity, Sensitivity. Positive Predictive Value and Negative Predictive Value of both APACHE II and MCTSI in predicting the severity of acute pancreatitis was calculated. The Sensitivity, Positive and negative Predictive Value of APACHE II score were higher than the MCTSI in predicting the severity. Same Specificity Values were seen for both APACHE II score and MCTSI.

Graph 4:Sensitivity, Specificity, PPV, NPV comparison of APACHE II and MCTSI in predicting severity
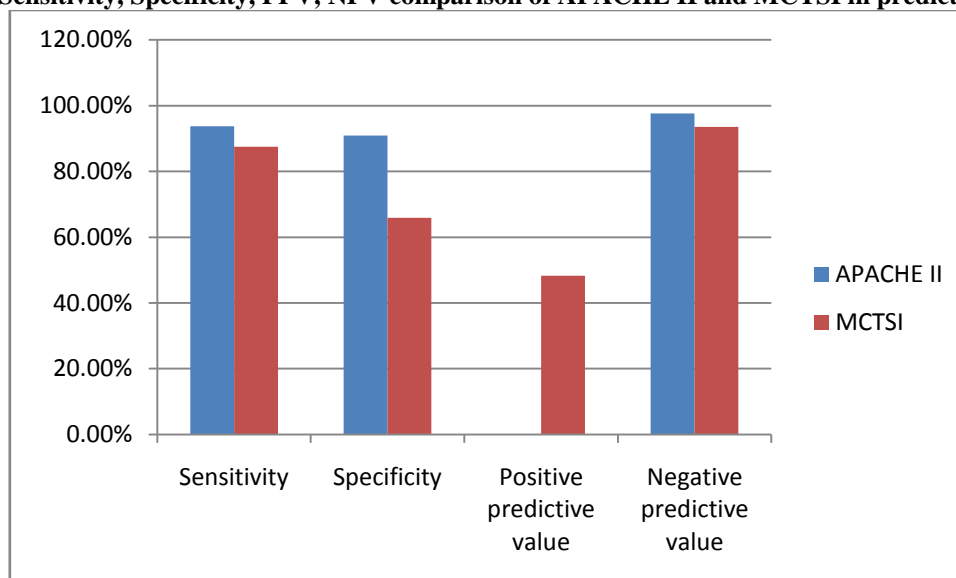
Discussion

Acute pancreatitis is a condition with high incidence and is associated with significant mortality rates. Therefore, determining the severity in patients with acute pancreatitis is important in triaging patients to either wards or intensive

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care units to provide the best outcome. The present study compares APACHE II score which is a clinical scoring system with MCTSI, which is a radiological score in predicting severity in 60 patients with acute pancreatitis.

Demographic details

The median age for acute pancreatitis in the study done by Cornfield et al[10] on 418 patients was 61 years. Nordestgaard et al[11, 12]did a study on 51 patients with acute pancreatitis with a mean age of 44 years. In the present study mean age of patients presenting with acute pancreatitis is 39 years.

Baig SJ et al[13] in their study acute pancreatitis done in 2008 in eastern India, also observed a male predominance with 73% of their patients being male. Vengadakrishnan K et al[14] in their study in Chennai, India in 2015 observed that acute pancreatitis was found five times more common in males than in females. Nesvaderani M et al[15] in 2015 published their retrospective cohort study of 932 patients and observed that 50.4% patient patients were females. Present study is in concurrence with other Indian studies. This may be because most of our patients had alcohol induced acute pancreatitis and alcoholism is far more common in male population in India. In the present study we observed that a total of 37(28.5%), were in the 4th decade of their life, followed by the 3rd decade (n=35, 26.9%) and the 5th decade (n=31, 23.8%) with mean age of 40.81 years and median age of 38.5.

G. Efron[12] in his study to determine the natural history of pancreatitis, published in British Journal of Surgery in the year 1966, observed that incidence of pancreatitis increased with age, was most in 3rd, 4th & 5th decades of life, and again dipped during later part of life. Vengadakrishnan et al[14] in their study observed that most patients were in the age group of 21 to 40 years. Nesvaderani M et al[15] observed a median age of 50 which was higher than what was observed in our study.

In this study, males were 97% and females were 3%. This is in contrast to most western studies where both sexes are equally affected. An Indian study conducted by Vaidya et al revealed similar age and sex distribution. This male preponderance is due to the significant incidence of alcohol consumption in the male population of rural India.

Chang MC et al[16] in their study done in Taiwan and published in 2003 observed that patients with alcohol-related acute pancreatitis were the youngest (mean age: 41.5 years), while those with gallstone pancreatitis were the eldest (mean age: 64.1 years). This observation made by Chang et al may be the cause of younger mean age in the current study.

Alcohol and gallstone are the most common etiological factors of acute pancreatitis. In the original study by Wu et al[17], gallstone contributed 23.8% cases and alcohol was responsible in 21.1% cases. In the present study alcohol is the most common etiological agent contributing 46% followed by gallstones contributing 27%. Other Indian studies also showed the similar distribution in etiological agents. This may be attributed to the difference in dietary, social, genetic and cultural factors between Indian population and Western population.

Guo-Jun Wang et al[18]in their review of etiology and pathogenesis of acute pancreatitis published in 2009 opined that in developed countries, obstruction of the common bile duct by stones (38%) and alcohol abuse (36%) are the most frequent causes of acute pancreatitis. Baig SJ et al[13] observed alcoholism in 41.1%, gallstones in 23.5%, trauma in 17.6%, idiopathic in 11.7% and post-ERCP in 5.8%. Simoes et al[19](97) in their study observed that the most common etiology was alcohol consumption (39.3%), followed by gallstones (24.1%). High incidence of alcoholism as an etiological factor in our study may be due to high prevalence of alcoholism among males in this part of the globe. Other authors have also made similar observation.[20, 21]It may be possible that recently alcoholism is replacing gall stone as the most common cause of acute pancreatitis. Only two patients in our study were post ERCP pancreatitis.

Comparison of scoring systems

In our study 16 out of 60 patients (27%) developed severe acute pancreatitis. The AUC for prediction of severity by APACHE II and MCTSI score are 0.952 (95%CI0.863–0.990) and 0.844(95%CI0.728–0.925) respectively. Papachristou et al[22]conducted a study of 185 patients which showed AUC for predicting severity in acute pancreatitis for APACHE II and MCTSI as 0.81 and 0.84 respectively. A study done by Gompertz et al[23] in 2012 noted APACHE II score ≥ 8 had sensitivity, specificity, positive and negative predictive values of 71.4, 99.1, 83.3 and 98.3 % respectively in predicting severity. The present study also had high specificity and negative predictive value compared with that of MCTSI ≥4 in predicting severity in acute pancreatitis.

Gomez et al[24] in their study in 2012 observed sensitivity of serum lipase to be 95-100% depending on cause.Some studies observed sensitivity for serum amylase to be 63.6% and that for serum lipase to be 99.5%, whereas, specificity for serum amylase to be 99.4% and that for lipase to be 99.2%.

Cho JH et al[6] in their comparison of scoring systems in predicting the severity of acute pancreatitis in 2015 concluded that the APACHE-II scoring system seems to have the highest accuracy in assessment of the severity and

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outcome of acute pancreatitis, although the predictive accuracy of APACHE-II was not significantly different compared to that of the other scoring systems.

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