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Severe acute pancreatitis admitted to intensive care unit: SOFA is superior to Ranson's criteria and APACHE II in determining prognosis

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Background/aims: *Severe acute pancreatitis usually requires intensive management of cardiovascular, pulmonary, renal, and septic complications. Many scoring systems are used in determining the outcomes. The aim of the study was to evaluate the role of three scoring systems, i.e. Acute Physiology and Chronic Health Evaluation, Sequential Organ Failure Assessment, and modified Ranson's criteria, in predicting mortality rate in patients with severe acute pancreatitis as well as other factors influencing mortality in patients admitted to intensive care unit.* ***Materials and Methods:*** *Charts of 43 patients hospitalized in intensive care unit with severe acute pancreatitis were screened retrospectively. Four patients were excluded. Acute Physiology and Chronic Health Evaluation II, Sequential Organ Failure Assessment and modified Ranson's scores were calculated on admission, and Sequential Organ Failure Assessment score was recorded on weekly intervals during the intensive care unit stay.* ***Results:*** *Thirty-nine patients were included in the study (65% male, mean age: 61 years). The intensive care unit mortality was 64% and hospital mortality was 71%. Sequential Organ Failure Assessment scores correlated significantly with mortality. All patients with Sequential Organ Failure Assessment score ≥11 at any time during intensive care unit stay had higher mortality (80% sensitivity, 79% specificity, ROC=0,837). Although Acute Physiology and Chronic Health Evaluation II is used to estimate mortality prognosis, we could not find any statistically significant association between Acute Physiology and Chronic Health Evaluation II scores and mortality.* ***Conclusion:*** *Various scoring systems are used to determine the prognosis of severe acute pancreatitis. In this group of patients, higher Sequential Organ Failure Assessment scores predict higher intensive care unit/hospital mortality.*

Key words: Severe acute pancreatitis, Sequential Organ Failure Assessment, Acute Physiology and Chronic Health Evaluation II, mortality

Yoğun bakıma alınan şiddetli akut pankreatit: SOFA skoru prognozu belirlemede Ranson ve APACHE II Skorundan üstündür

Giriş ve Amaç: *Şiddetli akut pankreatit genellikle kardiyovaskuler, pulmoner, renal ve septik komplikasyonlar açısından yoğun izlem gerektirir. Prognozu belirlemede birçok skorlama sistemi kullanılır. Bu çalışmanın amacı yoğun bakıma alınan şiddetli akut pankreatit olgularında akut fizyoloji ve kronik sağlık değerlendirme II skoru, ardışık organ yetmezliği değerlendirme ve modifiye Ranson skoru kullanılarak bu skorların mortaliteyi tahmin etmedeki değerini ve mortalite ile ilişkili diğer faktörleri saptamaktır.* ***Gereç ve Yöntem:*** *Şiddetli akut pankreatit nedeniyle yoğun bakıma alınan 43 hasta dosyası retrospektif olarak incelendi. Dört hasta çalışmaya alınmadı. Akut fizyoloji ve kronik sağlık değerlendirme II, ardışık organ yetmezliği değerlendirme ve modifiye Ranson skorları hasta yatışında, ardışık organ yetmezliği değerlendirme skoru yoğun bakım yatışı boyunca her hafta hesaplandı.* ***Bulgular:*** *39 hasta çalışmaya alındı (%65 erkek, yaş ortalaması: 61 yıl). Yoğun bakım mortalitesi %64, hastane mortalitesi %71 bulundu. Yoğun bakımda yatışı süresince herhangi bir zamanda ardışık organ yetmezliği değerlendirme skoru >11 seyredenlerde mortalite daha yüksekti (sensitivite %80, spesifisite %79, ROC=0,837). Mortaliteyi tahmin etmede kullanılan akut fizyoloji ve kronik sağlık değerlendirme II ile istatistiksel olarak anlamlı bir ilişki gösterilemedi.* ***Sonuç:*** *Şiddetli akut pankreatitte prognozunu belirlemede birçok skorlama sistemi kulllanılmaktadır. Bu grup hastalarda ardışık organ yetmezliği değerlendirme skoru yüksek olduğunda yoğun bakım ve hastane mortalitesinde artış olarak sonuçlanır.*

Anahtar kelimeler: Şiddetli akut pankreatit, ardışık organ yetmezliği değerlendirme, akut fizyoloji ve kronik sağlık değerlendirme II, mortalite

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INTRODUCTION

Diagnosis of acute pancreatitis can be difficult, as shown by the many cases diagnosed at autopsy (1). Although the exact incidence in Turkey is unknown, it is reported as 35-80/100.000 in the USA and 10-20/1.000.000 in the UK (2,3). The most frequent etiological factors are alcohol consumption and biliary stones as well as post-endoscopic retrograde cholangiopancreatography (post-ERCP), surgery, certain drugs, HIV infection, hyperlipidemia, and biliary anomalies. It is regarded as idiopathic acute pancreatitis when no causative factor is determined (4).

Clinical presentation may change from mild edematous pancreatitis to most severe forms (5). Approximately 25% of all cases require intensive care unit (ICU) admission and the mortality is high in this sub-population (2). Most patients who die from pancreatitis belong to the severe group, which has mortality rate approaching 40% (6). Severe acute pancreatitis usually requires intensive management of cardiovascular, pulmonary, renal, and septic complications. According to the Santorini Consensus Conference (7), patients with severe acute pancreatitis should be managed in ICU.

Fluid resuscitation, antibiotic therapy, nutrition, and mechanical ventilation are important in the treatment of acute pancreatitis in addition to the surgical techniques such as necrosectomy, pancreatic resection, debridement (8). Mortality rate was reported to be above 75% in mechanically ventilated patients (9). Many scoring systems such as Acute Physiology and Chronic Health Evaluation (APACHE), Sequential Organ Failure Assessment (SOFA) and modified Ranson's criteria are used in determining the outcomes. APACHE II is the most widely used, but there is still ongoing debate about the most appropriate scoring system (10,11). The APACHE II score (12) was compiled using the worst values of each of the 12 acute physiological variables obtained during the first 24 h in the ICU – temperature, blood pressure, heart rate, respiratory rate, arterial pH, arterial oxygen saturation, serum sodium, serum potassium, serum creatinine, haematocrit, white cell count, and itemized Glasgow Coma Scale score, together with an assessment of chronic health. The SOFA score (13) was compiled from the arterial oxygen saturation, fraction of inspired oxygen, serum creatinine, total bilirubin, platelet count, itemized Glasgow Coma Scale score, mean arterial pressure, and use of vasopressors such as dopamine, dobutamine, adrenaline and noradrenaline. The worst values for each parameter in each 48-h period were used.

The aim of the present study was to evaluate the role of APACHE II, SOFA and modified Ranson's scoring systems in predicting mortality rate in patients with severe acute pancreatitis as well as other factors influencing mortality in patients admitted to ICU.

MATERIALS and METHODS

This retrospective study was performed in a tertiary University Hospital ICU running by anesthesiology which is the main referral center for about 20 millions living around and consists of 27 beds with an annual admission of 650 patients. Charts of 43 patients with severe acute pancreatitis hospitalized between January 2008 and December 2011 were screened after Ethics Committee approval. Four patients with either repeated admission (3) or age under 18 (1) were excluded.

Diagnosis was obtained by clinical symptoms (abdominal pain with nausea and vomiting), laboratory parameters (3-fold increase in amylase and lipase levels) and radiological findings (edematous pancreatitis, cholelithiasis, choledocholithiasis, bile sludge with ultrasonography and/or CT-MRI). Demographic data, co-existing diseases (metabolic, cardiac, pulmonary, renal, hepatic disorders, and malignancy) on admission and C-reactive protein (CRP) levels at 24, 48 and 72 hours were recorded.

APACHE II, SOFA and modified Ranson's scores were calculated on admission, and SOFA score was recorded on weekly intervals during the ICU stay. The initial, highest and mean SOFA scores were taken into account.

According to radiological findings, the complications were classified as abscess, fistula, pseudocyst, and necrosis. The patients were divided into necrotizing and non-necrotizing pancreatitis, and the etiology was classified as biliary, alcoholic, idiopathic, post-ERCP, hypertriglyceridemia, and traumatic.

Use of vasoactive drugs (dopamine ≥5 μg/kg/min, dobutamine ≥5 μg/kg/min, adrenaline ≥0.2 μg/kg/min, or noradrenaline ≥0.2 μg/kg/min), need for renal replacement therapy, prophylactic antibiotics, route and duration of nutrition (enteral, parenteral, or combined), duration of mechanical ventilation, ICU and hospital stay, ICU and hospital mortality were recorded.

Statistical Analysis

Analyses were carried out using the Statistical Package for Social Sciences (SPSS) 19.0 for Windows by the Department of Biostatistics. Shapiro-Wilk test was used for normal distribution pattern analysis of numerical data. Because the subgroup distribution was not normal, nonparametric tests were used. The distribution pattern of the numerical data between survival and mortality was analyzed with Mann-Whitney U-test. Categorical variables were analyzed using Pearson's chi-square test or Ficher's exact test. The ability of scores to discriminate severity of pancreatitis and mortality were explored using receiver operator characteristic (ROC) curves and the area under ROC curves (AUROC). Continuous variables are expressed as mean ± standard deviation and categorical variables as percentage of number of cases. A two-tailed p-value of <0.05 was considered significant.

RESULTS

Twenty-five patients were male (64%), and the mean age of all patients was 61±14 (21-84) years. On admission, 27 patients (69%) were diagnosed as necrotizing pancreatitis with etiology such as biliary, hypertriglyceridemia, trauma or post-ERCP, while in 12 (30.8%) necrotizing pancreatitis patients, no cause was detected. Etiologies of severe acute pancreatitis are shown in Figure 1.

Recorded complications were: abscess in 15 patients, fistula in 3, pseudocyst in 14, and necrosis in 30. No complications were detected only in two patients.

Eight of the patients (20.5%) had no history of surgery, while 7 patients (17.9%) underwent resection, 23 patients (59%) had surgical drainage, and one patient (2.6%) underwent exploratory laparotomy.

Co-existing diseases are seen in Figure 2.

The route of nutrition during the whole ICU stay was parenteral in 63%, enteral in 26%, and combined (parenteral and enteral) in 11%. There was no significant relation between nutrition route and mortality.

The ICU mortality was 64% (n=25) and hospital mortality was 71% (n=28). Factors predictive of survival are presented in Table 1.

Correlation between SOFA score and mortality was evaluated by ROC analysis, and sensitivity and specificity cut-off values are shown in Table 2.

There was no significant relation between initial CRP values and ICU mortality, while a significant relation was observed between CRP value at 72 hours and hospital mortality (p=0.040).

When the correlation between duration of mechanical ventilation and either ICU or hospital stay was investigated by ROC curve analysis, it was found that the patients spending 76% of ICU stay on mechanical ventilation died with 100% sensitivity and 99.9% specificity.

57% of biliary acute pancreatitis cases and 91% of idiopathic acute pancreatitis cases died. These two specific etiologies were associated with high mortality when compared with other reasons (p=0.032). This relation is shown in Figure 3.

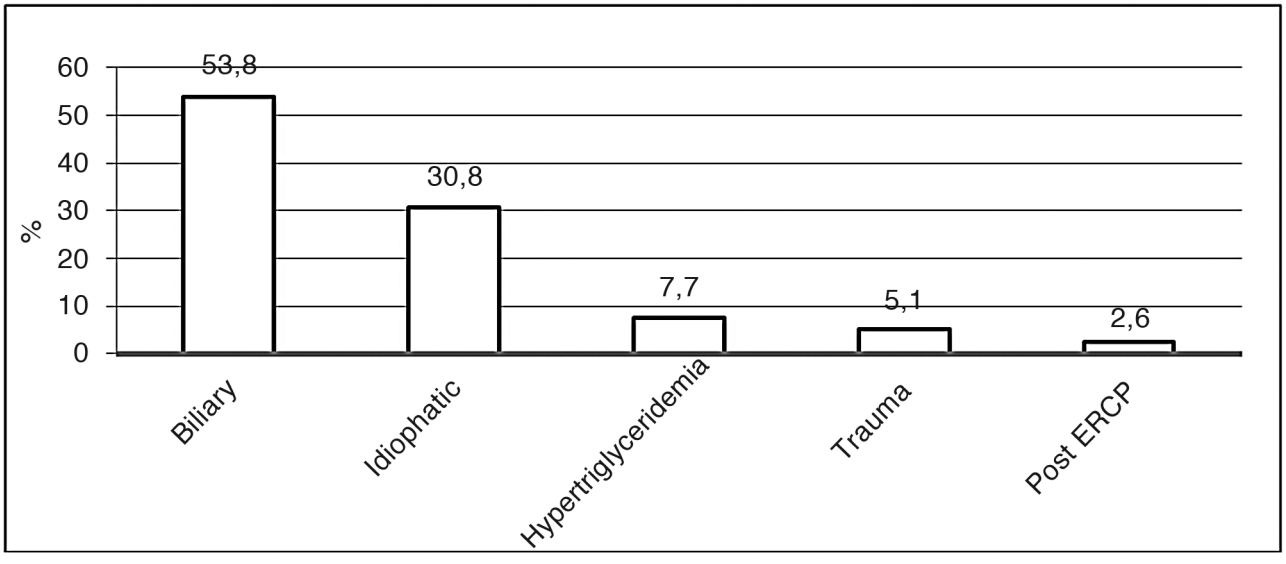

Figure 1. Etiologies of severe acute pancreatitis

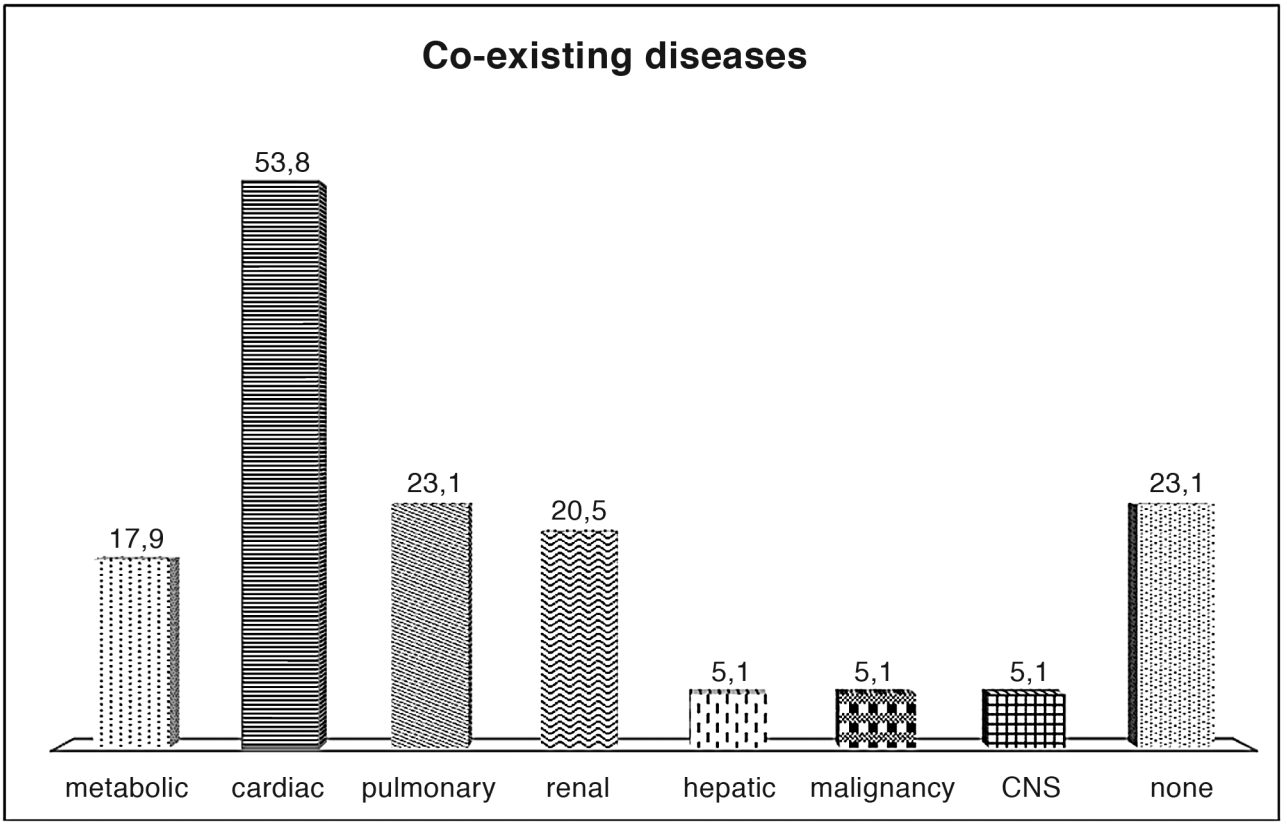

Figure 2. Co-existing diseases as % of total patients (patients might have more than one disease).

Table 1. Factors predicting ICU survival (n=39) (median/min-max)

	Death (n=25)	Survival (n=14)	p=
Age (years)	64 (43-84)	64 (21-77)	0,548
BMI (kg/m^2)	30,4 (24,2-41,7)	29,8 (19,1-39,1)	0,350
Ranson's score	7 (3-9)	7 (1-10)	0,929
APACHE II score	22 (10-35)	16 (11-24)	0,920
Initial SOFA score	8 (4-17)	4 (2-16)	0,042*
Mean SOFA score	10 (3-17)	3 (1-11)	0,000*
Highest SOFA score	13 (4-19)	5,5 (2-15)	0,001*

ICU: Intensive care unit, BMI: Body mass index, APACHE: Acute Physiology and Chronic Health Evaluation, SOFA: Sequential Organ Failure Assessment

Table 2. ROC analysis of Sequential Organ Failure Assessment Score (SOFA) and mortality correlation

	Cut-off value	AUC (95% CI)	Sensitivity (%)	Specificity (%)	p=
Initial SOFA score	7	0,697 (0,50-0,89)	64	65	0,042
Mean SOFA score	7	0,904 (0,79-1,01)	88	86	0,000
Highest SOFA score	11	0,837 (0,69-0,98)	80	79	0,001

DISCUSSION

Acute pancreatitis is a severe disease with mortality rate of 5-10%. No definitive etiological factors can be determined in approximately 10-25% of patients (14). The most common etiological factors are biliary stones and alcohol consumption. In parallel to previous studies, in our study, the most

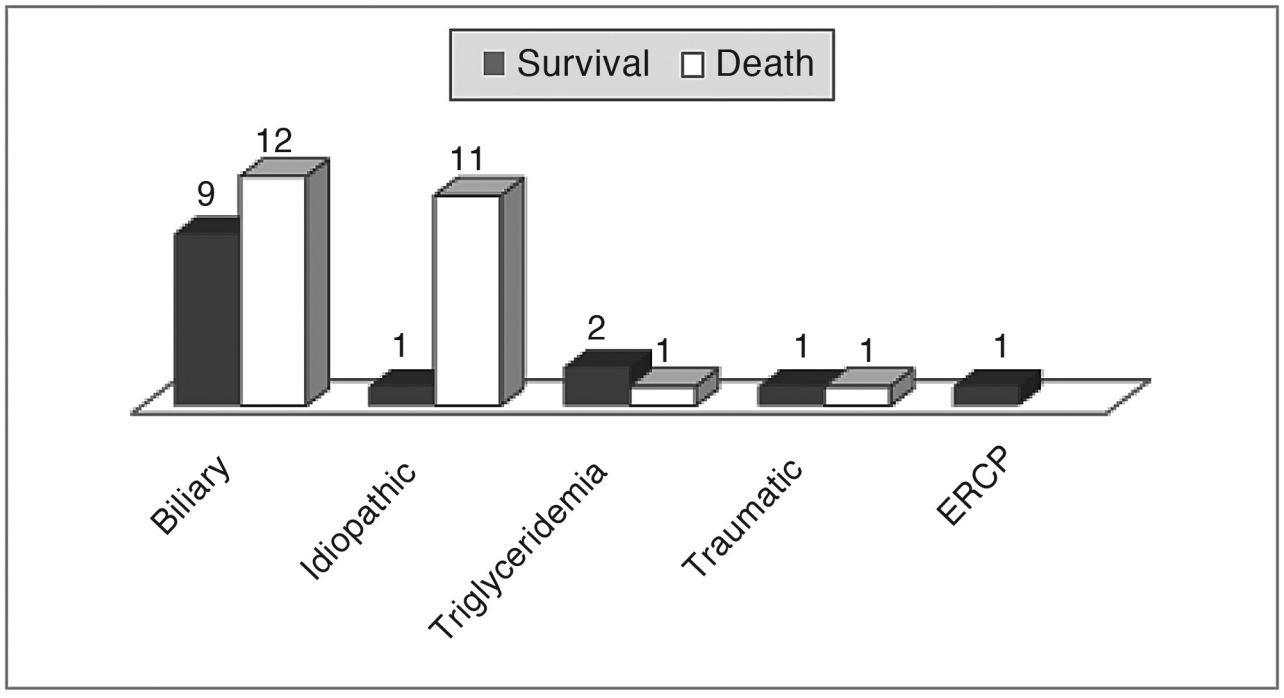

Figure 3. The relation between the etiology of pancreatitis and mortality

common causes are biliary stones (53.8%) and idiopathic (30.8%), even in patients admitted to ICU.

Acute pancreatitis may represent a diverse clinical course from mild cases to multiple organ dysfunction or local complications such as necrosis, abscess, and pseudocyst. Thus, various scoring systems are used to determine the clinical severity and prognosis during the acute phase of the disease. Recently, there is a widespread recommendation of the use of APACHE II and SOFA scores, especially in patients with organ dysfunction (15,16).

APACHE II score ≥8 and Ranson's score ≥4 are indicators of severe disease (3). In our study, we observed moderately high APACHE II, SOFA and modified Ranson's scores. Among them, SOFA score was found to be a significantly better prognostic measure ($p<0.05$). The development of organ failure may occur early after admission to an ICU, so a scoring system that allows examination of organ function is essential. This can be provided by measuring changes in the SOFA score after admission to the ICU. Trends in the SOFA score over the first 48 h in the ICU may be a sensitive indicator of outcome. In patients with septic shock, the SOFA score has been shown to have better predictive power than the APACHE II score (17). The APACHE II score has excellent capability to predict mortality on the basis of values measured within the first 24 h after admission. This score does not, however, take into account the many factors that can influence patient outcome during the course of an ICU stay, so proper evaluation of changes in patient status over time is also important (18).

Juneja et al. (5) evaluated 55 patients during a period of two years and showed that some SOFA scores correlated significantly with 30-day mortality (SOFA>4; 76,2% sensitivity, 69.2% specificity and SOFA>8; 86,7% sensitivity, 90% specificity). In our study, we observed that all patients with an initial SOFA score ≥7 died (64% sensitivity, 65% specificity, ROC=0,697). In addition, if SOFA score was ≥11 at any time during ICU stay, mortality was higher (80% sensitivity, 79% specificity, ROC=0,837).

Harrison et al. (3) showed significant results for the role of APACHE II to estimate mortality, however, we could not find any statistically significant relation between APACHE II score and mortality ($p=0.092$).

Some other studies speculate that there is a significant relationship between mortality and duration of mechanical ventilation and ICU stay (5,9). They demonstrated that mechanical ventilatory support was a reliable prognostic factor especially in severe acute pancreatitis with a mortality rate of 75% (9). We showed a similar relationship bet-

ween an increase in duration of mechanical ventilation and mortality (p=0,0001). Patients spending 76% of ICU stay on mechanical ventilation died with 100% sensitivity and 99.9% specificity.

As a conclusion higher SOFA scores predict higher mortality rates in severe acute pancreatitis. Duration of mechanical ventilation is significantly correlated with mortality. We speculate that prevention of complications and sepsis may decrease mortality in such patient groups.

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