

Evaluation of CT severity index, Ranson and APACHE II and Ranson scores for clinical course and mortality in mechanically ventilated patients depend to severe pancreatitis

Şiddetli akut pankreatite bağlı mekanik ventilasyon uygulanan hastalarda mortalite ve klinik prognozda CT şiddet indeksi, APACHE II ve Ranson skorlama sistemlerinin değerlendirilmesi

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ABSTRACT

Objective: To evaluate the utility of CT severity index (CTSI) and two main scoring systems (Ranson and APACHE II) for patients underwent mechanical ventilation due to pulmonary complications associated with severe pancreatitis.

Materials and Methods: Mechanical ventilated patients due to severe acute pancreatitis were enrolled the study. CTSI and two traditional clinical scoring systems including APACHE II and Ranson were used to predict the mortality rates in mechanical ventilated patients due to severe AP.

Results: Nine of 36 patients were survived (25%). The ICU (Intensive Care Unit) mortality was 66.6% (n= 24) and hospital mortality was 75% (n=27). Patients had upper then 17 scores for APACHE II score, the sensitivity and specificity were 64% and 66%, respectively to predict the mortality, by CTSI (>4) and Ranson scoring system (>6) with sensitivity and specificity of 60% and 40% and 50% and 46%, respectively.

Conclusion: In this study, high scores of CTSI, Ranson and APACHE II were found to be independent predictors in patients underwent mechanical ventilated due to severe pancreatitis in ICU. However, APACHE II was the most reliable and effective scoring system for predicting the mortality rate.

Key Words: Acute pancreatitis, APACHE II, CT severity index, Ranson scoring system

ÖZET

Amaç: Şiddetli akut pankreatitte, pulmoner komplikasyonlar sıklıkla görülmektedir. Bu çalışmada, akut pankreatite bağlı gelişen pulmoner komplikasyonlar nedeniyle mekanik ventilasyon uygulanan hastalarda bilgisayarlı tomografi şiddet indeksi (CTSI) ve geleneksel iki farklı skorlama sistemi olan APACHE II ve Ranson skorlama sistemlerinin uygulanabilirliği ve güvenilirliğinin karşılaştırılması amaçlandı.

Gereç ve Yöntem: Çalışmaya, akut pankreatit tanısı ile mekanik ventilasyon uygulanan toplam 36 hasta dahil edildi. Mortalite oranlarının öngörülmesi için CTSI, APACHE II ve Ranson skorlama sistemleri kullanıldı.

Bulgular: Toplam 36 hasta içinden sağ kalan hasta sayısı dokuz (%25) idi. Mortalite oranları yoğun bakımda %66.6 (n=24), hastanede ise %75 (n=27) olarak bulundu. Mortaliteyi öngörme konusunda 17'nin üzerinde APACHE II skoru en yüksek sensitivite (%64) ve spesifiteye (%66) sahipti. Bu oranları sırasıyla 4'ün üzerinde CTSI skoru (sensitivite %60, spesifite %40) ve 6'nın üzerinde Ranson skoru (sensitivite %50, spesifite %46) takip etmekteydi.

Sonuç: Bu çalışmada, akut pankreatite bağlı gelişen pulmoner komplikasyonlar nedeniyle yoğun bakımda mekanik ventilasyon uygulanan hastalarda mortaliteyi öngörme konusunda yüksek APACHE II, Ranson skoru ve CTSI skorlarının bağımsız birer belirleyici olduğu bulundu. Ancak APACHE II skorunun bu tür hastalarda; mortalite oranlarını öngörmeye en güvenilir ve etkili bir skorlama sistemi olduğu belirlendi.

Anahtar Kelimeler: Akut pankreatit, APACHE II, CT şiddet indeksi, Ranson skorlama

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Introduction

Acute pancreatitis (AP) is a common disease. In 15-20% of patients local and systemic complications occur (1). These complications are well described in the literature including acute inflammatory response to organ failure such as systemic inflammatory response syndrome (SIRS), multi-organ failure, and necrosis of pancreas tissue. Clinical biomarkers were described to predict the possibility of these complications to manage clinically. So far, different scoring with various parameters were developed for the evaluating the severity and prediction of complications and survey of AP. The most well known scoring systems are Ranson score, APACHE II Scoring system (Acute Physiology And Chronic Health Evaluation II), Glasgow scales, SAPS II, MPM II, SOFA, LODS, MODS and POP (2). In recent years, to predict severity of AP. Balthazar (3) described a computed tomography severity index (CTSI) as an alternative method. This method is based on radiographic findings on pancreas appearance and extent of necrosis during CT examination (4,5). This scoring system has been defined as superior to clinical scoring systems for prediction of severity of AP in adult patients.

Pulmonary complications are commonly developed during severe AP. The most important pulmonary complications are atelectasis, pulmonary oedema, effusions, and ARDS. The aim of this study is to compare the utility and reliability of CTSI with two traditional scoring systems including APACHE II and Ranson in patients with developed pulmonary complications and who need to mechanic ventilation due to acute pancreatitis.

Materials and Methods

The records of consecutive patients treated for severe AP by mechanic ventilation at our institution from 2008 through 2011 were examined retrospectively. Diagnose of the patients were verified by laboratory findings, history, and radiologic findings. Patients under 18 and who had a repeated admission were excluded from database.

Demographic data, clinical history, comorbidity, including metabolic anomalies, cardiopulmonary, hepatic, renal disorders on admission were recorded. After 24 hours of admission APACHE-II scores were calculated. The severity of AP was determined using a modified Ranson score (6, 7). All data to calculate the original Ranson score were not available for our study had a retrospective design. Therefore, we

had to use a modified Ranson score.

Severe acute pancreatitis can be defined as concomitant of local complications (fluid collections and necrosis), multiple organ failure, and systemic complications.

Organ failure was diagnosed according to Atlanta criteria with presence of one or more factors: shock (systolic blood pressure < 90 mm Hg), respiratory failure (pressure of O₂ less than 60 mmHg), and renal failure (level of creatinine > 2 mg/dL) (4). With the radiological images, the complications were recorded as pancreatic necrosis, abscess, pseudocyst, and pleural effusions. After discharge from Intensive Care Unit, or less if death had occurred earlier, the patients were followed up to 30 days non-survivor patients were died either in ICU or within 30 days after discharge from ICU. Thirty-day mortality was defined as mortality after discharge or not.

Contrast-enhanced CT images were retrospectively evaluated by two blinded radiologists. CTSI scores were calculated in patients had a contrast enhanced computerized tomography (CECT) within 48 hours from admission. The whole images with a contrast were evaluated for diagnosis of the pancreatitis and entity of the extent of necrosis (5).

The CT findings were graded as: Grade A (normal CT finding, point =0), Grade B (focal or diffuse pancreatic enlargement, point=1), Grade C (peri-pancreatic inflammation or gland abnormalities, points=2), Grade D (only one fluid collection, points, point=3), Grade E (more than one fluid collection or free gas images, points=4).

Necrosis was evaluated as following:

- 0 point: any necrosis,
- 2 points: 0% to 30% necrosis,
- 4 points: 30% to 50% necrosis,
- 6 points: more than 50% necrosis.

The CTSI scores of the datas were calculated as a sum of the scores depending on involved necrotic areas pancreas.

Statistical Analysis: The statistical analysis of the data was performed by the SPSS version 15.0. Datas were shown as mean \pm standard deviation. The normality for distribution was evaluated by Shapiro-Wilk test for parametric distribution. To distribute the data normally The Student's t test was carried out and the Mann-Whitney tests were utilized for the significance of differences. A p value of < 0.05 was considered to be statistically significant. Receiver operator characteristic (ROC), the area under curves (AUC) were used to evaluate the ability of scores.

Results

Thirty-six patients with severe AP undergoing mechanical ventilation were included to the study. The median age was 62 years (25-74), with 58% male. Etiology of pancreatitis were as follows; biliary (52%), idiopathic (33%), hypertriglycemia (5%), traumatic (5%) and post-ERCP (5%). The median APACHE II score was 20.5 (11-35); median Ranson score was 6.8 (4-10) and median CTSI was 5.4 on ICU admission (2-10). All patients were diagnosed with severe AP according to Atlanta criteria. The average stay in the hospital, under mechanic ventilation and ICU were as follows; 40.1 days (range 2 to 177 days); 15.4 days (range 1 to 83 days); 19.8 days (range 1 to 169 days).

Nine of 36 patients survived (25%). The mortality rate in ICU was 66.6% (n= 24) and in hospital was 75% (n= 27). The patients were divided into two groups according to the ICU mortality as survivors and non-survivors. The demographic, clinic and radiological findings of all patients were shown in Table 1.

The local complications such as pancreatic necrosis, pancreatic abscess, pseudocyst, pancreatic fistula and pleural fluid collection were compared between two groups. There were no significant differences between groups with respect to local complications except

pleural fluid collection. Pleural fluid collection was found significantly higher in non-survivors. In addition the etiologies of pancreatitis were also compared between two groups. Idiopathic pancreatitis was significantly higher in non-survivors compared to survivors (Table 1).

Correlation between CTSI, APACHE II, Ranson score and mortality was interpreted by ROC analysis (Figure 1). The sensitivity, specificity and cut-off values are shown in Table 2. An APACHE II score more than 17 had the best sensitivity and specificity of 64% and 66%, respectively for predicting the mortality, followed by CTSI (> 4) and Ranson score (> 6) with sensitivity and specificity of 60% and 40% and 50% and 46%, respectively.

The mortality rate and length of hospital stay was assessed by multiple logistic regression analysis including age, BMI, CTSI, APACHE II and Ranson criteria. CTSI, APACHE II and Ranson score were independent predictors for mortality.

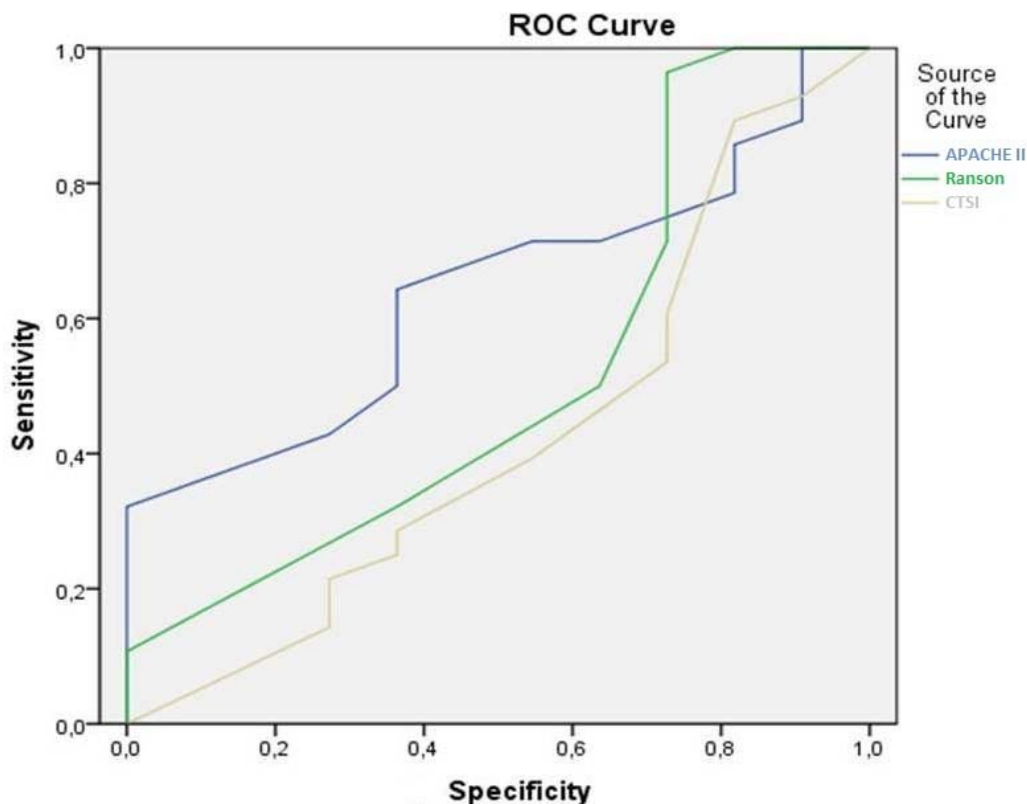
Discussion

In this study, all scoring systems including APACHE II, Ranson and CTSI were found as a predictor with high scores for mortality in acute pancreatitis followed in ICU with mechanical ventilation.

Table 1. Demographic, clinic and radiological findings of survivors and non-survivors

	Survivors (n= 12)	Non-survivors (n= 24)	p value
Age	58.16 ± 16.1	64.58 ± 9.6	0.1
Sex M / F	7 M / 5 F	14 M / 10 F	0.4
BMI	29.18 ± 5.4	31.96 ± 6.0	0.1
CTSI	5.59 ± 2.9	6.08 ± 2.4	0.4
APACHE II Score	17.66 ± 4.6	21.95 ± 7.0	0.08
Ranson Score	6.70 ± 1.3	7.08 ± 1.5	0.4
Etiology of Pancreatitis			
Biliary	8 (66.7%)	11 (45.8%)	
Idiopathic	1 (8.3%)	11 (45.8%)*	
Hypertriglycemia	1 (8.3%)	1 (4.2%)	
Traumatic	1 (8.3%)	1 (4.2%)	
Post-ERCP	1 (8.3%)	0 (0%)	
Complications			
Pancreatic necrosis	9 (78%)	19 (79.2%)	
Pancreatic abscess	5 (41.7%)	8 (33.3%)	
Pseudocyst	1 (8.3%)	1 (4.2%)	
Pancreatic fistula	1 (8.3%)	2 (8.3%)	
Pleural fluid	5 (41.7%)	17 (70.8%)*	

M: Male, **F:** Female, **BMI:** Body Mass Index, **CTSI:** Computed Tomography Severity Index, **APACHE:** Acute Physiology and Chronic Health Evaluation, **ERCP:** Endoscopic Retrograde Cholangiopancreatography, *: p< 0,05.



#####Fig. 1. ROC analysis of CTSI, APACHE II and Ranson scoring systems.

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Table 2. ROC analysis of CT severity index, APACHE II, Ranson and mortality correlation

	Cut-off value	AUC (95% CI)	Sensitivity (%)	Specificity (%)
CT severity index	4	0.425	60	40
APACHE II	17	0.640	64	66
Ranson score	6	0.516	50	46

ROC: Receiver Operating Characteristic, **CT:** Computed Tomography, **AUC:** Area Under the Curve, **CI:** Confidence Interval.

However, APACHE II was the most reliable and effective to predict the mortality rate in patients suffered severe acute pancreatitis. To best our knowledge, there is no study comparing reliability of Ranson, CTSI, APACHE II scores for mechanical ventilated patients depend to severe pancreatitis.

So far, a number of scoring systems have been studied for prediction of mortality and morbidity in severe AP. Ranson scoring system is one of the most well known for clinicians including 11 parameters which are recorded during first admission and after 48 hours. Kim et al. (8) evaluated the estimation of severity by using the Ranson criteria. In this, the authors determined Ranson scoring system not an appropriate method due to need for 48 h for completing criteria and they declared that low specificity and sensitivity of Ranson. Another commonly used scoring system is the APACHE II

with a proven high specificity and sensitivity for patients with acute pancreatitis (9-11). APACHE II provides benefits such as follow up the progression with the therapy response, but the system has also some limitations including difficulty to practice and unsuccessfully to detect the local complications (12). The other limitations of the APACHE II scoring system are not to identify interstitial and necrotizing pancreatitis, and cannot differentiate sterile and infected necrosis. In one large multi-center study, 2677 patients with severe AP were evaluated. The authors concluded that the better discrimination for mortality was provided by the APACHE II score system (13). Balthazar (3) found sensitivity and specificity of 86.7% and 70% of Ranson for prediction of mortality and 80% and 87.5% for APACHE II in patients with AP. In our study, the sensitivity and specificity rate to predict the mortality

is significantly lower than most of these studies. These differences are due to selection of patients who underwent mechanical ventilation because of severe AP.

CT severity index is calculated by using the findings of Computerized Tomography scans after administration of intravenous contrast to evaluate the degree of pancreatitis, necrosis and complications due to acute pancreatitis. CTSI has shown a strong positive correlation for detection of local complications and mortality due to AP (3). In the literature, there are conflicting results about the role of CTSI for predicting the clinical severity and mortality of AP. Chatzicostas et al. (14) prospectively evaluated the prognostic usefulness of CTSI, Ranson, APACHE II and APACHE III in assessing the severity of AP, development of organ failure and pancreatic necrosis. They suggested that CTSI was superior to three clinical scoring systems in predicting AP severity and pancreatic necrosis. In another study with larger group of patients with AP, the authors concluded that CTSI was an applicable and comparable predictor of outcomes in severe pancreatitis (15). In contrast to these studies, some of the investigators argued that CTSI was not correlated with the severity of AP and was not highly important for the final patient outcome (16-18). In a study from China, the authors assessed the accuracy of CTSI, Ranson and APACHE II in patients with AP. They suggested that CTSI was a useful method for determination the severity AP. Moreover, they also concluded that the sensitivity of CTSI for predicting the mortality was higher than APACHE II and Ranson (19). Different from these studies, we only evaluated the mechanically ventilated patients with severe pancreatitis. In our study, we showed that CTSI was a useful scoring system for predicting the mortality. However this study showed that the sensitivity and specificity of APACHE II to predict the mortality was higher than CTSI and Ranson for patients mechanically ventilated due to severe AP.

The second important result of our study was the difference between survivors and non-survivors based on the etiology. Gallstones and alcohol together are the two major etiological factors for AP more than 80% (20,21). In elderly patients, the biliary and idiopathic pancreatitis are reported as 64.9% and 26.6% respectively (22). Many studies have indicated a worse prognosis in idiopathic AP compared to pancreatitis induced by alcoholism or gallstone (23). In our study, the most common cause of pancreatitis was gallstone in survivors. However, the gallstones and idiopathic pancreatitis were the most common causes in non-survivors. According to our results, we suggested that idiopathic and gallstone induced

pancreatitis are the most important etiological factors that lead to high mortality rates especially in ventilated patients in ICU.

Another important result of our study was the higher mortality rate of patients with pleural fluid collection. De Waele et al. (24) evaluated the EPIC score (based on the presence of pleural effusion, ascites, and retroperitoneal fluid collections) of patients with AP by abdominal CT scan. They showed that EPIC score of 4 or more had 100% sensitivity and 70.8% specificity for predicting severe pancreatitis. According to our study, we hypothesis that pleural fluid collection could be used for prognostic marker for predicting mortality in especially mechanically ventilated patients with severe AP.

In conclusion, we suggested that the CT severity index, APACHE II and Ranson score were useful scoring systems to predict mortality in mechanically ventilated patients with severe acute pancreatitis. However, in mechanically ventilated patients with severe AP, APACHE may be preferred primarily rather than Ranson and CTSI.

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