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ORIGINAL ARTICLE / ARAŞTIRMA YAZISI

Radiology / Radyoloji

Evaluation of the Role of Computed Tomography Imaging Findings in Determining The Prognosis in Acute Pancreatitis Case by Comparison with Ranson Criteria

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ABSTRACT

Background/Purpose: Acute pancreatitis (AP) progresses with pathological changes. Therefore, the prognosis of the disease can be quite variable. In severe pancreatitis, local or systemic complications with high mortality may occur. Treatment of patients after diagnosis of AP depends on early assessment of disease severity. In this study, we aimed to evaluate the effectiveness of predicting pancreatitis severity and prognosis by comparing computerized tomography (CT) scan findings with Ranson criteria.

Methods: Patients aged 18 years and over who applied to our hospital with the diagnosis of AP between January 2018 and December 2020 were included in the study. We retrospectively analyzed 190 patients in order to determine the severity and prognosis of pancreatitis by comparing CT scan findings and Ranson criteria. Demographic, clinical, radiological and laboratory data of the patients at the time of admission were retrospectively analyzed. In laboratory data, hematocrit (HTC) decrease, blood urea nitrogen (BUN) increase, serum calcium (Ca) level, partial arterial oxygen pressure (PaO2), base deficit and fluid sequestration were evaluated. On CT findings, pancreatic expansion, pancreatic density, peripancreatic fluid collection, intra-abdominal ascites, peripancreatic fatty tissue heterogeneity, presence of peripancreatic lymph nodes, Wirsung duct diameter, presence of pathology in the gallbladder, hepatosteatosis, splenomegaly, splenic vein diameter were assessed.

Results: A statistically significant difference was found in the comparison of the degree of peripancreatic fluid collection and the severity of pancreatitis. There was no statistically significant difference in our other comparisons.

Conclusion: In general, studies are dominated by the opinion that the presence of necrosis in patients with AP may be a criterion for determining the prognosis. In our study, it was determined that the presence or absence of pancreatic necrosis in the CT performed at the time of admission was not a prognostic predictor. However, follow-up of necrosis in control imaging can be a marker in determining the prognosis.

Keywords: acute necrotizing pancreatitis, prognosis, computerized tomography

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Akut Pankreatit Tanısı Alan Olgularda Bilgisayarlı Tomografi Bulgularının Prognozu Belirlemedeki Rolünün Ranson Kriteri ile Karşılaştırılarak Değerlendirilmesi

ÖZET

Giriş/Amaç: Akut pankreatit (AP) patolojik değişikliklerle seyreder. Bu nedenle, hastalığın prognozu oldukça değişken olabilir. Şiddetli pankreatitte mortalitesi yüksek lokal veya sistemik komplikasyonlar ortaya çıkabilir. AP tanısından sonra hastaların tedavisi, hastalık şiddetinin erken zamanda değerlendirilmesine bağlıdır. Bu çalışmada bilgisayarlı tomografi (BT) tarama bulgularını Ranson kriterleri ile karşılaştırarak pankreatit şiddeti ve prognozunu tahmin etmedeki etkinliği değerlendirmeyi amaçladık.

Metot: Ocak 2018-Aralık 2020 tarihleri arasında hastanemize AP tanısı ile başvuran 18 yaş ve üzeri hastalar çalışmaya dahil edildi. BT tarama bulguları ve Ranson kriterlerini karşılaştırarak pankreatitin şiddetini ve prognozunu belirlemek için 190 hastayı retrospektif olarak inceledik. Hastaların başvuru anındaki demografik, klinik, radyolojik ve laboratuvar verileri retrospektif olarak incelendi. Laboratuvar verilerinde hematokrit (HTC) düşüşü, kan üre nitrojeni (BUN) artışı, serum kalsiyum (Ca) düzeyi, parsiyel arteriyel oksijen basıncı (PaO2), baz açığı ve sıvı sekestrasyonu değerlendirildi. BT bulgularında pankreas genişlemesi, pankreas yoğunluğu, peripankreatik sıvı toplanması, karın içi asit, peripankreatik yağ dokusu heterojenliği, peripankreatik lenf nodu varlığı, Wirsung kanal çapı, safra kesesinde patoloji varlığı, hepatosteatoz, splenomegali, splenik ven çapı değerlendirildi.

Bulgular: Peripankreatik sıvı toplanma derecesi ile pankreatit şiddeti karşılaştırıldığında istatistiksel olarak anlamlı fark bulundu. Diğer karşılaştırmalarımızda istatistiksel olarak anlamlı fark yoktu.

Sonuç: Çalışmalarda genel olarak AP'li hastalarda nekroz varlığının prognozu belirlemede bir kriter olabileceği görüşü hakimdir. Çalışmamızda başvuru anında çekilen BT'de pankreatik nekroz varlığının veya yokluğunun prognostik bir belirteç olmadığı belirlendi. Ancak kontrol görüntülemede nekrozun takibi prognozu belirlemede bir belirteç olabilir.

Anahtar Kelimeler: Akut nekrotizan pankreatit, prognoz, bilgisayarlı tomografi

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Acute pancreatitis (AP) progresses with pathological changes of varying severity, ranging from mild edematous pancreatitis to severe necrotizing pancreatitis. Therefore, the prognosis of the disease can be quite variable. In severe pancreatitis, local or systemic complications with high mortality may occur (1). Treatment of patients after diagnosis of AP depends on early assessment of disease severity. This assessment, based on objective parameters, is crucial for predicting clinical complications and identifying potentially fatal attacks known to occur in 2-10% of patients with AP (2,3). It is also important in terms of predicting the prognosis of the disease and determining and planning the need for systemic antibiotics, intensive care or surgical treatment. Many scoring systems have been developed for this purpose. Ranson, APACHE-II and Atlanta criteria are the most commonly used and known scoring systems (4,5).

Contrast-enhanced Computed tomography (CT) according to the Atlanta criteria is the first choice for imaging cases with prediagnosis of pancreatitis. Because it is easily accessible for acute patients and has a high degree of accuracy (6). On CT, the presence of pancreatic necrosis, pancreatic parenchymal and extrapancreatic fluid collections is evaluated and characterized. The presence of gallstones, biliary dilatation, venous thrombosis, aneurysms, inflammatory involvement of the gastrointestinal tract such as ascites and extra-pancreatic findings are defined (7).

In this study, we aimed to evaluate the effectiveness of predicting pancreatitis severity and prognosis by comparing CT scan findings with Ranson criteria.

MATERIALS and METHODS

Patients aged 18 years and over who applied to our hospital with the diagnosis of AP between January 2018 and December 2020 were included in the study. Ethical approval for this study was obtained from the Trakya University Study Ethics Committee (TÜTF-GOBAEK 2022/416) and written consent was received from all patients included in the study.

Patients who were being 18 years of age or older, meeting the diagnostic criteria for AP and having an abdominal CT image were included in the study. Patients who had missing laboratory data, pregnancy and technical inadequacy of CT imaging were excluded. A total of 204 patients were diagnosed with AP and underwent abdominal CT imaging, of whom six patients were excluded due to missing data and eight patients due to technical inadequacy of CT images. The number of patients included in the study was 190.

Demographic, clinical, radiological and laboratory data of the patients at the time of admission were retrospectively analyzed. In laboratory data, hematocrit (HTC) decrease, blood urea nitrogen (BUN) increase, serum calcium (Ca) level, partial arterial oxygen pressure (PaO2), base deficit and fluid sequestration were evaluated. On CT findings, pancreatic expansion, pancreatic density, peripancreatic fluid collection, intra-abdominal ascites, peripancreatic fatty tissue heterogeneity, presence of peripancreatic lymph nodes, Wirsung duct diameter, presence of pathology in the gallbladder, hepatosteatosis, splenomegaly, splenic vein diameter were assessed.

In the diagnosis of AP, typical abdominal pain, known as the Atlanta criteria, increase in serum amylase and/or lipase values more than 3 times the upper limit of normal, and imaging findings compatible with AP on CT were used (8). Patients with 2 or more of these findings were considered AP. Demographic, clinical and laboratory data of patients diagnosed with AP were recorded. CT studies were performed using an 8-channel Toshiba Aquilion 64 multislice device (Toshiba Medical Systems, Tokyo, Japan), and all images were interpreted with the PACS imaging system (Sectra PACS Linköping-Sweden). The radiologist with 15 years of experience interpreting CT images was unaware of the study and patient outcomes. Age, gender, vital signs and laboratory data of the patients were recorded. At the end of the study, the first 24-hour Ranson scores were calculated retrospectively using the clinical, laboratory and radiological imaging findings of the patients.

Statistical analysis was performed with Turcosa Analytics software. The conformity of the variables to the normal distribution was examined by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Descriptive analyses were given for normally distributed variables using mean, standard deviation and median. Pearson's Chi-Square and Fisher's Exact Tests were compared on 2x2 tables. In cases where the data did not show normal distribution, groups of 2 were evaluated with the Mann Whitney U test. Differences where the p value was less than 0.05 were considered statistically significant.

RESULTS

In our study, the data of 190 patients with a mean age of 63.6±16.1 (oldest 94, youngest 18) were analyzed retrospectively. Of the cases, 91 (47.8%) were male and 99 (52.2%) were female (Table 1).

Pancreatitis severity was divided into four categories as mild, moderate, severe and very severe. There were 56 patients with mild pancreatitis, 106 patients with moderate pancreatitis, 26 patients with severe pancreatitis and 2 patients with very severe pancreatitis.

On CT imaging, pancreatic expansion degree, amount of intra-abdominal ascites, peripancreatic fatty tissue heterogeneity and severity of pancreatitis were compared. There was no statistically significant difference between these CT findings and the severity of pancreatitis (Table 1).

Table 1. Comparison of demographic data with study groups

	Severity of Pancreatitis				p
	Mild	**Moderate**	**Severe**	**Very Severe**	
Age	58.3 (18-85)	64.9 (23-94)	68.6 (26-92)	80 (71-89)	0.003*
Sex					
Male n (%)	30 (32.9)	51 (56.1)	8 (8.8)	2 (2.2)	0.144**
Female n (%)	26 (26.3)	55 (56.5)	18 (18.2)	0	

*Note: Data were obtained by *Kruskal-wallis test ** Chi-square test. p<0.05 was considered statistically significant and statistically significant difference is highlighted in bold. Abbreviations; n: number of patients*

A statistically significant difference was found in the comparison of the degree of peripancreatic fluid collection and the severity of pancreatitis (Table 2).

On CT imaging, the presence of peripancreatic lymph nodes, the presence of gallbladder pathology, the degree of hepatosteatosis, the presence of splenomegaly, the presence of pancreatic-peripancreatic necrosis were compared with the severity of pancreatitis, and no statistically significant difference was detected between these CT findings and the severity of pancreatitis (Table 3).

No statistically significant difference was found in the comparison of the density of the pancreas (Hounsfield Unit, HU) with the severity of the disease on CT imaging (ANOVA, p=0.363, ANOVA, Figure 1).

The results of the Kruskal-Wallis test revealed that there was no statistically significant difference was observed in the comparison of the diameter of the main pancreatic duct (wirsung) and the severity of the disease on CT imaging (Kruskal-Wallis, p=0.503, Figure 2).

No statistically significant difference was found in the comparison of the splenic vein diameter and the severity of the disease on CT imaging (ANOVA, p=0.482, Figure 3).

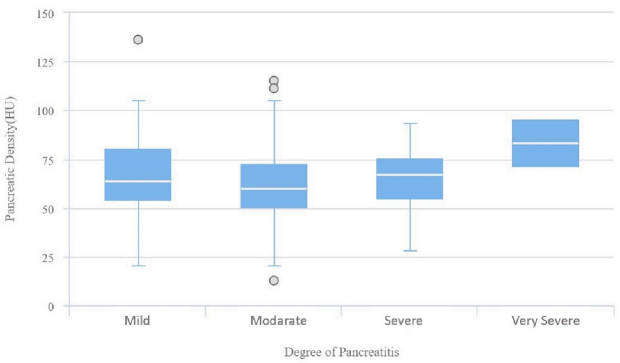

***Fig. 1** Comparison of pancreatic density (HU) on CT with the severity of the disease*

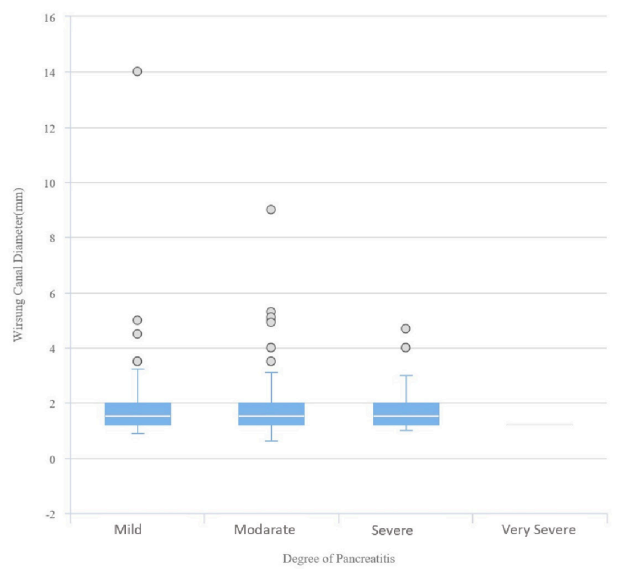

***Fig. 2** Comparison of wirsung diameter (mm) with disease severity on CT*

Table 2. Comparison of the degrees of CT findings and the severity of pancreatitis

		Severity of Pancreatitis				p
		Mild (n, %)	Moderate (n, %)	Severe (n, %)	Very Severe (n, %)	
Pancreas expansion on CT	Absent	12(%25.5)	29(%61.6)	6(%12.9)	0	0.705*
	Focal	13(%34.2)	21(%55.4)	3(%7.8)	1(%2.6)	
	Diffuse	31(%29.2)	56(%53.3)	17(%16.3)	1(%1.2)	
Peripancreatic fluid collection on CT	Minimal	25(%22.6)	68(%61.2)	16(%14.4)	2(%1.8)	0.042*
	Focal	14(%51.9)	8(%29.6)	5(%18.5)	0	
	Diffuse	17(%32.7)	30(%57.7)	5(%9.6)	0	
Intra-abdominal ascites	Absent	20(%25.3)	48(%60.8)	9(%11.4)	2(%2.5)	0.352*
	Mild	18(%26.5)	39(%57.4)	11(%16.1)	0	
	Moderate	16(%43.3)	17(%45.9)	4(%10.8)	0	
	Massive	2(%33.3)	2(%33.3)	2(%33.4)	0	
Peripancreatic fatty tissue heterogeneity on CT	No	10(%32.3)	19(%61.3)	2(%6.5)	0	0.551*
	Yes	46(%28.9)	87(%54.7)	24(%15.1)	2(%1.3)	

*Note: Data were obtained by * Chi-square test. Categorical variables are presented as counts (percentages).*
p<0.05 was considered statistically significant and statistically significant difference is highlighted in bold.
Abbreviations; n: number of patients, CT: computerized tomography

Table 3. Comparison of the degrees of CT findings with the severity of pancreatitis

		Severity of Pancreatitis				p
		Mild (n, %)	Moderate (n, %)	Severe (n, %)	Very Severe (n, %)	
Peripancreatic lymph node on CT	No	15(%27,3)	31(%56,4)	8(%14,5)	1(%1,8)	0.895*
	Yes	41(%30,4)	75(%55,5)	18(%13,3)	1(%0,8)	
Gallbladder pathology	Nonbiliary	5(%20,9)	17(%70,8)	2(%8,3)	0	0.445*
	Biliary	51(%30,7)	89(%53,6)	24(%14,5)	2(%1,2)	
Degree of hepatosteatosis	Absent	34(%27,4)	74(%59,7)	16(%12,9)	0	0.226*
	Mild	14(%35)	20(%50)	5(%12,5)	1(%2,5)	
	Moderate	5(%22,7)	11(%50)	5(%22,7)	1(%4,6)	
	Severe	3(%75)	1(%25)	0	0	
Splenomegaly	No	51(%28,5)	101(%56,5)	25(%13,9)	2(%1,1)	0.673*
	Yes	5(%45,4)	5(%45,4)	1(%9,2)	0	
Pancreatic-peripancreatic necrosis on CT	No	50(%29,3)	96(%56,1)	23(%13,4)	2(%1,2)	0.948*
	Yes	6(%31,6)	10(%52,6)	3(%15,8)	0	

*Note: Data were obtained by * Chi-square test. Categorical variables are presented as counts (percentages).*
p<0.05 was considered statistically significant and statistically significant difference is highlighted in bold. Abbreviations; n: number of patient, CT: computerized tomography

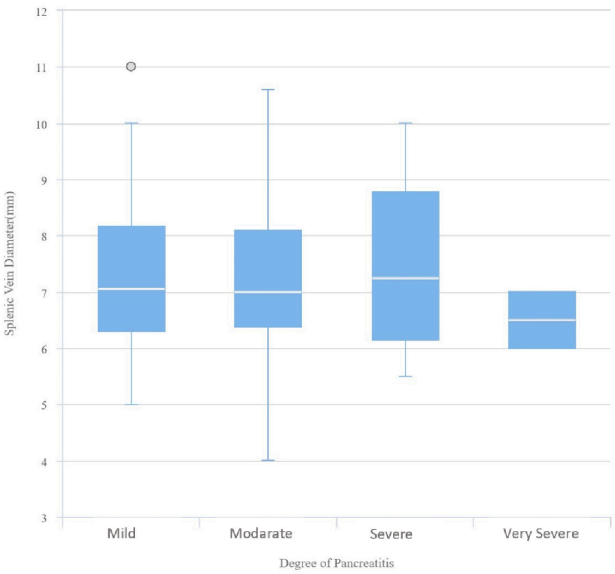

Fig. 3 *Comparison of the splenic vein diameter (mm) and the severity of the disease on CT*

DISCUSSION

In our study, of the patients admitted to our hospital and diagnosed with AP, the severity of the disease was evaluated to be mild in 56 (29.3%), moderate in 106 (55.5%), severe in 26 (13.6%), and very severe in 2 (0.5%) (according to Ranson criteria). In the studies available in the literature, they conducted research on prognosis prediction by scoring the severity of the disease on CT (CT severity score) in cases diagnosed with AP. We evaluated the CT criteria in this scoring system, in addition to splenic vein diameter, hepatosteatosis grade, splenomegaly, etc., by adding a few more criteria, and we separately evaluated whether they were effective in determining the prognosis. As a result of our study, a statistically significant difference was found only in the comparison of the degree of peripancreatic fluid collection and the severity of pancreatitis (p=0.042). Moreover, we concluded that the comparison of the CT findings at the time of application with the Ranson criteria, which we evaluated, did not have a predictive value or contribution of its own in determining the prognosis.

Shen et al (9,10) reported that the use of contrast-enhanced CT is not an accurate method for estimating severity in patients with pancreatitis. However, in another study, it has been shown to be superior to the Ranson criteria. In the study of Aphinives et al (11), it was found that the sensitivity of Ranson criteria was only 40.9%, while that of contrast-enhanced CT was 64.2%. However, the specificity of Ranson criteria was higher than CT (93.4% vs. 84.5%). Chand et al (12) showed that there was no statistically significant difference between Ranson criteria and Modified CT severity index (CTSI) in evaluating the outcome of AP among systemic complications. Although local complications were observed in patients with high Ranson score, the difference was not statistically significant. Kumar et al (13) showed that there was no significant difference between Ranson criteria and Modified CTSI in predicting pancreatic necrosis, organ failure, and intensive care unit hospitalization in patients with AP, with a p value of 0.10, 0.22, and 0.10 respectively.

Some CT findings have been suggested as an indicator of disease severity in AP. Meyrignac et al (14) measured the necrosis volume in adults with AP using a software and reported that an extrapancreatic necrosis volume greater than 100 ml was associated with organ dysfunction.

In general, studies are dominated by the opinion that the presence of necrosis in patients with AP may be a criterion for determining the prognosis. In our study, it was determined that the presence or absence of pancreatic necrosis in the CT performed at the time of admission was not a prognostic predictor. However, follow-up of necrosis in control imaging can be a marker in determining the prognosis.

Although CT is a very useful imaging method in diagnosing pancreatitis, CT imaging performed at the time of diagnosis does not provide sufficient information about the prognosis. An important criterion in this regard is how long after the onset of the patient's symptoms CT imaging is performed. In our study, the patients underwent CT imaging after an average of 24.1±23.8. hours. Pancreatic necrosis associated with severe AP usually occurs within 72 hours of disease onset. CT scan can be suspicious within 24-48 hours. Therefore, CT scan is recommended 72 hours after the onset of symptoms (15).

Limitations of our study include being a retrospective study and having a small number of patients. In addition, the fact that CT was performed at an average of 24 hours from the onset of symptoms can also be considered a limitation of our study.

CONCLUSION

Correlation was found between the parameters showing the severity of CT findings and the clinical parameters (Ranson, APACHE, etc.) evaluating the severity of AP in most of the studies. However, there was no general advantage. When we evaluated the criteria one by one, only one criterion (peripancreatic fluid collection) made a statistically significant difference. In this context, the contribution of CT in the diagnosis and prognosis of AP is clearly evident. However, with the combination of these findings, there is a need for larger and longer-term studies to be conducted in prospective cases, taking into account the CT hours at the time of diagnosis, in order to create a more quantitative prognostic prediction.

DECLARATIONS

Funding

Not applicable

Conflicts of Interest/Competing Interests

Authors declare no conflict of interest.

Ethics Approval

All protocols for this study were approved by the Trakya University Study Ethics Committee (TÜTF-GOBAEK 2022/416).

Availability of Data and Material (Data Transparency)

All data has been presented.

Authors' Contributions

All authors contributed to this work in accordance with the ICMJE authorship criteria.

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