Original Article

DOI: 10.56016/dahudermj.1279501

DAHUDER Medical Journal
e-ISSN: 2791-9250

The value of procalsitonin in determining the severity acute pancreatitis cases

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ABSTRACT

Objectives: Many markers and indication systems are being used to indicate the prognosis of acute pancreatitis. Our study was planned to investigate the importance of procalcitonin(PCT) in patients with severe pancreatitis in terms of predicting prognosis by comparing C-reactive protein , modified CT severity index, and duration of hospitalization.

Methods: In our cross-sectional retrospective study, 30 patients who were hospitalized with a diagnosis of A. pancreatitis were included in the study. Our study was conducted from January 2013 to January 2019 at Katip Çelebi University. PCT, CRP, duration of hospitalization, gender, age, CRE, CA, pleural effusion, and modified CT severity scores were recorded in all patients.

Results: Of the 30 patients included in the study,13 (43.33%) were male and 17(56.66%) were female. The presence of stones in 80% of patients was detected in 6.7% of patients due to hypertriglestrimia. The PCT value was found to be a minimum of 0.0 ng/ml, a maximum of 39.68 ng/ml, and an average of 1.97 ng/ml. There is a significant relationship between the PCT value and the length of hospitalization for the patients. The hospitalization period was a minimum of 3 days, a maximum of 23 days, and an average of 10.13 days in the 30 patients studied. It was determined that there was a statistically significant relationship between PCT and length of stay (r = 0.437; p 0.016).

Conclusion: In patients with A. pancreatitis, the evaluation of PCT, CRP, and modified CT severity index can be used to estimate the duration of hospitalization.

Keywords: acute pancreatitis, procalcitonin, modified CT severity index, CRP

Acute pancreatitis (AP) is known as the reversible inflammation of the pancreas. This inflammatory event may remain localized in the pancreas and may spread to the peripancreatic tissues and other organ systems.[1] The annual incidence of acute pancreatitis ranges from 13 to 45 per 100,000 people, with the incidence in men being more frequent than in women. Gallstones are responsible for 80-90% of acute pancreatitis cases and analysis is responsible for 10-20%. Alcoholism increases the incidence of gallstones in men and women. 10-15% of the cases are severe acute pancreatitis and 80% are syncretizing pancreatitis.[2]

It can be seen in acute pancreatitis from mild interstitial edema to necrotizing pancreatitis and infected pancreatic necrosis. It can occur in varying degrees from abdominal pain to hypotension, fluid sequestration, metabolic disorders, sepsis, and death.

Received: *April 8, 2023;* ***Accepted:*** *July 21, 2023;* ***Published Online:*** *July 29, 2023*

How to cite this article: *Zeynettin A, Demir İ, Akay HS. The value of procalsiton in determining the severity acute pancreatitis cases DAHUDER MJ 2023,3(3):85-90. DOI: 10.56016/dahudermj.1279501*

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Diagnosis of the disease; patient history, physical examination, serological markers, and radiological scoring systems have been developed to date. Ranson, APACHE II, and Atlanta classifications are the most used ones.[3] Many studies have proven the relationship between Ranson, APACHE-II, Glasgow, and Balthazar CT Severity Index and Serum procalcitonin in the prediction of acute pancreatitis.[4, 5]

In our study, we aimed to investigate the relationship between procalcitonin values, course of the disease, and length of hospitalization in patients with mild, moderate, and severe pancreatitis.

METHODS

Our study included 30 patients hospitalized with the a diagnosis of A. pancreatitis in Katip Çelebi University Atatürk Training and Research Hospital Gastroenterology, General Internal Medicine clinics between January 2013 and January 2019. Our study was supported by decision number 36 of the institutional ethics review board dated 14.02.2018.

The study was planned as retrospective in one center. The diagnosis of acute pancreatitis was made according to the coexistence of at least two or more of the following criteria in patients presenting with acute abdominal pain:

of back pain in the epigastric region,

-The presence of 3 times or more elevation in serum amylase and lipase values,

-Verification of pancreatitis table with imaging methods

In our study, a modified computed tomography (CT) severity index (Balthazar record) was used to classify the severity of the disease. Contrast-enhanced CT is recommended for imaging patients with AP and evaluating the severity of AP.[6] This scoring; The degree of necrosis was developed based on the presence of inflammation and fluid collections. The maximum score is 10, if the score is ≥ 6, there is a serious disease.

Patients were treated using accepted AP standard management. Oral intake for all patients was stopped immediately after hospitalization. Fluid therapy was administered, electrolyte disturbance was regulated, and analgesics were given. Systemic antibiotics were applied when necessary. Endoscopic retrograde cholangiopancreatography was performed in the first 24 hours in patients with suspected biliary angiography. Although the sensitivity and specificity of all these systems to predict severe AP vary between 55% and 90% depending on the timing of the record and the cutoff values of the parameters used, these recording systems required at least 48 hours to complete. In the study, CTs were taken 48-72 hours after admission.

According to the Atlanta criteria, mild and severe acute pancreatitis were differentiated in all patients and these numbers were recorded.

Since the patients recruited in our study were hospitalized in the emergency department, and because procalcitonin could not be measured in emergency conditions, the procalcitonin level was requested on the day of admission to our service. Procalcitonin was measured using Serum PCT concentration. A chemiluminescent immunoassay (LUMItest PCT, Brahms Diagnostica, Berlin, Germany). Analytical test sensitivity is about 0.1 ng/mL. Functional test sensitivity (20% coefficient of variation between tests) is approximately 0.3 ng/mL. In PCT, blood samples were centrifuged for 10 minutes (3,000 rotations per minute at -4 °C). Serum was removed and stored at -80 °C until being used for biochemical analysis.

Using the hospital computer system (probel), the age, gender, max proc, max CRP, Urea, Creatinine, Calcium, modified CT severity index score of the patient, pleural effusion, clinical follow-up notes, epicrisis notes and the duration of staying at the hospital were included. In addition, the number of surgical interventions (in numbers and types), ERCP requirements, interventional radiology procedures, and mortality, if any, during the hospitalization were recorded.

Blood samples were taken from the AP diagnosed hospitalized patients from the emergency department or polyclinics immediately after hospitalization. These blood tests were performed on the PCT Siemens Advia Centaur XPT immunoassay device (Siemens Healthcare GmbH, Erlangen, Germany). The reference range of the PCT kit is 0-0.1ng/mL. CRP, ALT, amylase, lipase, and Ca measurements were measured by the Abbott Architect c16000 spectrophotometer device. (Abbott Park, Illinois, USA) CRP reference range is 0-0.5 mg/dL, ALT reference range is 0-55 U/L, amylase reference range 25-125 U/L, lipase reference range 8-78 U/L, Ca reference range is 8.5-10.5 mg/dL. WBC was performed on a Sysmex XN 1000 complete blood count. (Wakinohama-Kaigandori Chuo-ku, Japan) WBC reference range 4-10 10 9 /L' was evaluated.

Statistical analysis

SPSS-24 software program was used for statistical analysis. The normality of numerical data was evaluated with the Shapiro-Wilk test. Normally distributed numerical data were expressed as mean and standard deviation, and non-normally distributed data were expressed as median and interquartile range. Independent Student's t-test was used to compare normally distributed data, and the Mann-Whitney U test was used to compare non-normally distributed data. The chi-square test and Fischer Exact test were used to compare categorical variables. Spearman correlation analysis was used to analyze the relationship between activity level and clinical variables.

RESULTS

Thirty patients with a definite diagnosis of acute pancreatitis were included in the study. The number and percentage of male patients was 13 (43.33%) and 17 (56.66%) were female; The youngest patient was 38 years old and the oldest patient was 93 years old. The mean age was 57.55 and the standard deviation was ± 16.3. Biliary causes were determined in 86.67% of patients, hypertriglyceridemia in 6.67% of patients, and drug-related in 6.67%. In the modified CT severity index 2 patients (6.7%) with pancreatic inflammation in acute pancreatitis with 0 points, 2 patients with 5 (16.7%) points, and 23 patients with 4 points (76.7%) were recorded. The number of patients with a pancreatic necrosis score of 0 was 25 (83.3%), 2 patients were 4 (13.3%), and the number of patients with 4 patients was 1 (3.39%). In the grading of extra pancreatic complications, the number of patients with a record of zero was 12 (40%), and the number of patients with a record of 2 was determined as 18 (60%). The number of patients with a modified CT severity index total recorded of 0 is 1 (3.3%), the number of patients with 2 is 6 (20%), the number of patients with 4 is 6 (20%), number of patients with 6 is 12 (40%), number of patients with 8 The number of patients with a record of 4 (13.3%) and a record of 10 was determined as 1 (3.3%). The minimum value of procalcitonin, which can be used to predict poor prognosis in patients diagnosed with acute pancreatitis, was 0.0ng/mL, and the maximum detected value was found to be 39.6800 ng/mL, with a mean of 1.9783 ± 7.2907. The minimum hospitalization period of the patients was 3 days, the maximum was 23 days, and the mean was 10.133 ± 5.20 days. The lowest value seen in CRP was 0.100, and the highest value was 32.2700, with an average of 15,639 ± 9,127. The lowest value of Creatinine was found to be 0.4600 and the highest value of 2.200 was found to be 0.845 ± 0.3068. BUN's lowest value 6 highest value is 29.00 mean of 14.36 ± 6.96. The lowest value of Calcium was 7.30 mg/dL and the highest value was 9.800 mg/dL with an average of 8.2933 ± 0.525. One of the systemic complications of acute pancreatitis is pleural effusion. In our study, the number of patients with pleural effusion was 14 (46.7%) and the number of patients without pleural effusion was found to be 16 (53.3%). Our study was conducted on a total of 30 patients aged between 38 and 93. In this study, the mean age was 57.55 years, and there was no statistically significant relationship between the investigated parameters and age and gender. In this study, we investigated the correlation of PCT values measured at admission with different parameters in patients hospitalized with the diagnosis of acute pancreatitis. The procalcitonin value was found to be a minimum of 0.0 ng/mL, maximum of 39.68 ng/mL average 1.97 ng/mL. There is a significant relationship between the procalcitonin value and the length of hospital stay of the patients. The hospitalization period was a minimum of 3 days, a maximum of 23 days, and an average of 10.13 days in 30 patients studied. It was determined that there was a statistically significant relationship between procalcitonin and length of hospital stay ($r = 0.437$; $p < 0.016$). In 30 patients investigated, CRP levels were found to be minimum of 0.1 mg/dL, a maximum 32.27 mg/dL, and a mean of 15.6393 mg/dL ($r = 0.653$; $p < 0.001$). It was determined that the relationship between the length of stay and modified CT severity index total score and the level of relationship with CRP were closed. CT severity index total scoring was found to be a minimum of 0, maximum of 10, and mean 5 No correlation was found between the modified CT severity index and PCT (p : 0.539). However, a positive correlation was found between the Modified CT severity index and CRP (p : 0.539), but a positive correlation was found between the Modified CT severity index and CRP ($p < 0.001$). In 30 patients studied, a negative correlation was found only with the modified CT severity index total score of serum calcium levels ($r= -0.483$; $p < 0.007$) The maximum calcium level was 9.8000 mg/dL and the minimum level was 7.3000 mg/dL.

DISCUSSION

Various recording systems are used to determine clinical severity and prognosis in acute pancreatitis. The main systems are Ranson criteria, Acute Physiology and Chronic Health Evaluation (APACHE) II score, Multiple Organ System Score (MOSS), Modified Glasgow, and Modified CT severity index scores.

The annual incidence of acute pancreatitis ranges from 13 to 45 per 100,000 people.[7] Clinical symptoms and signs in acute pancreatitis may vary depending on the age and severity of the attack. Sudden onset of abdominal pain, nausea, vomiting, and abdominal distention are common symptoms and signs.[8] The most common of these symptoms are abdominal pain felt in the epigastric region or the left upper quadrant. Although pain is often severe, it is not proportional to the severity of the disease.[9] Although in many studies there are differences between countries in the etiology, gallstones and alcohol are blamed in 90% of the cases. While alcohol occupies the first place in the etiology of AP in western countries, biliary causes are the first in our country.[10, 11] In our study, consistent with the literature, biliary causes were found in 86.67% of patients, hypertriglyceridemia in 6.67%, and drug-related in 6.67% of patients. The rate of acute biliary pancreatitis in women was 56.66%. The higher incidence of gallstone pancreatitis in women may be due to the higher incidence of gallstones in women, but the risk of developing gallstone pancreatitis is relatively higher in men than in women (relative risk12 vs. 25).[12] It is known that gender does not cause an increase in the severity and mortality of acute pancreatitis.[13] In our study, no significant difference was found between the male and female gender in terms of mortality and complications. It is more mortal in advanced age.[14, 15] In our study, pancreatitis was found with a similar frequency in both genders, which is consistent with the literature. Contrast-enhanced CT is considered the gold standard for the diagnosis of acute pancreatitis and the assessment of the severity of the disease.[16, 17] He found the diagnostic value of CT for acute pancreatitis to be 75-90%,18 CT defines anatomical structures better and can reveal complications such as pancreatic inflammation and necrosis.[19] CT is also helpful in determining clinical severity and prognosis. In acute pancreatitis, the pancreas may be normal at a rate of 14-28% on CT. Normal pancreas is generally associated with good clinical outcomes. The modified CT severity index provides standard grading for acute pancreatitis scoring to CT findings. In this score system, the degree of inflammation and necrosis in the pancreas defines the clinical severity. Although the subject of which tests should be requested in the diagnosis of acute pancreatitis is still controversial, an early CT scan comes to the first when the benefits of the Modified CT severity index score are taken into consideration. It is stated that routine CT repetition is not required during follow-up in patients whose Modified CT severity index score is between 0-3 in the early period, but control CT is recommended in this patient group in case of unexpected clinical worsening, abscess, pseudocyst and other complications.

In the study of Vriens et al., it was reported that early determination of the Modified CT severity index is an important prognostic indicator in determining complications and mortality. The higher the modified CT severity index score, the higher the mortality rate. While the mortality rate is 0% in patients with an index of 0-2, it is accepted as 17% in patients with an index of.[7-10, 13] There are many studies supporting this view.2 However, in the study of De Waele et al. in 2007, no correlation was found between the Modified CT severity index and mortality.[15, 17] In our study, a significant correlation was found between the modified CT severity index score and mortality, which is consistent with many studies in the literature. Our study shows that there is a significant correlation between the modified CT severity index score and the length of hospital stay ($p < 0.000$).

In the study of Zrnic et al., it was observed that CRP levels and disease severity were correlated in patients with AP. This is useful in predicting complications that may occur.[18] In the study of Dambrauskas et al., CRP and leukocyte values were found to be important distinguishing parameters in the development of infected pancreatic necrosis.[10] Similarly, in the study of Schütte et al., it was shown that erythrocyte sedimentation rate and CRP were successful in determining the severity of acute pancreatitis in the first 24 hours.[11] The synthesis of CRP starts very rapidly after a single stimulant, and serum concentrations rise above 5 mg/L around 6 hours, reaching pixelum concentrations around 48 hours. The plasma half-life of CRP is approx.

It is 19 hours and the only determinant of the circulating concentration of CRP is the rate of synthesis. Therefore, stimulation of CR production reflects the severity of pathological processes. CRP concentration is a very useful nonspecific biochemical marker for inflammation. CRP measurement provides important contributions in screening for organic

disease, monitoring the response to inflammation and infection treatment, and detecting concomitant infection in immunocompromised individuals.

In our study, it was determined that the high level of CRP affects the length of stay in line with the literature. It was observed that patients with high CRP values were hospitalized longer ($p < 0.001$).

In large study groups, procalcitonin was found to be more successful in demonstrating the severity of pancreatitis and the risk of developing necrosis compared to other inflammatory markers.[12, 13] In a prospective international multicenter study, it has been proven that procalcitonin plays a role in the development and prognosis of pancreatitis. In the study of Rau et al., procalcitonin and CRP values were compared and procalcitonin was found to be a more valuable marker in early diagnosis and prognosis. It has been shown that Ranson criteria and CRP level are correlated with the development of severe acute pancreatitis, but procalcitonin level is more effective when compared to procalcitonin level.[15] In our study, no correlation was found between the procalcitonin values at the time of hospitalization and the modified CT severity index score. However, in our study, a significant correlation was found between the procalcitonin value obtained at the first hospitalization of the patient and the duration of hospitalization ($p < 0.016$).

found prolonged hospitalization (≥ 8 days) in 46 (20%) of 231 mild AP patients.[16] The main determinants of prolonged hospitalization are symptoms associated with ongoing pancreatitis. Direct healthcare costs related to AP exceed $2.6 billion annually[16], with two-thirds of these costs associated with hospitalization.[17] The mean hospitalization period of the patients hospitalized with AP was 5.8 days in 1997 and 6.4 days in 2003. In the last ten years, the rate of hospitalization has decreased to 4.7 days.[5] This is probably due to a better understanding of the pathophysiology of AP and earlier diagnosis and treatment of complications. It is also an increase in awareness of reducing the cost of health care.

According to the experience of Harkirat Singh et.al.[18], a significant proportion of mild AP patients stay in the hospital longer than 4-5 days. The main reasons for long-term hospitalization are the presence of comorbidity, longer periods of fasting, ongoing abdominal pain, oral refeeding intolerance, the need for abdominal imaging and endoscopic retrograde cholangiopancreatography (ERCP) during hospitalization, and inadequate hydration therapy.

CONCLUSION

Acute pancreatitis was observed more frequently in women than in men. According to our study, biliary causes were the most common etiology, followed by hyperlipidemia and medication, respectively. According to our study, the duration of hospitalization can be estimated by calculating the CRP, procalcitonin, and modified CT severity index score, which may be related to the length of stay. Significant cost savings can be made and the mortality of the disease can be reduced by reducing the length of stay with symptom treatment and enteral nutrition of the patients. A single measurement of procalcitonin may not be sufficient to determine the prognosis, follow-up is more meaningful. Measurements should be made at 24-hour intervals. Larger prospective studies are needed to reveal the relationship between the severity of acute pancreatitis and serum procalcitonin.

Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding Sources

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Approval

The protocol of the study was approved by the Medical Ethics Committee of Izmir Katip Celebi University, İzmir, Turkey. (Decision number: 14.02.2018, date: 14.02.2018).

Authors' Contribution

Study Conception: AZ; Study Design: AZ; Supervision; HSA; Funding: AZ; Materials: AZ; Data Collection and/or Processing: AZ; Analysis and/or Data Interpretation: AZ, İD, HSA; Literature Review: İD; Critical Review: AZ; Manuscript preparing: AZ.

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