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Original Research Article

Computed tomography severity index and serum CRP concentration for predicting the severity of acute pancreatitis

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ABSTRACT

Background: The assessment of the severity of pancreatitis is important for management of this challenging disease. An accurate system which could predict the severity and identify the local extent and complications of a serious inflammation is beneficial for the patient outcome. The aim was to establish the value of the CTSI in predicting the severity of acute pancreatitis and to compare it with the accuracy of the serum CRP concentrations.
Methods: Prospective clinical study based on analysis of 55 patients. Each patient underwent thorough clinical and biochemical analysis and CECT abdomen. CTSI within 5 days, serum CRP level 48 hours after admission.
Results: The mean values of predictive markers in the mild and the severe pancreatitis groups were: computed tomography severity index 1.26 and 6.30 ($p<0.001$) and CRP 96.0 mg/l and 192.4 mg/l ($p<0.001$), respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated for the CTSI (greater than 3: 85%, 98%, 92%, 95%, and 95%) and for CRP (equal to, or greater than 150 mg/l: 85%, 74%, 50%, 94%, and 76%).
Conclusions: We found a close correlation with CRP levels and the CTSI of patients having severe pancreatitis and a CTSI score greater than 3 had a serum CRP level in excess of 150 mg/l. CRP is incapable of identifying local complications. The CTSI is a reliable method for staging the severity of acute pancreatitis and showing the local extent of the inflammation and the occurrence of local complications.

Keywords: Acute phase reaction, Inflammation, Pancreas

INTRODUCTION

Acute pancreatitis is highly variable in clinical presentation and severity. In the majority of patients, the course is mild and self-limiting, but in 20% of patients it may become fulminant and progress to multisystem organ failure and death.[1] Because of this potential for catastrophic deterioration, the stratification of injury severity is essential. It is necessary to manage these patients in an intensive care unit with early and aggressive treatment in order to improve outcome.

Both anatomic and physiologic criteria are used to stage the severity of acute pancreatitis.[1-3] The most common anatomic method of staging is based on contrast-enhanced computed tomography imaging. Balthazar and Robinson developed a grading system for severity based on CT findings. This computed tomography severity index (CTSI) is derived by assessing the degree of pancreatic and peripancreatic inflammation, fluid collection and parenchyma necrosis.[4,5] Contrast enhanced computed tomography is currently the best modality of evaluation of pancreas. It correlates patients' outcomes.

C- reactive protein is an inflammatory marker that peaks 48-72 hours after onset of pancreatitis and correlates with severity of pancreatitis. CRP levels 150 mg/l or more defines severe pancreatitis.[6,7]

The aim was to assess the value of the computed tomography severity index in predicting the severity of acute pancreatitis and to compare it with the accuracy of the serum CRP concentrations.

METHODS

This prospective clinical study is based on analysis of 55 patients with acute pancreatitis admitted to M.V.J. Medical College and Research Hospital from January 2019 to October 2019 (10 months).

Each patient underwent thorough clinical evaluation, biochemical analysis of blood and contrast enhanced abdominal CT. There were 18 men and 37 women. The mean age was 57 years (range: 23-98 years) (Table 1).

CRP levels were measured at 24, 48 and 72 hours after the onset of symptoms. The levels of CRP determined at 48 hours were used in this study and those higher than 150 mg/l were accepted as being indicative of severe inflammation as reported in previous studies.[5,8]

Contrast-enhanced abdominal CT was performed to assess the degree of pancreatic inflammation, pancreatitis-related fluid collections and necrosis within the first five days. The CTSI was calculated from the extent of inflammation and necrosis, and the presence of fluid collections.

Table 1: Fischer's exact test for comparison of Gallstones vs Other Causes.

	Mild pancreatitis (n=42)	Severe pancreatitis (n=13)	P value
	N (%)	N (%)	
Gender			0.314
Males	12 (28.6)	6 (46.2)	
Females	30 (71.4)	7 (53.8)	
Age, years mean (range)	56.1 (28-98)	60.3 (23-77)	0.391
Etiology			0.037
Gallstone	33 (78.5)	6 (46.2)	
Alcohol	-	4 (30.8)	
Idiopathic	7 (16.7)	2 (15.4)	
Hypertriglyceridemia	2 (4.8)	-	
Trauma	-	1 (7.7)	
Hospital stay, days mean (range)	10.3 (6-19)	21.4 (12-42)	<0.001
Mortality	-	1 (7.7)	0.236

The CTSI is scored as: normal gland (0 points), gland enlargement (1 point), peri pancreatic inflammation (2 points), single fluid collection (3 points) and multiple fluid collection (4 points). Extent of pancreatic necrosis: <30% (2 points), 30 to 50% (4 points), > 50% (6 points).[9]

The criteria of the severity of acute pancreatitis were based on the Atlanta classification including the presence of local (pancreatic necrosis, pseudocysts, abscess), and systemic complications (accompanying organ failure, renal failure, pulmonary insufficiency, shock e.g.).[10] The sensitivity, specificity, accuracy, and positive predictive values (PPVs), and negative predictive values (NPVs) of all parameters were calculated in order to evaluate their diagnostic capacity in identifying the severity of pancreatitis.

Inclusion criteria

All patients with clinical and laboratory diagnosis of Acute pancreatitis.

Exclusion criteria

Patients diagnosed other than pancreatitis.

Statistics

Results were expressed as mean±SE based on based on analysis of 55 patients with acute pancreatitis admitted to MVJ Medical College and Research Hospital from January 2019 to October 2019 (10 months). Statistical analyses were made using the Student t test, the Fisher's exact test, and the McNemar test and were carried out by means of the SPSS for Windows (version 13.0). P values less than 0.05 were accepted as statistically significant.

Ethical approval

Ethical approval was obtained from Institute Ethical Committee.

RESULTS

All 42 patients with acute mild pancreatitis according to the Atlanta classification have shown complete resolution with conservative treatment. 13 patients were classified as having severe disease and were monitored in the intensive care unit (ICU) due to local and/or systemic complications (necrosis less than 30% in 6, necrosis less

than 30% and renal failure in 3, necrosis between 30 and 50% in 3, and respiratory failure in one patients).

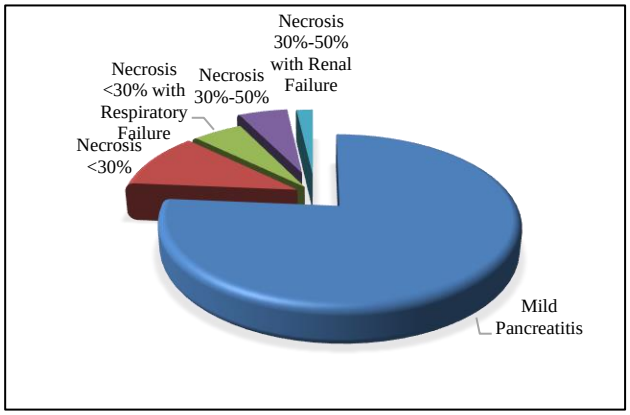

Figure 1: Grouping of patients according to Atlanta Classification into mild and severe pancreatitis.

The severity markers which were used in this study, were found to be significantly different between the mild and the severe groups (p<0.001) (Table 2).

Table 2: Comparison of severity markers in acute pancreatitis (Mean±SEM).

	Mild pancreatitis (n=42)	Severe pancreatitis (n=13)	P value
CTSI	1.26±0.14	6.30±0.41	<0.001
CRP (mg/dl)	96.0±8.2	192.4±15.6	<0.001

Table 3: The value of scoring system for predicting the severity of pancreatitis.

	CTSI (>3)	CRP (≥150 mg/l)
Sensitivity	11/13 (84.6%)	11/13 (84.6%)
Specificity	41/42 (97.6%)	31/42 (73.8%)
Positive predictive value (PPV)	11/12 (91.7%)	11/22 (50.0%)
Negative predictive value (NPV)	41/43 (95.4%)	31/33 (93.9%)
Accuracy	52/55 (94.5%)	42/55 (76.4%)

CTSI versus CRP; p=0.013

DISCUSSION

The majority of patients with acute pancreatitis have mild disease and their clinical symptoms and laboratory findings resolve with supportive care within 3 to 5 days. On the contrary, severe pancreatitis is associated with organ failure and local complications such as necrosis, abscess formation and pseudocysts, and constitutes 15-20% of such cases.[1,2,10]

Serum CRP is an acute phase reactant, which is elevated in various inflammatory conditions, and serves as a nonspecific inflammation marker. It is easy and economical to measure the CRP serum level. CRP is a proven predictor of severity for acute pancreatitis when serum level over 150 mg/l is measured at 48 hours after the onset of symptoms.[11-13] Significantly higher serum concentrations of CRP in our patients with severe disease have shown the value of this easy detectable marker.

Neoptolemos et al have also found that CRP concentrations were significantly different between mild and severe pancreatitis cases at 48 hours, but not at 24 hours.[14] The sensitivity and the positive predictive values of serum CRP levels in patients with severe pancreatitis have been reported to be 83 to 100%, and 37 to 77%, respectively.[8]

In our study, the sensitivity (84%), the specificity (73%) and the PPVs (50.1%) of serum CRP measurements have revealed their potential to determine the severity of the disease. These rates were not considerably high but the advantage of easily measuring the CRP level by blood chemistry outweighs these relatively lower values.

Arvanitakis et al have investigated the correlation between magnetic resonance imaging (MRI) and clinical outcome.[15] They have demonstrated that MRI on admission correlated with CRP levels at 48 hours after admission.

Balthazar et al have shown that contrast-enhanced computed tomography assessment correlated with the clinical course of the disease and with the prediction of mortality. Score and mortality rate were as follows <3- 3%, 4-6- 6% and 7-10- 17%.

Similarly, the higher CTSI scores in our severe pancreatitis cases with local and/or systemic complications have predicted the complicated course of the disease when compared with the CTSI score of the mild group.

Simchuk et al have shown that there was a correlation not only with the CTSI score and the mortality rate but also with the duration of the hospital stay and the need for necrosectomy.[12]

In our study, a CTSI score greater than 3 suggested was indicative of a longer hospital stay and a higher complication rate than in cases with a lower CTSI score. Contrast-enhanced computed tomography provides a better and earlier recognition of such a risk as compared to other scoring systems.[5,12,16,17]

In our study, the sensitivity of CRP measurement was comparable with the CTSI study found a close correlation with CRP levels and the CTSI, so high that 91% (10/11) of patients having severe pancreatitis and a CTSI score greater than 3 had a serum CRP level in excess of 150 mg/l. CRP is incapable of identifying local complications. Additionally, computed tomography has

the ability of detecting the extent of local inflammation and the presence of local complications.

This study has some limitations. CRP level should be measured at 48 hours of onset of disease and it will not identify local complications. CT severity index is usually not indicated for mild inflammation, used when diagnosis is in doubt and no improvement with conservative management after 72 hours of onset of disease because within 72 hours it may underestimate the extent of necrosis.

CONCLUSION

Study concluded that scoring systems allow us to target patients with high scores for close monitoring and more aggressive intervention. The CTSI correlates to the clinical course, severity of disease, and has better accuracy rates when compared with CRP level.

Enhanced computed tomography is advantageous in establishing the extent of local inflammation and the occurrence of local complications.

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