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A Comparative Study of Assessment of Different Parameters for Assessing Severity of Acute Pancreatitis

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Abstract
Introduction: *The need for assessing the severity of acute pancreatitis is because the management and prognosis are mainly decided by the severity of the disease. A parameter with high positive predictive value and accuracy which could be best correlated with clinical course, severity and identifies the local extent and complications, is beneficial for proper planning and management of the patient.*
Materials and Methods: *This was a prospective study conducted over 2 years period on admitted cases of acute pancreatitis. Total 157 patients were selected for study. All data regarding APACHE II Score, CT severity index and C - reactive protein parameter for assessing the prognosis of acute pancreatitis were analysed to find out best indicator.*
Results: *According to APACHE II scoring system 73.2% categorised as mild whereas 26.8% into severe groups. As per CT severity index, 79% patients were categorised in mild and 21 % in severe group. CRP level showed 61.7% in mild group whereas 38.3% in severe group. In our study CT Severity index showed highest sensitivity (84.2%), specificity (97.4%), positive predictive value (91.4%) negative predictive value (95%) and accuracy (94.2%), compared to APACHE II score and CRP levels.*
Conclusion: *The comparative study between different scoring systems, CTSI had the highest PPV, NPV, sensitivity, specificity and accuracy and best correlated with the clinical course of the disease and was able to detect the extent of local inflammation and the occurrence of local complications.*
Keywords: *Acute Pancreatitis, Atlanta classification, APACHE II score, CT Severity Index, C - reactive protein.*

Introduction

Clinical presentation and severity of acute pancreatitis varies in each patient from mild to severe. The Atlanta classification of acute pancreatitis divides patients into mild and severe groups based on clinical and biochemical criteria. Over the years there have been several critical assessments of this classification and in 2008 the acute pancreatitis working group incorporated a morphologic, imaging (CECT) based criteria to establish a more accurate classification. [1]

The need for assessing the severity of acute pancreatitis is because the management and prognosis are mainly decided by the severity of

the disease. Mild pancreatitis responds well to supportive therapy while severe pancreatitis requires very intensive management and has a grave prognosis. [2]

The various clinical, radiological and biochemical parameters and severity scoring systems help in deciding the management protocol and in assessing the progress of the patient. Both anatomic and physiologic criteria are used to stage the severity of acute pancreatitis. [3]

Attempts have been made for severity assessment of acute pancreatitis ever since 20th century. The prediction of severity in acute pancreatitis was first suggested by John HC Ranson in 1974. [4] However, a more recent comprehensive evaluation of 110 studies concluded that Ranson signs provided very poor predictive power of severity of acute pancreatitis. [5]

The most common anatomic method of staging is based on contrast enhanced computed tomography imaging. The computed tomography severity index (CTSI) is derived by assessing the degree of pancreatic and peripancreatitic inflammation, fluid collection and parenchymal necrosis.[6] E J Balthazar et al (1990) did contrast enhanced computed tomography (CECT) study of acute pancreatitis and concluded that patients with a high CT severity index had 92% morbidity and 17% mortality, patients with a low CT severity index had 2% morbidity and none died.[7] The numerical CTSI has a maximum of ten points and is the sum of the Balthazar grade (Table1) and necrosis score points (Table 2).[8]

Severity index = CT grade + percentage of necrosis (points)

Mild (0-3), moderate (4-6), severe (7-10).

The prognostic value of early CT in acute pancreatitis, the role of pancreatic necrosis as an indicator of prognosis was investigated by Dario J, et al (2004). He did a retrospective study of 148 patients with acute pancreatitis. All complications (n=15) and deaths (n=4) occurred in patients with a CT grade of severe disease. CT grade has sensitivity and specificity of 100% and 61.5% respectively for predicting morbidity and 100% and 56.9% for predicting mortality. The 13 patients with necrosis were all in the severe groups. Necrosis detection on early CT had sensitivity and specificity of 53.3% and 90.2% respectively for predicting morbidity and 75% and 83% for mortality. [9]

Table 1. Balthazar Grade or CT severity index

CT grade	Appearance on CT	CT grade points
A	Normal pancreas	0
B	Focal or diffuse enlargement of the pancreas	1
C	Inflammation - pancreas and/or peripancreatic fat	2
D	Single ill defined peripancreatic fluid collection	3
E	Two or more ill defined peripancreatic fluid collections	4

Table 2. Necrosis score

Necrosis percentage	Points
No necrosis	0
0-30% necrosis	2
30-50% necrosis	4
Over 50% necrosis	6

More recently the Acute Physiology and Chronic Health Evaluation II score (APACHE II) score has been proposed for the assessment of the severity of acute pancreatitis. [10] The components are chronic organ failure, acute renal failure, age, body temperature, heart rate, mean blood pressure, respiratory rate, serum creatinine, serum sodium, serum potassium, serum calcium, hematocrit, WBC count, Ph, Glasgow coma scale, PaO2. The point score is calculated from routine physiological measurements during the first 24 hours after admission.[11] Scores higher than 7 were likely to have severe disease. The advantage of the APACHE II score was the availability of this information within the first 24 hours and daily. An APACHE II score that increases during the first 48 hour strongly suggestive of the development of severe pancreatitis, where as APACHE II score that decreases within the first 48 hour strongly suggests mild pancreatitis. The sensitivity and specificity of the APACHE II system for assessing severe acute pancreatitis at the time of admission are 75% and 79% respectively. [12]

The acute phase reactant C reactive protein (CRP) is the best established and most available predictor of inflammation although this marker is not valid until 48-72 hours after the onset of pain. [3, 13, 14] The CRP assay is cheap, widely available, and fast to perform but lacks specificity. It has been reported to be a prognostic indicator of disease severity with a sensitivity of 80%. [15]

Materials and Methods

This was a prospective study conducted over 157 patients admitted with acute pancreatitis over 2 years period. Informed consent was taken from each patient on the day of admission. The study protocol conformed to the ethical guidelines laid down by the ethical committee. Patients were categorized under mild and severe pancreatitis groups according to various severity scoring systems. All data regarding clinical, radiological and biochemical parameter were analysed to find out best indicator for assessing the prognosis of acute pancreatitis.

APACHE II score and CRP level was calculated at 48 hours after admission and was taken as the clinical and Biochemical parameter respectively for severity assessment. CT severity index (CTSI) was considered as the radiological parameter for severity assessment.

Comparative study between APACHE II, CRP and CTSI

Patients were categorised as mild and severe acute pancreatitis as per the Atlanta classification.[1] According to this classification mild acute pancreatitis included patients with absence of organ failure or the presence of organ failure that does not exceed 48 hours in duration. In severe acute pancreatitis there is persistence of organ failure recorded at least once during each of three consecutive days. It includes the presence of local (pancreatic necrosis, pseudocysts, abscess), and systemic complications (accompanying organ failure, renal failure, pulmonary insufficiency, shock). [1]

APACHE II score were calculated at 48 hours. Scores ≤7 were considered as mild and score >7 as severe disease. [6, 16]

CRP levels were measured at 24, 48, and 72 hours after onset of symptoms. The levels of CRP determined at 48 hours were used in this study and higher than 150 mg/L were accepted as being indicator of severe inflammation. Levels ≤150 mg/L was considered with mild disease. [3]

Intravenous contrast enhanced abdominal CT was performed to assess the degree of pancreatic inflammation, pancreatitis related fluid collection and necrosis. The CTSI was calculated from the extent of inflammation and necrosis and the presence of fluid collections.[7]

Comparison between APACHE II score, CRP levels and CTSI scores was done keeping Atlanta classification as standard. Results were expressed as sensitivity, specificity, accuracy, and positive predictive values (PPV) and negative predictive values (NPV) of all parameters and their diagnostic capacity in identifying the severity of pancreatitis was assessed.

Results were expressed as mean ± standard error. Statistical analysis was made using student t test and chi square test were carried out by means of SPPS for windows. p value less than 0.05 were accepted as statistically significant.

Results

As per Atlanta classification, 119 patients (75.8%) had acute mild pancreatitis and 38 patients (24.2%) had acute severe pancreatitis in our study. (Table 3)

This categorisation of mild and severe acute pancreatitis regarded as standard for comparing other parameters.

Clinical parameter

APACHE II: score ≤7: acute mild pancreatitis

Score >7: acute severe pancreatitis

Among total patients (n=157) according to APACHE II scoring system 73.2% (n=115) categorised as mild whereas 26.8% (n=42) into severe groups. (Table4)

Table 3.Gender wise distribution of mild and severe cases of acute pancreatitis as per Atlanta classification

Gender	Mild acute pancreatitis (n=119)	Severe acute pancreatitis (n=38)
Female	79(66.3%)	23(60.5%)
Male	40(33.7%)	15(39.5%)
Total	119 (100%)	38 (100%)

Table 4: Mild and Severe cases according to APACHE II scoring system

APACHE II score	No. Of patients (n=157)	%
Mild	115	73.2
Severe	42	26.8

Table 5: mild and severe case according to CT severity Index

CTSI	No. Of patients (n=157)	%
Mild	124	79
Severe	33	21

Radiological parameter

CTSI: score ≤3: mild pancreatitis

Score >3: severe pancreatitis

According to CT severity index, 79% (n=124) patients were categorised in mild and 21% (n=33) in severe group. (Table5)

Biochemical parameter:

CRP: Levels ≤150 mg/L: AP with mild inflammation

Levels >150 mg/L: AP with severe inflammation

CRP level showed 61.7% (n=97) in mild group whereas 38.3% (n=60) in severe group. (Table6)

Comparison of three parameters: APACHE II, CTSI and CRP

CTSI showed highest Sensitivity (84.2%), Specificity (97.4%), PPV (91.4%), NPV (95%) and Accuracy (94.2%) in predicting the severity of acute pancreatitis. (Table7)

Table 6: mild and severe case according to CRP levels

CRP level	No. Of patients (n=157)	%
Mild	97	61.7
Severe	60	38.3

Table 7. The values of scoring systems for predicting the severity of pancreatitis

	CTSI(>3)	APACHE II (>7)	CRP (>150 mg/L)
Sensitivity	32/38(84.2%)	23/38(60.5%)	31/38(81.5%)
Specificity	116/119(97.4%)	101/119(84.8%)	88/119(73.9%)
Positive predictive value(PPV)	32/35(91.4%)	23/41(56%)	31/62(50%)
Negative predictive value(NPV)	116/122(95%)	101/116(87%)	88/95(92.6%)
Accuracy	148/157(94.2%)	124/157(79%)	79/104(76%)

Discussion

This study was conducted over two years period to find out the best indicator for assessing the severity of acute pancreatitis among clinical, radiological and biochemical parameter. This was a prospective study which conducted over 157 diagnosed cases of acute Pancreatitis. This study was carried out between the clinical (APACHE II score), biochemical (CRP levels) and radiological (CT severity index score) parameters for assessing the severity of the disease. Patients were classified as acute mild pancreatitis and acute severe pancreatitis according to Atlanta classification. [1]

Out of 157, 119(75.8%) patients had acute mild pancreatitis and 38(24.2%) were classified as acute severe pancreatitis. Acute pancreatitis found to be more common in females (n=102)65% as compared to males (n=55)35%. Study conducted on 104 patients showed same finding with female to male ratio 1.8:1. [16]

In our study, the positive predictive value (PPV) of CTSI was 91.4%; sensitivity and specificity were 84.2% and 97.4% respectively. The PPV of APACHE II was found to be lower (56%) at 48 hours after admission, Larvin and McMahon[17] have shown that he APACHE II score had PPV as 67% and 71% at 24 and 48 hours after admission. In our study, the sensitivity (60.5%) and specificity (84.8%) of APACHE II were comparable with previous findings. Osvaldt et al. [18] have reported the sensitivity and specificity to be 75% and 79%, respectively.

The sensitivity and 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. [3] In our study, the sensitivity (81.5%) and specificity (73.9%) and the PPV (50%) of serum CRP measurement 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.

The APACHE II system allows monitoring of disease progression and response to therapy but the system is complex, more difficult to perform and is less accurate for identification of local complications.[19]

Contrast enhanced computed tomography assessment and CTSI calculation requires expertise. The APACHE II system is complex and has a low accuracy rate in identifying local complications. The serum CRP level is easily detectable using blood chemistry and it is the most economical marker for severity of inflammation.

In our study, the sensitivity of CRP (81.5%) measurement was comparable with the CTSI (84.2%). the complex APACHE II system is no advantageous when compared to the easily detectable CRP concentration, having a lower sensitivity, and comparable PPV and accuracy rates. These two markers (APACHE II and CRP) are incapable of identifying local complications. The highest (sensitivity, specificity, PPV, NPV, and accuracy) rates of a CTSI score greater than 3 according to the other two markers of our study have supported the value of enhanced computed tomography evaluation for determining the severity of acute pancreatitis. Additionally, computed tomography has the ability of detecting the extent of local inflammation and the presence of local complications.

We concluded that CTSI correlates to the clinical course, severity of disease, and has better accuracy rates when compared with APACHE II score and CRP level. Enhanced computed tomography is advantageous in establishing the extent of local inflammation and the occurrence of local complications.

Conclusion

The comparative study between severity prediction by APACHE II score, CRP levels and CT severity index revealed significant results. Among the 3 scoring systems, CTSI had the highest PPV (91.4%), sensitivity (84.2%), specificity (97.4%) and accuracy (94.2%) and best correlated with the clinical course of the disease and was able to detect the extent of local inflammation and the occurrence of local complications.

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