

Assessing the Severity of Acute Pancreatitis with CT Severity Index and Other Conventional Methods in a Tertiary Care Hospital in Tamil Nadu, India – A Comparative Cross-Sectional Study

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ABSTRACT

BACKGROUND

Acute pancreatitis is not uncommon in surgical practice with variable clinical presentation. Because of its potential notable catastrophic complications, it is mandatory to assess the severity at the earliest. In recent times, the decision making in the management is quite difficult due to its complications and outcome. So, an objective assessment of severity based on clinical and laboratory scoring verses computed tomography (CT) severity is still debate, hence the need for study. The purpose of this study was to compare the efficiency of CT severity index verses APACHE II and Ranson criteria in predicting the severity of acute pancreatitis.

METHODS

A total number of 36 consecutive cases of acute pancreatitis who were admitted between January 2013 and December 2014 in Apollo Specialty Hospitals – Madurai were included in the study. Written informed consent was obtained from all study participants.

RESULTS

In our study, out of 36 patients, 30 (83.33 %) were males and 6 (16.66 %) were females. The sex distribution shows a clear male predominance. Most of the patients in the present study belonged to the middle age group. Alcohol was the most common cause accounting for 41.7 % of the cases followed by the biliary pathology. CT severity index was the superior tool for prediction of the prognosis and early complications.

CONCLUSIONS

When using contrast enhanced computed tomography, it was found that there was a significant correlation between the development of organ failure and severity of pancreatitis. The specificity, sensitivity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of Ranson and acute physiology and chronic health evaluation – II (APACHE II) at 48 hours of admission with acute pancreatitis does not correlate in determining the severity of acute pancreatitis.

KEYWORDS

Acute Pancreatitis, Severity Markers, CT Severity Index

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BACKGROUND

Acute pancreatitis can be mild or severe. Mild pancreatitis is also called as interstitial or oedematous pancreatitis. It is less severe and there is minimal organ failure. Recovery is uneventful. Severe pancreatitis is also known as necrotizing pancreatitis. It accounts for 20 % of patients. It is associated with organ failure and or local complications including necrosis, infection, or pseudo cyst formation.¹ The severity of acute pancreatitis is essential because it helps in prognostication as well as selection of therapy. Mild pancreatitis responds well to supportive therapy, whereas severe pancreatitis requires intensive monitoring and specific therapies and has a more guarded prognosis.^{1,2}

An ideal prognostic method that allows differentiation between patients with mild and with severe pancreatitis should be accurate, easy to use, and widely available and should have low inter observer variability.^{3,4} It should correlate well with the disease process, so that patients who are likely to develop complications can be identified and be treated immediately.

A proper analysis of the severity of pancreatitis requires thorough laboratory evaluation and clinical assessment. (mainly numeric system). Over the years, many clinical criteria (numeric systems) have evolved for this purpose. Few such criteria are – Ranson's criteria,⁵ the acute physiology and chronic health evaluation (APACHE II) scoring system⁶ and computed tomography severity index (CT severity index).^{7,8}

Numeric systems (APACHE II, Ranson's criteria) are used today extensively to identify organ failure. The data thus acquired data indirectly indicates the severity of the disease. The sensitivity of these numeric systems is approximately 70 %.

Individual risk factors evaluated using laboratory tests (markers of pancreatitis injury and inflammatory response) can be used to help in prognostication. Several such individual markers were evaluated in research settings. Their clinical usefulness is yet to be determined.

Contrast enhanced computed tomography (CECT) is the imaging modality of choice to help to stage the severity of inflammatory processes, determine the extent of necrosis of the pancreas, and complications that could have occurred locally.

After four days of onset of necrosis of the pancreas, CT is known to have an early detection rate of 90 % with nearly 100 % sensitivity. Hence, it was decided to perform prospective study of usefulness of CT severity index in assessing the patients of acute pancreatitis who were admitted in our hospital over a period of two years.

Aims and Objectives

To assess the efficiency of CT severity index in diagnosing the severity of acute pancreatitis when compared to other numeric systems in practice.

METHODS

A total of 47 cases were diagnosed as having acute pancreatitis between January 2013 and December 2014. But only 36 cases of acute pancreatitis satisfied the inclusion and exclusion criteria. These 36 cases admitted in Apollo Specialty Hospital, Madurai were prospectively studied after obtaining a written informed consent. The study was conducted after approval from the hospital ethics committee.

Inclusion Criteria

- All patients diagnosed with acute pancreatitis between the ages of 18 to 75 years.
- Symptom onset less than 72 hours before CT examination.

Exclusion Criteria

- Pregnant women diagnosed with acute pancreatitis.
- Patient diagnosed to have acute or chronic pancreatitis.
- Patient with contraindications for intravenous iodinated contrast agents according to protocols adopted by the respective CT units.

All patients included in the study underwent thorough clinical assessment and laboratory investigations. After obtaining the necessary laboratory profile values and radiological studies, it was decided to determine whether the CT severity index was better in assessing the outcome of the acute pancreatitis patients when compared to other numeric systems. All investigation were repeated at 48 hours to create a Ranson's score, APACHE II evaluation and CT severity index to assign the severity of pancreatitis at 72 hours.

The severity of acute pancreatitis was determined using criteria which based on the Atlanta criteria 11" The Atlanta criteria divided severity of acute pancreatitis into 'mild acute pancreatitis' in which there are no systemic complications or local complication and 'severe acute pancreatitis' which include the presence of both local and systemic complications.

If the Ranson's score is < 3, then severe pancreatitis is unlikely. If the score is ≥ 3, then it is considered as severe pancreatitis. Acute physiology and chronic health education (APACHE) score 15 was used at the time of admission and at 48 hours after admission. Scores with > 8 points were considered likely to have severe disease.

Computed Tomography Severity Index

Using spiral CT scan, abdominal CT was done. Before and after injecting the contrast, 5 mm axial slices were taken. After assessing the extent of necrosis and inflammation, and the presence or absence of fluid collection CTSI was calculated.

CTSI is determined as

1. Gland is normal (0 points),
2. Gland is enlarged (1 point),

3. Presence of peripancreatic inflammation (2 points),
4. There is only one fluid collection (3 points)
5. There are multiple fluid collections (4 points),
6. Extent of pancreatitis necrosis is less than 30 % (2 points),
7. Extent of pancreatic necrosis is between 30 and 50 % (4 points) and
8. Extent of pancreatic necrosis is more than 50 % (6 points).

Statistical Analysis

Data was described as percentages, frequencies, mean and standard deviation. The diagnostic value of each method of severity index was expressed as its positive predictive value, negative predictive value, accuracy, the area under the receiver operating characteristic curve (ROC), sensitivity, and specificity. Student t test was used to compare the mean scores obtained in each method between mild and severe pancreatitis. P-value less than 0.05 was considered as statistically significant. All statistical analysis was done by IBM Statistical Package for Social Sciences (SPSS) software version 16.

RESULTS

Majority of the patients in the present study were males accounting for 83.3 % and the rest were females (16.7 %). Most of the patients were between 30 years and 50 years of age. The mean age of presentation was 40. The minimum age of presentation was found to be 19 years and maximum age of presentation was found to be 74 years. The common aetiology was alcohol (47.2 %), followed by biliary pathology (33.3 %) and idiopathic (19.4 %). The commonest complication was acute respiratory distress syndrome (ARDS) (16.7 %) followed by pancreatic ascitis (13.9 %), pleural effusion (13.9 %). Shock, renal failure and necrosis were found in 11.1 % each. The least was pseudo cyst accounting for 2.8 %.

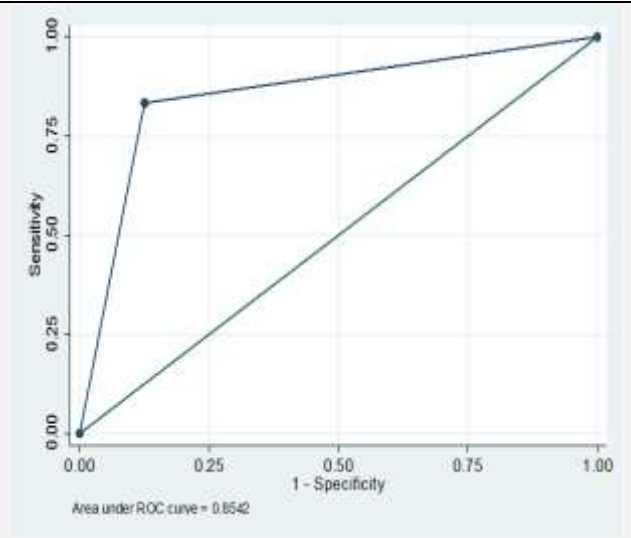


Figure 1. Area Under Curve – Ranson's Score

Correlation of Ranson with Severity of Acute Pancreatitis

Out of 24 mild cases of acute pancreatitis, 21 (87.5 %) cases were shown to have milder form of acute pancreatitis by Ranson's score, but 3 (12.5 %) patients had complications which were not detected by Ranson's score.

The sensitivity and specificity were found to be 76.9 % and 91.3 % respectively. The PPV, NPV was 83.3 %, 87.5 % respectively with good discriminatory ability, area under the curve (AUC) was 0.85 (0.72 - 0.98) with accuracy of 86.1 %. The high negative predictive value (NPV) of 87.5 % allows this score to exclude severe acute pancreatitis outcome.

Correlation of APACHE II with Severity of Acute Pancreatitis

Out of 24 mild cases of acute pancreatitis, 19 (79.16 %) cases were found to have milder form of acute pancreatitis by APACHE II but 5 (20.83 %) patients had complications which were not detected by APACHE II.

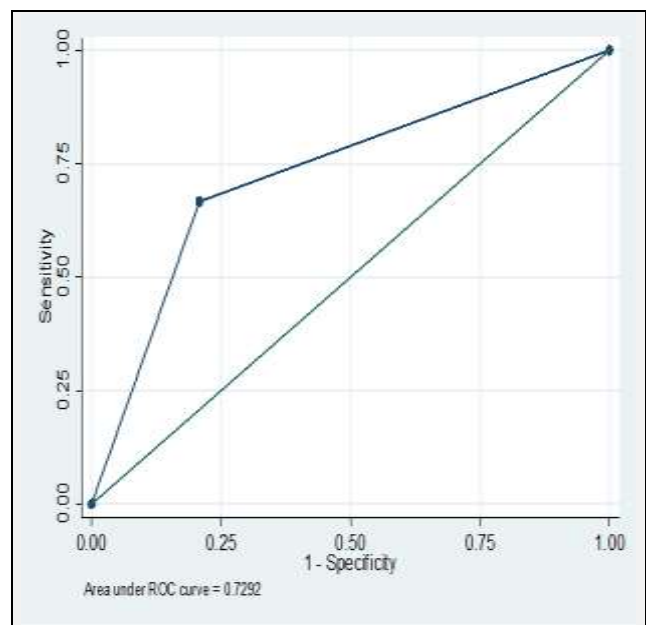


Figure 2. Area Under Curve of APACHE II

The sensitivity and specificity of APACHE II were found to be 61.5 % and 82.6 % respectively. The PPV, NPV, and accuracy were 66.7 %, 79.2 % and 75 % respectively. APACHE II had the ability of predicting severe acute pancreatitis of AUC 0.73 (0.57 - 0.89).

Correlation of CT with Severity of Acute Pancreatitis

In severe cases of acute pancreatitis, the correlation between CT severity index (CTSI) and the prognosis (p < 0.001) was significance.

CTSI had a sensitivity of 84.6 % and specificity of 95.7 %. The area under the curve had excellent discrimination of 0.92 (0.82 - 1.00) with accuracy of 91.7 %. The PPV and NPV was 91.7 % and 91.7 % respectively.

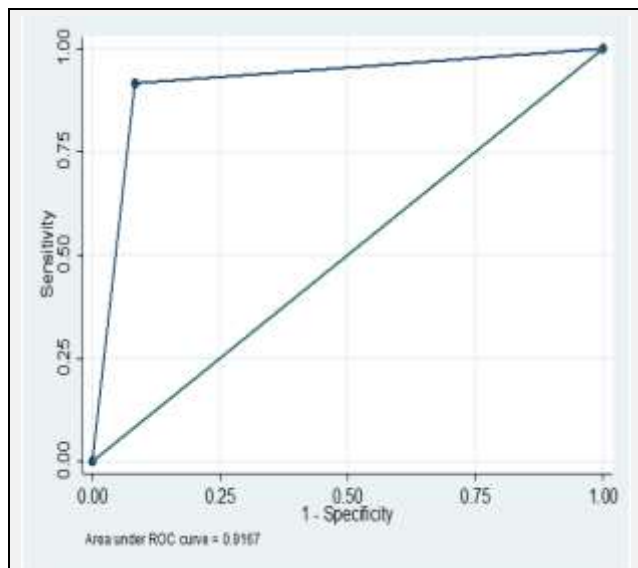


Figure 3. Area Under Curve of CTSI

Test	CT SI	APACHE II	RANSON
Sensitivity	84.6 %	61.5 %	76.9 %
Specificity	95.7 %	82.6 %	91.3 %
PPV	91.7 %	66.7 %	83.3 %
NPV	91.7 %	79.2 %	87.5 %
Accuracy	91.7 %	75.0 %	86.1 %
Area ROC	0.92	0.73	0.85
95% CI	0.82 - 1.00	0.57 - 0.89	0.72 - 0.98

Table 1. Comparison of Severity Index in Acute Pancreatitis

	Mild	Severe	P Value
CT	1.89 ± 0.70	3.89 ± 0.63	< 0.001
Ranson	1.23 ± 0.29	3.27 ± 0.54	< 0.001
APACHE II	6.19 ± 1.52	10.43 ± 2.54	< 0.001

Table 2. Comparison of Scores in Each Method

The severity scores in mild pancreatitis and severe pancreatitis were compared. There was significant difference in the scores of mild pancreatitis and severe pancreatitis (P < 0.001).

DISCUSSION

Acute pancreatitis is a multisystem disorder and can cause complications in multiple organ systems. Most patients suffering from acute pancreatitis have mild pancreatitis. In such patients, the clinical symptoms and laboratory markers reduce with conservative management in about 5 days. But severe cases of acute pancreatitis are associated with multiple organ failure and local complications that might need surgical intervention, which carries high morbidity.^{9,10}

At present, many clinical scoring systems are available and have proved useful in the management of acute pancreatitis, which predicts the prognosis of acute pancreatitis. Initial assessment can be done by clinical scoring systems which are based on age, and a few laboratory and radiological investigations. Of these, Ranson's, APACHE II and computed tomography are widely studied and easy to apply.

Various studies have been conducted to explore the application of Ranson's score, APACHE II and CT severity index.^{11,12,13}

Ranson's Score

Ranson's score is determined using eleven measures recorded as binary values at the time of the admission and after 48 hours. It is used to decide upon the mode of treatment, particularly early surgical intervention in acute pancreatitis. A composite score of 3 and above is commonly used to classify a patient having severe disease. Its sensitivity varies from 40 % to 90 %.¹⁴

A study of 126 patients done by Marco et al.¹⁵ author had a sensitivity of 91.2 % and specificity of 74.4 with a good discriminatory ability with an AUC of 0.879 (0.818 - 0.940). The high negative predictive value (NPV) of 95.75 allows this score to exclude severe acute pancreatitis outcome.

There was a significant correlation between the disease severity and Ranson's score of 3 or above (p < 0.001). Another study done by Khanna et al.¹⁶ shows a sensitivity 83.9 with PPV of 74.3.

Specificity of 74.3 and NPV of 86.5 % in prediction of severe acute pancreatitis according to the AUC (with 95 % CI). Ranson has good accuracy of 80.6 in predicting the severe acute pancreatitis. Also has a sensitivity of 83.9 % with good PPV of 74.3 and specificity, NPV of 78.0, 86.5 % respectively. A Study done by Georgios et al.¹⁷ of 185 patients with acute pancreatitis were prospectively enrolled has shown Ranson's score had slightly higher accuracy for predicting severe acute pancreatitis of AUC 0.94 (CI 0.89 - 0.97) with excellent NPV of 95.3 % with specificity and sensitivity 89.8 % and 84.2 % respectively.

In the present study, the sensitivity, specificity, PPV, NPV were 76.9 %, 91.3 %, 83.3 %, 87.5 % respectively with good AUC of 0.85 (0.72 - 0.98). The disease predicting sensitivity is lower with other studies as in Khanna et al.¹⁶ Marco et al.¹⁵ Georgios et al.¹⁷ but has excellent specificity. The AUC is also statistically comparable with good discriminatory ability. The correlation between Ranson's score of 3 and above and the severity of the disease was significant (p < 0.001).

APACHE II

In acute pancreatitis, it has a good discriminatory ability. This scoring was also significantly higher in cases of severe pancreatitis in our study. The APACHE II system is complex. It is useful in monitoring of disease progression and response to therapy. It is more difficult to perform and is less accurate for the identification of local complications.^{13,18}

Marco et al.¹⁵ a study done by using cut off value of 8 the AUC at 48 hours was 0.89 (0.832 - 3.952) a good discriminatory ability. The sensitivity, specificity, PPV, NPV of 79.2 %, 83.2 %, 64.3 %, 91.4 %. Another study done by Gunay Gurleyik et al.¹⁹ is statistically comparable with our study. In the present study, the specificity and sensitivity of APACHE II were found to be 82.6 % and 61.5 % respectively. The PPV, NPV and accuracy were 66.7 %, 79.2 %, 75 % respectively.

The specificity and accuracy remain the same around 82 % and is comparable with studies like Marco et al.¹⁵ Gunay et al.¹⁹ Khanna et al.¹⁶ except Georgios et al.¹⁷

which has shown a lower value of 71.9 %. APACHE II scoring system in the present study also had passable discriminatory ability of predicting severe acute pancreatitis of AUC 0.73 (0.57 - 0.89).

Sensitivity and positive predictive value (PPV) were different in different studies including the present study with respect to APACHE II score. This is also comparable to our study (61.5 %). The correlation between significant between the APACHE II score and disease severity was significant ($p < 0.001$).

Since biliary causes are more common, it can be easily intervened either by endoscopic retrograde cholangiopancreatography (ERCP) or laparoscopic cholecystectomy before the development of complications.

CTSI (Computed Tomography Severity Index)

Balthazar had shown that "contrast enhanced computed tomography assessment correlated with clinical course of the disease and with the predictor of mortality with a CTSI score of less than 7, whereas patients with a CTSI score greater than 7 had a mortality rate of 17%.²⁰ Similarly, the higher CTSI score in severe pancreatitis presents with local and systemic complications and thus predicts the complicated course of the disease when compared with CTSI score of mild group.²¹

Simuhuk 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.¹⁸

In the present study, the sensitivity, specificity, PPV and NPV of CTSI score were 84.6 %, 95.7 %, 91.7 %, and 91.7 % respectively. The area under the curve has excellent discrimination of 0.92 (0.82 - 1.00). This is in par with study of Gunay et al.¹⁹ Sensitivity remained the same with other studies like Gunay et al.¹⁹ and Georgios et al.¹⁷ for predicting the disease severity in acute pancreatitis. A study done by Khanna et al.¹⁶ was shown to have low values. The correlation between CTSI and the disease severity was significant ($p < 0.001$).

CTSI was more accurate in predicting the severity of acute pancreatitis. Its accuracy was significantly higher compared to other parameters. Its discriminatory ability is also very high with an AUC of 0.92 (0.82 - 1.00). The average number of days of hospital stay was 9.36 days, and the range varies from 4 days to 26 days. This is similar to the studies of Marco et al.¹⁵ 10.7 days and Martin Gomez et al.¹⁴

CONCLUSIONS

The various scoring systems help us in differentiating between patients who need just conservative management and those patients who need very close monitoring and aggressive intervention measures. Enhanced computed tomography has several advantages including determination of the extent of local inflammation and

identification of local complications if any. Necrosis should be identified at the earliest as it can lead to mortality.

Ranson and APACHE II were incapable of identifying the local complication and their sensitivity and specificity is also low when compared to CTSI. APACHE II system is complex and not advantageous in comparison with CTSI.

Hence in the present study, CTSI was found to be the best method to identify and categorise the complications in patients with acute pancreatitis and helps to grossly reduce the duration of hospital stay and the cost of treatment.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

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