Comparison between Ranson’s score and modified CT Severity Index (CTSI) for assessment of severity of acute pancreatitis based upon Revised Atlanta Classification

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Abstract

Aim: Comparison between Ranson’s score and modified CT Severity Index (CTSI) for assessment of severity of acute pancreatitis based upon Revised Atlanta Classification.

Materials and Methods: The present hospital based prospective study conducted among 58 patients diagnosed of acute pancreatitis admitted in the Department of General Medicine, Dr. D.Y. Patil Medical College, Pimpri, Pune. All patients of suspected moderate & severe acute pancreatitis will be admitted and evaluated for acute pancreatitis cases diagnosed by both serology and CT scan findings are enrolled in the study. After explaining the study, consent is obtained, and patients are enrolled in the study. Detailed clinical history (as per proforma appendix A) & examination is taken to evaluate the symptoms, demographic data & risk factors. All routine workup will be done for patients as per proforma. Using the Revised Atlanta Classification 2012, acute pancreatitis was categorized as mild with no local or systemic consequences, moderately severe with organ failure that resolves within 2 days, and severe with organ failure lasting >2 days. To determine the severity of the disease, the following prognostic markers were used: pancreatic necrosis, ICU hospitalization, and mortality.

Results: Mean age of the study population was 39.7 ± 12.8 years and majority of them were in the 18 to 30 years age group (29.3%). The majority of the population were males (75.9%) followed by females (24.1%). all participants presented with pain abdomen, followed by vomiting (70.7%). Majority of them had alcohol history (79%) as aetiology followed by gall stone history (21%). Ranson’s Score criteria had 100% sensitivity and 56% specificity in detecting Revised Atalanta Score- severe grade. 100% sensitivity and 90% specificity in detecting Revised Atalanta Score- combined moderate & severe grade.
Conclusion: Both mCTSI and Ranson’s score had 100 percent sensitivity in predicting severity of acute pancreatitis (According to Revised Atlanta score), mCTSI had better specificity especially in predicting severe grade.

Keywords: mCTSI, Atlanta score, acute pancreatitis, severity, Ranson's score
Introduction

Acute pancreatitis (AP) is characterized by pancreatic inflammation, as well as acinar cell damage and a local and systemic inflammatory response. AP can be self-limiting, with modest pancreatic oedema, or it can be severe, with pancreatic necrosis, organ failure, and death\(^1\). The incidence of this disease is ranging from 13-45/100,000 population-years\(^2\).

The greater number of people who were diagnosed with acute pancreatitis went on to develop mild or moderate symptoms. A lesser number of individuals acquired severe forms, which were marked by multiple system organ failure, necrotic changes in the pancreas, and peripancreatic complications, as well as increased morbidity and death. As a result, it's critical to determine the severity of AP as soon as feasible. Numerous predictive factors for death in AP have been identified in recent studies\(^3\).

Despite high advancements in critical care medicine during the last two decades, the fatality rate of acute pancreatitis has remained about 10%. Pancreatic diseases are notoriously difficult to diagnose, and treatments are typically postponed due to the organ's inaccessibility\(^4\).

The majority of deaths in the first week of sickness are caused by multiorgan system failure. The infection becomes increasingly important in the weeks after that, but organ failure remains a leading cause of death. Acute respiratory distress syndrome/ARDS, Acute renal failure/ARF, Cardiac depression, Bleeding, and Hypotensive shock are all possible systemic complications of severe acute pancreatitis\(^5\). Patients with severe disease (organ failure), who make up around 20% of all presentations, have a death rate of roughly 30\(^6\).

It is advised to identify individuals in the greatest need of intensive medical therapy by categorizing their disease severity as mild or severe. In mild illness, the pancreas has interstitial
oedema, inflammatory infiltrates without bleeding or necrosis, and little to no organ failure. The inflammatory infiltration in severe disease is severe, coupled with parenchymal necrosis, frequently accompanied by signs of severe gland dysfunction, and may be linked with multiorgan system failure.

As a result, it's critical to determine the severity of acute pancreatitis as soon as feasible. Numerous predictive markers for death in acute pancreatitis have been identified in recent studies. Many scoring systems, such as RANSON, Glasgow, MOSS, SIRS, BISAP, APACHE-2, Computerised Tomography Severity Index (CTSI) SCORE, and others, have been created to aid in the early identification of severe acute pancreatitis. Ranson's score is one of the earliest scoring systems to assess the severity of acute pancreatitis and continues to be widely used. At least 17 alternative grading systems have been verified since their beginnings. Glasgow prognostic criteria, Ranson’s score, Balthazar CT-enhanced scoring system, and APACHE II classification, are the most often used clinical prognostic ratings.

Contrast-enhanced scans have significantly improved the grading system by detecting pancreatic necrosis, parenchymal damage, and other conditions that might serve as predictors of severity. For the identification of prolonged pancreatic necrosis, Contrast Enhanced Computerized Tomography Abdomen & Pelvis (CECT A&P) has an accuracy of 87 percent and a sensitivity of 100%. As the degree of non-enhancement increases, so does the specificity and sensitivity for detecting pancreatic necrosis.

Western Researcher's comparison between various scores in the assessment of the severity of AP showed incongruous results. The purpose of this study is to compare one of the older scoring systems, Ranson's scoring system, with one of the newer methods, modified CTSI, for predicting the severity of AP based on the updated Atlanta 2012 classification. Very few similar studies are
done in India till date. Hence the present study was conducted to assess the comparison between Ranson’s score and modified CT Severity Index (CTSI) for assessment of severity of acute pancreatitis based upon Revised Atlanta Classification.
Materials and Methods

Study Design

The present hospital based prospective study conducted among 58 patients diagnosed of acute pancreatitis admitted in the Department of General Medicine, Dr. D.Y. Patil Medical College, Pimpri, Pune, from August 2019 to September 2021.

Ethical clearance and consent

Ethical clearance taken from Ethical committee of the institution and informed consent was taken from the study subjects before doing this study.

Inclusion Criteria

- All patients diagnosed to be acute pancreatitis of age ≥ 12 years. The diagnosis is established by the two of the following criteria
  - typical abdominal pain in the epigastrium that may radiate to the back,
  - threefold or greater elevation in serum lipase and/or amylase, and
  - confirmatory findings of acute pancreatitis on cross sectional abdominal imaging

Exclusion Criteria

- Acute on chronic pancreatitis
- Admission of patient after 48 hours of onset of disease
- Patient not suitable for CECT due to high creatinine levels

Methodology

All patients of suspected moderate & severe acute pancreatitis will be admitted and evaluated for acute pancreatitis cases diagnosed by both serology and CT scan findings are enrolled in the study. After explaining the study, consent is obtained, and patients are enrolled in the study. Detailed
clinical history (as per proforma appendix A) & examination is taken to evaluate the symptoms, demographic data & risk factors. All routine workup will be done for patients as per proforma

Patient will be subjected to a complete workup which includes.

1. Blood Investigations: Hemogram, LFT, RFT, BSL, Urine Routine Microscopy, Serology for HIV & HBSAG, Serum Amylase, Serum Lipase, CRP

2. Radiological Investigations: Chest X-ray, USG abdomen pelvis, CECT abdomen pelvis thorax

3. Information regarding Site, Character, Radiation, Associated Symptoms, Aggravating & Relieving Factors.

CT-Severity Index, Serum Amylase & Serum Lipase will be done & treatment will be given accordingly.

All patients were started on prophylactic broad-spectrum antibiotics. Adequate analgesics & antacid along with adequate hydration in the form of IV fluids.

Using the Revised Atlanta Classification 2012, acute pancreatitis was categorized as mild with no local or systemic consequences, moderately severe with organ failure that resolves within 2 days, and severe with organ failure lasting >2days. To determine the severity of the disease, the following prognostic markers were used: pancreatic necrosis, ICU hospitalization, and mortality.

Age, TC, LDH, AST, RBS upon admission, and haematocrit, BUN, Calcium, PO2, Base deficit, and fluid sequestration at 48 hours were used to generate Ranson's score. The modified CTSI score was determined. On day 4, CECT was used in necessary cases to look for pancreatic necrosis, local complications, and the possible cause of AP. After the CT scan, the CTSI score was recorded.
The occurrence of organ failure for more than 48 hours and local consequences were used to classify patients as having mild, moderately severe, or severe acute pancreatitis. Shock (systolic blood pressure less than 90 mmHg), pulmonary insufficiency (arterial PO2 less than 60 mmHg at room air or the necessity for mechanical ventilation), and renal failure (serum creatinine level greater than 2 mg/dl after rehydration or hemodialysis) were all examples of organ failure.

CECT was used to assess pancreatic necrosis; evidence of pancreatic necrosis on CT was defined as a lack of contrast enhancement of the pancreatic parenchyma.

Data Analysis

Data was entered in MS-excel 2007 and data was analysed using IBM SPSS (Statistical Package for the Social Sciences) software trail version 22. Relevant statistical tests (chi-square test, Yates corrected chi-square test, t-test etc) were applied and p<0.05 is considered as Statistical significance. Results were expressed in numbers and frequencies. Upon constructing the ROC curve (receiver operating characteristic curve) with Revised Atalanta Score - Severe, CT Severity Index individual scores & and Ranson’s Scores showed excellent accuracy with AUC (area under the curve) of 0.998, and 0.996 respectively. Ranson's score cut-off value of 6 is showing 100% sensitivity and 98% specificity in detecting severe grade of revised Atlanta score. CTSI score cut-off value of 7 is showing 100% sensitivity and 98% specificity in detecting severe grade of revised Atlanta score.

Results

Table 1: Distribution of age and gender
In the present study, the majority of the population were in the 18 to 30 years age group (29.3%) followed by 41 to 50 (25.9%) and followed by 31 to 40 years (24.1%). 39.7 + 12.8 years is the mean age of the study population. The majority of the population were males (75.9%) followed by females (24.1%).

Table 2: distribution of clinical features and aetiology
In the present study, all participants presented with pain abdomen, followed by vomiting (70.7%). Radiating pain is seen in 56.9%, distension of abdomen and diffuse pain in 46.6%, and non-passage of stools or flatus in 36.2% of the study population. Majority of them had alcohol history (79%) as aetiology followed by gall stone history (21%).

Table 3: Ranson's Criteria Vs Revised Atlanta Score (Severe Grade and Moderate & Severe Grade)
<table>
<thead>
<tr>
<th>Ransons Criteria</th>
<th>Revised Atalanta Score - Severe Grade</th>
<th>Revised Atalanta Score - Moderate &amp; Severe Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Severe ( &gt; 3)</td>
<td>True Positive</td>
<td>5</td>
</tr>
<tr>
<td>Mild ( &lt; 3)</td>
<td>False Negative</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td>Mild ( &lt; 3)</td>
<td>True Positive</td>
<td>25</td>
</tr>
<tr>
<td>Severe ( &gt; 3)</td>
<td>False Negative</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 4: Diagnostic Accuracy of Ranson's Criteria in Detecting Revised Atalanta Score – (Severe and Moderate & Severe Grade)
### Revised Atalanta Score

<table>
<thead>
<tr>
<th></th>
<th>Severe Grade</th>
<th>Moderate &amp; Severe Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td>56.60%</td>
<td>90.91%</td>
</tr>
<tr>
<td><strong>Positive Likelihood Ratio</strong></td>
<td>2.3</td>
<td>11</td>
</tr>
<tr>
<td><strong>Negative Likelihood Ratio</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Disease prevalence</strong></td>
<td>8.62%</td>
<td>43.10%</td>
</tr>
<tr>
<td><strong>Positive Predictive Value</strong></td>
<td>17.86%</td>
<td>89.29%</td>
</tr>
<tr>
<td><strong>Negative Predictive Value</strong></td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>60.34%</td>
<td>94.83%</td>
</tr>
</tbody>
</table>

Ranson’s Score criteria had 100% sensitivity and 56% specificity, and 60% accuracy in detecting Revised Atalanta Score- severe grade. Ranson’s Score criteria had 100% sensitivity and 90% specificity, and 94.8% accuracy in detecting Revised Atalanta Score- combined moderate & severe grade.

**Discussion**

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In the present study, half of the acute pancreatitis study population were in the 18 to 40 years with 40 years as the mean age. An Indian similar study done in Haryana by Deepak Jain et al.\textsuperscript{10} showed 42 years as their mean age which coincides with the presents study. The average age of presentation was 34.6 in a similar Indian study done by Padu G et al.\textsuperscript{11} A western study done by Papachristou, Georgios I et al.\textsuperscript{12} showed 51.7 years as the mean age of AP presentation. Another western study done in the Republic of Korea also had high mean age (50.6) at presentation. These studies indicate that, age presentation was different for different geographic areas, and in India it was consistent around 35 to 40 years.

Three-quarters of the study population were males in present study. Much studies\textsuperscript{13-15}, showed high contribution in male gender which is ranging from 60 to 80\% is supporting our present study. Some studies\textsuperscript{12,16} showed almost equal contribution by both the genders in their study which is not coinciding with the present study.

In the present study, all participants presented with pain abdomen followed by vomiting. Similar findings in the literature\textsuperscript{15,17} was observed where pain abdomen followed by vomiting reported by majority of the patients.

In the present study more than half of them had alcohol history as aetiology followed by gall stone history. There were only 3 cases that had idiopathic aetiology. A Bangalore based study done by Manjunath BD et al.\textsuperscript{15} had a similar aetiology as present study. In other studies\textsuperscript{16-18} gall stone played a major role in the aetiology than alcohol. In few studies\textsuperscript{16,18} idiopathic as a cause was also seen in more than 10\% of their study population, which is not coinciding with present study.

In the present study according to Revised Atlanta Score, majority were categorized as Mild grade (56.9\%), followed by Moderate grade (34.5\%), and followed by Severe grade (8.6\%). Whereas
Among Ranson’s Score grades, mild grades were 51.7% and severe grades were 48.3% and among CT Severity Index majority were in mild grade (53.4%), followed by moderate (36.2%) and severe grade cases were only 10.3%.

In the present study, both Ranson’s Score criteria and CT Severity Index criteria had 100% sensitivity. But when it comes to specificity and AUC, CT Severity Index criteria had a high edge over Ranson’s Score criteria (98% vs 56% specificity .0.9 VS 0.7), whereas for diagnostic accuracy, CT Severity Index had a slight edge (94.8% vs 98.2%).

Thus present study states that, though both the scores have high and equal sensitivity, CT Severity Index criteria had a clear edge over Ranson’s Score criteria when overall predictive (diagnostic accuracy sensitivity and AUC) is considered.

In the present study, Ranson’s Score criteria had 100% sensitivity and 90% specificity, and 94.8% accuracy in detecting Revised Atlanta Score - combined Moderate & Severe Grade. In the present study, CT Severity Index criteria had 100% sensitivity and 98% specificity, and 98.2% accuracy in detecting Revised Atlanta Score - combined Moderate & Severe Grade.

CT Severity Index grades showed satisfactory accuracy with AUC (area under the curve) of 0.62, and Ranson’s Score criteria grade showed excellent accuracy with AUC (area under the curve) of 0.95 in predicting Revised Atalanta Score-combined Moderate & Severe grades. Few studies supported present study by showing better accuracy with modified CTSI over other scores which supports present study. Many studies were showing better accuracy with Ranson's score in predicting the severity of acute pancreatitis by revised atlanta score & it is not supporting present study findings with severe grade, but supporting when predicting moderate and severe grades are combined.
Conclusion
Presents study concluded that, though both mCTSI and Ranson's score had 100 percent sensitivity in predicting severity of acute pancreatitis (According to Revised Atlanta score), mCTSI had better specificity especially in predicting severe grade. Ranson's score can be used in predicting combined (moderate and severe) grade rather than just only severe grade.

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