



COMPARATIVE STUDY OF RANSON'S VERSUS APACHE II SCORING SYSTEMS IN PREDICTING THE CLINICAL OUTCOME IN PATIENTS WITH ACUTE PANCREATITIS

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ABSTRACT

INTRODUCTION: Acute pancreatitis is an acute inflammatory process of the pancreas with varying involvement of other regional tissues or remote organ systems. About 80% of the attacks are mild, 20% are severe and they are commonly accompanied by necrosis of the pancreas and or organ failure. Pathologically there are two types of pancreatitis, interstitial and necrotizing. Patho physiologic mechanisms include micro-circulatory injury, leucocyte chemo-attraction, release of pro and anti-inflammatory cytokines, oxidative stress, leakage of pancreatic fluid into the region of pancreas, bacterial translocation to the pancreas and systemic circulation. The initial step in the pathogenesis of acute pancreatitis is conversion of trypsinogen to trypsin within acinar cells in sufficient quantities to overwhelm normal mechanisms to remove active trypsin.

Materials and Methods: Present study was aimed at analyzing patients admitted to Department of General Surgery, in a tertiary care centre with a diagnosis of acute pancreatitis during the period between December 2015 and May 2017. All the patients were subjected to detailed clinical examination, laboratory investigations and radiological imaging. All the 100 patients were subjected to both Ranson's and APACHE II scoring systems. Scoring was done on admission/time of diagnosis and at 48 hours. The scores were compared with the clinical severity which was graded according to Atlanta criteria and also compared with the clinical outcome.

Results and Discussion

	Ranson's mean	APACHE's mean
Mild	2.40	5.28
Severe	4.53	12.27
Over All	3.20	7.90

Ranson's Score and APACHE II Score in severe acute pancreatitis were significantly higher than those in the mild cases ($p < 0.001$). The Ranson's scores were very sensitive for prediction of systemic complications (100%) but less sensitive for prediction of local complications (93.33). As Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Accuracy are found to be the same for Ranson's and APACHE II scores, Ranson's scoring system is equally efficacious as APACHE II scoring system in assessing the prognosis of acute pancreatitis.

CONCLUSION: From this study, we can conclude Ranson's scoring system is not inferior to APACHE II scoring system in predicting the severity of acute pancreatitis. Ranson's scoring system is a simple, cheap, easy to remember, recollect, and calculate scoring system. Moreover, Ranson's scoring system was developed specifically for acute pancreatitis. In the developing world, where cost effectiveness of each test is important, Ranson's scoring system can be used in place of APACHE II scoring system. The Ranson's scoring system accurately predicts the outcome in patients with acute pancreatitis and compares favourably with the physiological scoring systems in the prediction of disease severity for acute pancreatitis, the only disadvantage being a 24 hours delay.

KEYWORDS : Acute pancreatitis, Ranson's and APACHE II scoring systems, prognostic indicator

INTRODUCTION

Acute pancreatitis is an acute inflammatory process of the pancreas with varying involvement of other regional tissues or remote organ systems. About 80% of the attacks are mild, 20% are severe and they are commonly accompanied by necrosis of the pancreas and or organ failure. Gall stones and chronic ethanol abuse account for 70% of cases of acute pancreatitis. Pathologically there are two types of pancreatitis, interstitial and necrotizing. Pathophysiologic mechanisms include micro-circulatory injury, leucocyte chemo-attraction, release of pro and anti-inflammatory cytokines, oxidative stress, leakage of pancreatic fluid into the region of pancreas, bacterial translocation to the pancreas and systemic Circulation. The initial step in the pathogenesis of acute pancreatitis is conversion of trypsinogen to trypsin within acinar cells in sufficient quantities to overwhelm normal mechanisms to remove active trypsin. However, enzyme colonisation may occur without inducing significant acinar injury.

Assessment of severity of acute pancreatitis is important for early identification of patients who may benefit from additional supportive and specific therapeutic procedures. Many different scoring systems have been devised for the assessment of severity of acute pancreatitis, which are divided into two types:

1. The first type attempts to correlate laboratory and clinical markers specific to pancreatitis with subsequent outcome and disease severity, the most widely used in this group is Ranson's Score.
2. The second type of scoring system is the application of nonspecific physiological scoring system, which was originally created for use in general population of critically ill patients, the most widely used in this group is APACHE II score.

The Ideal scoring system should be simple, non-invasive, accurate and quantitative; with the criteria, readily available at the time of diagnosis. In this study, we compare the Ranson's scoring system with the APACHE II scoring system. We have classified the severity of acute pancreatitis in this study based on the Atlanta criteria.

2. AIMS AND OBJECTIVES

Present study was aimed at analyzing patients admitted to Department of General Surgery, in a tertiary care centre with a diagnosis of acute pancreatitis during the period between December 2015 and May 2017 with the following objectives:

1. To assess the severity of acute pancreatitis using Ranson's scoring system and APACHE II scoring system.
2. To compare the scoring systems with respect to their accuracy in predicting the outcome in cases of acute pancreatitis.

3. MATERIAL AND METHODS

3.1. Source of Data

Patients admitted to Surgical wards in Tirunelveli Medical College Hospital, Tirunelveli.

3.2. Method of Collection of Data

A time bound prospective study was conducted on patients admitted with acute pancreatitis during the study period from December 2015 to December 2017. All the patients were subjected to detailed clinical examination, laboratory investigations and radiological imaging.

3.3. Inclusion Criteria

Patients with confirmed diagnosis of acute pancreatitis based on

clinical/laboratory/radiological investigations.

3.4. Exclusion Criteria

- Age less than 16years; as physiological thresholds are calibrated for adults.
- Patients with acute on chronic pancreatitis.

3.5. Sample Size

After considering both inclusion and exclusion criteria, total number of patients included in the study were 100.

All the 100patients were subjected to both Ranson's and APACHEII scoring systems. Scoring was done on admission/time of diagnosis and at 48 hours. The scores were compared with the clinical severity which was graded according to Atlanta criteria and also compared with the clinical outcome.

3.6. Methods of Statistical Analysis

Independent test was used to examine differences in age; fisher's exact test for sex; and chi square test for aetiology were used. Sensitivity, specificity, positive predictor value, negative predictor value and accuracy were calculated. A "p" value of less than 0.05 was considered to be statistically significant. Data analysis was performed using SPSS software.

4.OBSERVATION AND RESULTS

The study was conducted in a tertiary care centre in south TamilNadu. Total number of patients studied were 100. According to the Atlanta Criteria, 62 patients were classified as Mild Acute Pancreatitis and 38 patients were classified as Severe Acute pancreatitis. Of the 100patients, 92 were Male (92.5%) and 8 were Female (7.5%). There was no statistical significance of Sex(p=0.545) on the severity of the disease.

4.1. Aetiology of Acute Pancreatitis

Table No 1: Severity of pancreatitis according to Aetiology

Etiology	Mild	Severe	Male	Female	Total
Alcohol	65	23	88	0	88
Gall stones	6	2	0	8	8
Idiopathic	2	2	4	0	4

Out of 100 patients, 30(74%) had Alcohol induced Acute Pancreatitis, 3(8%) had Gallstones induced Acute Pancreatitis and 7 (18%) had Idiopathic Acute Pancreatitis. There was no statistical significance of Aetiology (p=0.943) on the severity of the disease.

4.2. Outcome of Patients

Table No 2–Outcome of Patients

No of patients without complicated	No of Patients with complicated	Complicated			
		Local complications			System complications
		Pseudo cyst	Pancreatic necrosis	Hemorrhagic pancreatitis	SIRS
60	40	16	15	6	3

- Out of 100 patients
- 60% had uncomplicated outcome
- 40% of patients with any complication
- 6.4% of patients developed pseudo cyst
- 6% of patients developed Pan – Neurosis

Out of 100 patients with acute pancreatitis, 25patients (62.5%) had an uncomplicated outcome. 15 patients (37.5%) developed complications, of which 14 patients (93.4%) developed local complications and 1 patient (6.6%) developed systemic complication. Of the local complications, 6 patients developed Pseudocyst, 6 patients developed pancreatic necrosis, and 2 developed haemorrhagic pancreatitis. The patient who developed systemic complication(SIRS) had a fatal outcome. Surgical intervention was performed in one patient. Exploratory Laparotomy with necrosectomy was done and the patient eventually recovered.

4.3. Outcome of patients based on different cut-off Ranson's Score

Table No 3– Outcome for different Ranson's Score

Ranson's score	Uncomplicated outcome	Complicated outcome			
		Local complications			Syst complications
		Pseudo cyst	Pancreatic necrosis	Hemorrhagic pancreatitis	SRS
<=3	39	3	0	0	0
>3	25	10	15	5	0
>5	0	0	0	0	3

<=3	39	3	0	0	0
>3	25	10	15	5	0
>5	0	0	0	0	3

Table No 3– Outcome for different Ranson's Score

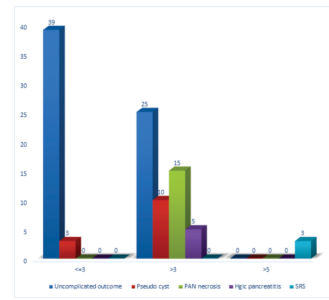


Figure No:1–Outcome for different Ranson's Score

- Out of 42 patients <+ 3
- 32.85% are uncomplicated
- 7.14 % are complicated
- Out of 55 patients > 3
- 45.45% Are uncomplicated
- 18.18% are complicated – pseudo cyst
- 27.27% are complicated – Pan necrosis
- 9.09% are complicated – Hgic pancreatitis

Of the 25patients (62.5%) who had Ranson's score of less than or equal to 3, 24(96%) had an uncomplicated outcome and one (4%) developed Pseudocyst. No patient in this group had Pancreatic Necrosis or any major organ failure. There were no deaths in this group.

15 patients (37.5%) had Ranson's score of more than 3, one (6.6%) of them had an uncomplicated course and 14 patients (93.4%) developed complications, 13 had local complication and one had systemic complication.

One patient (2.5%) had Ranson's score more than 5 and developed systemic complication (SIRS) and had fatal outcome.

Of the 25 Patients with Ranson's Score <=3, 96% had an uncomplicated course. The inference being Ranson's Score <= 3 predicts an uncomplicated outcome – mild acute pancreatitis.

Of the 15 Patients with Ranson's Score >3, 93.4% developed complications. The inference being Ranson's score >3 predicts a complicated outcome – severe acute pancreatitis.

4.4. Outcome of patients based on different cut-off APACHE II Score

Apache II Score	Uncomplicated outcome	Complicated outcome			
		Local complications			Systemic complications
		Pseudo Cyst	PAN Necrosis	Hemorrhagic Pancreatitis	SIRS
<=8	57	3	0	0	0
>8	4	6	9	2	0
>12	1	6	6	3	3

Table No 4: Severity of acute pancreatitis with APACHEII score

Apache II score <8, Uncomplicated outcome were 57%. Local complications: pseudo cyst was 5.26%.

Apache II score >8, Uncomplicated outcome were 4%. Local complications: pseudo cyst was 35.29%, pancreatitis necrosis was 55.97%, Haemorrhagic pancreatitis was 11.17%.

Apache II score >12, Uncomplicated outcome were 1%. Local complications: pseudo cyst was 33.3%, pancreatitis necrosis was 33.3%, Haemorrhagic pancreatitis was 16.6%. and SIRS was 16.6%.

4.5. Mean of Ranson's and APACHEII Score

	Ranson's mean	APACHE's mean
Mild	2.40	5.28
Severe	4.53	12.27

Over All	3.20	7.90
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Table No 5–Mean Ranson's Score/ Apache's mean

Ranson's Score and APACHE II Score in severe acute pancreatitis were significantly higher than those in the mild cases (p<0.001).

4.6. Prediction of severity by Ranson's Score

Ranson's Score	Sensitivity	Specificity	PPV	NPV	Accuracy
>=3	100	56	57.69	100	72.5
>=4	93.33	96	93.33	96	95
>=5	53.33	100	100	78.1	82.5

Table No 6–Prediction o severity by Ranson's Score

Ranson's score of greater than or equal to 4, predicted 93% of severe attacks and 96% of mild attacks with a PPV of 93.33 and NPV of 96 and accuracy of 95.

Ranson's score of greater than or equal to 3, predicted 100% of severe attacks but less number of mild attacks (56%) with PPV of 57.69 and NPV of 100 and accuracy of 72.5.

Ranson's score of greater than or equal to 5, predicted less number of severe attack (53%) and branded more severe attacks as mild attacks. Ranson's score of greater than or equal to 4 had the best sensitivity, specificity and accuracy.

4.7. Prediction of severity by APACHEII Score

Apache II Score	Sensitivity	Specificity	PPV	NPV	Accuracy
>=8	100	80	75	100	35
>=9	93.33	96	93.33	96	95
>=10	86.66	100	100	92.6	95
>=11	80	100	100	89.2	92.5

Table No 7–Prediction of severity by APACHEII Score

APACHEII score of greater than or equal to 9, predicted 93.33% of severe attacks and 96% of mild attacks with a PPV of 93.33 and NPV of 96 and accuracy of 95. APACHEII score of greater than or equal to 10 also had the same accuracy.

APACHEII score of greater than or equal to 8, predicted more number of severe attacks (100%) but less number of mild attacks (80%) with PPV of 75 and NPV of 100.

APACHEII score of greater than or equal to 11, predicted less number of severe cases and labelled more number of severe cases as mild. APACHE II score of more than or equal to 9, had the best sensitivity, specificity and accuracy.

4.8. Prediction of Major Organ failure and Pancreatic collection by Ranson's Score

Ranson's Score	Sensitivity	Specificity	PPV	NPV	Accuracy
Pancreatic Collection	93.33	96	93.33	96	95
Major Organ Failure	100	64.1	6.66	100	65

Table No 8–Prediction of organ failure & pancreatic collection by Ranson's Score

The Ranson's scores were very sensitive for prediction of systemic complications (100%) but less sensitive for prediction of local complications (93.33).

4.9. Prediction of Major Organ failure & Pancreatic collection by APACHEII Score

APACHE II Score	Sensitivity	Specificity	PPV	NPV	Accuracy
Pancreatic Collection	93.33	96	93.33	96	95
Major Organ Failure	100	64.1	6.66	100	65

Table No 9–Prediction of organ failure & pancreatic collection by APACHEII Score.

APACHEII scores showed higher sensitivity in the prediction of systemic complications(100%) than in the prediction of local complications(93.33%).

4.10. Prediction of Severity by the two scoring Systems

	Sensitivity	Specificity	PPV	NPV	Accuracy
Ranson's Score	93.33	96	93.33	96	95
APACHE II Score	93.33	96	93.33	96	65

Table No 10–Prediction of severity by Ranson's and APACHEII scoring systems

As Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Accuracy are found to be the same for Ranson's and APACHEII scores, Ranson's scoring system is equally efficacious as APACHEII scoring system in assessing the prognosis of acute pancreatitis.

5. DISCUSSION

Acute Pancreatitis is an increasing common abdominal emergency.

5.1. Ranson's Scoring System

It is one of the most widely used scoring system for acute pancreatitis. First proposed in 1974.

On admission:	After 48 hrs
•Age - >55yrs	•Fall in hematocrit > 10%
•WBC - > 16000/A	•Fluid sequestration >6 L
•Blood glucose > 200 mg/dl	•Serum calcium < 8 mg/dl
•Serum LDH > 350 IU/L	•PaO2 < 60mmHg
•Serum AST >250 IU/L	•Increase in BUN > 5 mg/dl
	•Base deficit > 4mmol/L

- Total score of more than 3 indicates severity.
- Main disadvantage is that it is possible to assess the severity only after 48hours.

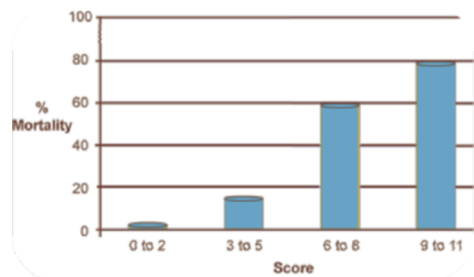


Figure No 2-Prediction of mortality according to Ranson's score

5.2.1. APACHEII Scoring System

- It means Acute Physiology and Chronic Health Evaluation I.
- It is a physiological scoring system based on 14 criteria.
- Total score of more than 8 indicates severity.
- Advantages over other systems
- Severity can be assessed within 24 hours unlike others where 48 hours are required.
- Severity can be assessed continuously throughout the clinical course of the disease.
- Prognosis can also be assessed after interventions like debridement.

5.2.2. Disadvantages:

- Cumbersome
- Not specific for pancreatitis

5.2.3. Modifications:

- APACHEIII Here 5 additional criteria are taken in to account to increase the accuracy.
- APACHEO-Here clinical assessment of obesity is also taken into account.
- Treatment of acute pancreatitis involves 3 main components.
- Initial management of the acute episode
- Surgical management
- Management of complications

In this study, acute pancreatitis was found 12 times more commonly in males than females and the mean age was 37.5 years. These results are different from the results of the study of Larvin et al, where male to female ratio was 47:53 and mean age was 62 years.

In the present study alcohol was the etiological factor in 74% of patients and gallstones in 8%, contrary to alcohol being 22% and gallstones 43% in Larvin et al. The aetiology had no significant influence on the scores or the final outcome of acute pancreatitis, suggesting that once the pathogenic mechanisms have initiated the disease, the course and outcome of acute pancreatitis are not influenced by underlying etiological factors. Some authors have published similar results as in the study by SuMiWoo et al².

Out of the 40 cases in this study, 25 patients (62.5 %) had mild acute pancreatitis and 15 patients (37.5%) had severe acute pancreatitis. The percentage of severe cases was higher in our study as compared to most of the other studies. In the study by Larvin et al, 20% of all the cases were severe. Mortality in our study was 2.5% and mortality in the study by Larvin et al was 7.6%.

In our study, the mean Ranson's and APACHEII scores calculated during the first 48 hours showed significantly higher values for severe cases than for mild cases of acute pancreatitis. The mean Ranson's score in mild and severe cases were 2.4 and 4.53 respectively. The mean APACHEII score was 5.28 and 12.27 for mild and severe cases respectively. Comparing outcomes, inpatient groups based on Ranson's and APACHEII scores, it was observed that complications like Pseudocysts, Pancreatic Necrosis, major organ failure and deaths were more common when Ranson's score exceeded 3 and APACHEII scores exceeded 8. Contrary to expectation Pseudocyst was observed in one patient whose Ranson's and APACHEII scores were 3 and 8 respectively. These patients presented to hospital later than 48hours after the onset of symptoms by which time the severity of the attack has subsided and the recorded scores were spuriously low. It can therefore be concluded that patients with Ranson's score more than 3 and APACHEII score of more than 8 are high risk patients.

In our study Ranson's score of greater than 3 and APACHEII score of greater than 8 had the highest sensitivity, specificity and accuracy for the prediction of severity of acute pancreatitis.

In our study, the Ranson's and APACHEII scoring systems were very sensitive for the prediction of systemic complications (100%) but less sensitive for prediction of local complications (93.33%). This is comparable to the study by Larvin et al, where the sensitivity to detect systemic complications was higher (76%) than to detect local complications (73%). In our study the sensitivity, specificity, positive predictor value, negative predictor value and accuracy of Ranson's and APACHEII scores are comparable.

	Sensitivity	Specificity	PPV	NPV	Accuracy
Ranson's Score	93.33	96	93.33	96	95
APACHE II Score	93.33	96	93.33	96	95

Table No 11–Accuracy of Ranson's and APACHEII scoring systems

As sensitivity, specificity and accuracy of Ranson's and APACHEII scores are comparable in our study, Ranson's is as powerful a prognostic scoring system as APACHEII.

5.3. Comparison of diagnostic performance of Ranson's and APACHEII Score with Larvin et al and Wilson et al

	Ranson's Scoring System			APACHEII Scoring System		
	Present Study	Larvin et al	Wilson et al	Present Study	Larvin et al	Wilson et al
Sensitivity	93.33	75	87	93.33	71	68
Specificity	96	68	71	96	91	67
PPV	93.33	37	49	93.33	67	40
NPV	96	91	94	96	93	87
Accuracy	95	69	75	95	87	68

Table No 12 – Comparison of Ranson's and APACHEII scoring systems with Larvin & Wilson et al

The sensitivity, specificity, positive predictive value, negative predictive value, accuracy in the present study were higher than the studies by Larvin et al and Wilson et al and the correlation between Ranson's and APACHEII scores were also higher in the present study compared to the other studies.

5.4. Comparison of diagnostic performance of Ranson's and APACHEII Score with SuMiWoo et al² and Constantinos et al³.

	Ranson's Scoring System			APACHEII Scoring System		
	Present Study	Su Mi Woo et al	Constantinos Et al	Present Study	Su Mi Woo et al	Constantinos Et al
Sensitivity	93.33	89.50	82	93.33	78.9	58
Specificity	96	96	74	96	76	78
PPV	93.33	94.4	48	93.33	71.4	43
NPV	96	92.3	93	96	82.6	86
Accuracy	95	93.2	76	95	77.3	73

Table No 30 – Comparison of Ranson's and APACHEII scoring systems with SuMiWoo² & Constantinos et al³

The sensitivity, specificity, positive predictive value, negative predictive value, accuracy in the present study were higher than the studies by SuMiWoo et al and Constantinos et al. In the study by SuMiWoo et al and Constantinos et al the sensitivity and specificity of Ranson's were higher than that of the APACHEII scoring system. Whereas in the present study the sensitivity and specificity of Ranson's is the same as that of the APACHEII scoring system. Comparing with the study by Arif A Khan et al¹ the accuracy of APACHEII scoring system in the study by Arif et al was 75% and in the present study accuracy was 95%.

Several theories may explain how the Ranson's score performed as good as the APACHEII scoring system. First, the Ranson's score has always been a specific predictor of outcome in patients with pancreatitis whereas the APACHEII score was developed to encompass a wide variety of disease processes. Secondly, we studied a relatively small population of patients in which the proportion of severe pancreatitis was quite high. A larger study from multiple centres might prove different results. Thirdly, the Ranson's scoring system performed well in the study as significant number of cases were secondary to alcohol intake (Ranson's scoring system was derived using data from a predominantly alcoholic patient population).

The Ranson's scoring system is a simple scoring system wherein the laboratory tests required are simple, routine and readily available out of hours compared to the more cumbersome APACHE II scoring system, the only disadvantage being a 24hour delay. According to our study, the Ranson's scoring system still accurately predicts the outcomes in patients with acute pancreatitis and it compares favourably with the physiological scoring systems in the prediction of disease severity for pancreatitis.

6. CONCLUSION

From this study, we conclude that Ranson's scoring system is superior to APACHEII scoring system in predicting the severity of acute pancreatitis. Ranson's scoring system is a simple, cheap, easy to remember, recollect, and calculate scoring system. Moreover, Ranson's scoring system was developed specifically for acute pancreatitis. In the developing world, where cost effectiveness of each test is important, Ranson's scoring system can be used in place of APACHEII scoring system. The Ranson's scoring system accurately predicts the outcome in patients with acute pancreatitis and compares favourably with the physiological scoring systems in the prediction of disease severity for acute pancreatitis, the only disadvantage being a 24hour delay. The Ranson's scoring system proved to be as powerful a prognostic model as the more complicated APACHEII scoring system even in the present era of advanced investigations.

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