

## Comparison Study of Apache-II Vs Ranson's scoring And CT Severity Index for Its Outcome in Acute Pancreatitis In MMC & RI

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**Abstract:** Acute pancreatitis is one of the common encountered disorders in common surgical practice. In recent times management has changed dramatically with majority of decisions like role of antibiotics, use of Ryle's tube, nutrition etc. Ranson's and APACHE II scoring systems are the two major scoring systems to predict the severity of disease, but the efficacy between the two scoring systems still remains a debate and hence the need for the study.

**Objectives:** To assess the severity and to predict the outcome of Acute Pancreatitis using Ranson's scoring system and APACHE II Scoring system and CT severity index.

**Materials and Methodology:** Data for the study will be collected from patients who are admitting in Surgery wards from Dec 2013 to Jun 2015 with Acute Pancreatitis using a pretested proforma and CT severity index meeting the objectives of study.

**Source of Data:** Patients admitted in Meenakshi medical college in Surgery wards.

**Study Period:** Dec 2013 to Jun 2015

**Study Design** Time bound prospective study.

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### I. Introduction

Acute pancreatitis is a commonly encountered routine surgical problem, encountered in day to day practice and it poses a great challenge to the treating surgeon. It is a protean disease, capable of wide clinical presentation, ranging from mild abdominal pain to death itself. Following statement grossly summarizes its consequences. "Acute pancreatitis is the most terrible of all the calamities that occur in connection with the abdominal viscera. The suddenness of its onset, the illimitable agony which accompanies it, and the mortality attendant upon it, all render it the most formidable of catastrophes"

#### - Lord Moynihan, 1925

And hence the severity of acute pancreatitis must be pre assessed and surgeon must be prepared to face any outcome of the same. Several scoring systems were devised for the same and hereby we try to prove the effectiveness of two different scoring system comparing the results with CT severity index as a tool for diagnosis of Acute Pancreatitis.

### II. Objectives

Present study was aimed at analyzing patients admitted to wards in Department of General Surgery, Meenakshi medical college, Kanchipuram with a diagnosis of acute pancreatitis, during the period between December 2013 and June 2015 with the following objectives:

- To assess the severity of acute pancreatitis using Ranson's scoring system and APACHE II scoring system and comparing the results with CT severity index.

To compare these two scoring systems with respect to their accuracy with CT severity index in predicting the outcome in cases of acute pancreatitis.

### III. Materials And Methods

#### Source of Data

Patients admitted to Male and Female surgical wards in Meenakshi medical college, Kanchipuram from Dec 2013 to June 2015.

#### Method of Collection of Data

A time bound prospective study was conducted on patients admitted with acute pancreatitis during the study period from December 2013 to December 2014.

#### Inclusion Criteria

Patients with confirmed diagnosis of acute pancreatitis based on clinical, laboratory and radiological investigations.

#### Exclusion Criteria

- Age less than 16 years.
- Patients with acute on chronic pancreatitis.
- Patients above 70 years.

#### Sample Size

After considering both inclusion and exclusion criteria, total number of patients included in the study were 60. All the 60 patients were scored for both Ranson's and APACHE II scoring systems. Scoring was done at the time of admission and at 48 hours after the same. The Ranson's and APACHE II scores were compared with CT severity index and results were analyzed.

#### Methods of Statistical Analysis

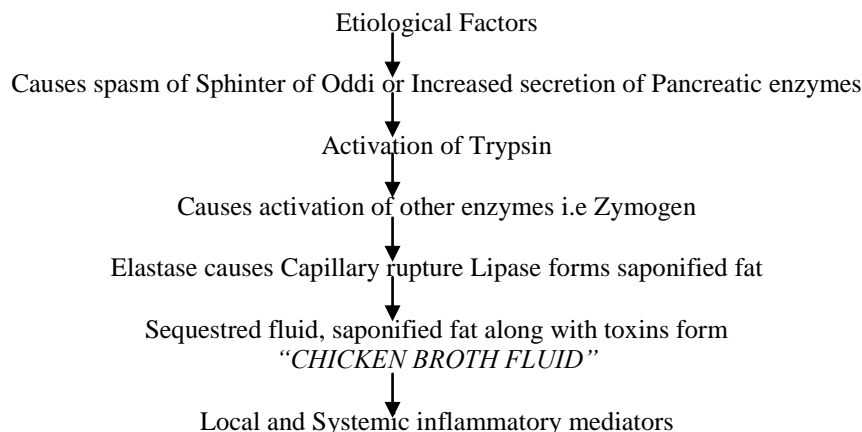
Independent tests was used to examine differences in age; fisher's exact test for sex; and chi square test for etiology were used. Sensitivity, specificity, positive predictor value, negative predictor value and accuracy were calculated. A "p" value of less than 0.05 was considered to be statistically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

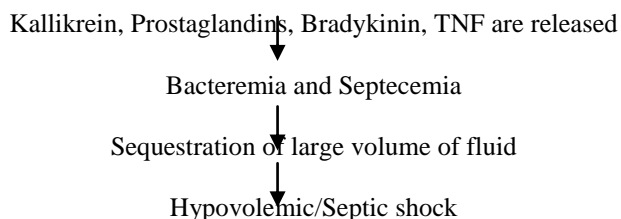
### IV. Observation And Results

- The study was conducted in Meenakshi medical college, Kanchipuram from December 2013 to June 2015.
- Total number of patients included in the study was 60.
- Of the 60 patients, 33 patients had a Ranson's score of more than or equal to 3, 27 patients had a Ranson's less than 3.
- Of the 60 patients, 40 patients had an Apache II score of more than or equal to 9, 20 patients had an Apache II score of lesser than 8.
- All the cases suspected for Acute Pancreatitis was compared with CT findings for CT severity index along with Ranson's and Apache II scoring.

### V. Discussion

Acute Pancreatitis is a common abdominal emergency, surgeons must come through. Assessment of severity of acute pancreatitis is vital for early detection of patients, who need additional supportive and specific therapeutic procedures. Acute pancreatitis is the development of acute inflammation of the normally existing pancreas. It may be first attack or relapsing attacks with a completely normal gland in between attack phases. The exact mechanism is not clearly understood. Various concepts and theories have been proposed and few are based on experimental animal studies. Most accepted mechanism is





**Pathophysiology of acute pancreatitis**

Many different scoring systems have been used for the assessment of severity of acute pancreatitis, which are divided into two types: The first type, attempts to correlate laboratory/clinical markers specific to pancreatitis, to predict it's outcome. The most widely used in this group is the Ranson's Score. The second type of scoring system is the application of non-specific physiological scoring system, which was originally devised for the use in general population for critically ill patients like APACHE II scores.

Ideal scoring system must be simple, non-invasive, accurate and the assessment tests should be cheap, readily available at all times of the study of the admitted patient. In this study we compare the proven and simple Ranson's scoring system with the more non-specific but reliable APACHE II scoring system. In this study, acute pancreatitis was found to be prevalent more commonly in males compared to females and the mean age was 36.9 years. These results does not correlate with the results of the study of Larvin et all where male is to female ratio was 47:53 and mean age was found to be 62 years.

In the study, alcohol was the etiological factor in 75 % of patients and gall stones in 8.3 %, contrary to alcohol being 22 % and gall stones 43 % in Larvin et al study. The etiology had no significant influence on the results of scoring systems or the final outcome in acute pancreatitis, suggesting that once the pathogenic mechanisms have initiated the disease, the course and outcome of the disease is not influenced by underlying etiological factors. Su Mi Woo et al published similar results proving the same. Out of the 60 cases taken in this study, 36 patients (60 %) had mild acute pancreatitis and 24 patients (40 %) 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 Larvinet a1 20 % of all the cases were severe. Mortality is nil in our study and mortality in the study by Larvin et al was about 7.6 %. Mortality was not taken into consideration in our study.

In our study, the mean Ranson's and APACHE II scores calculated during the first 48 hours showed significantly higher values for severe than for mild cases of acute pancreatitis. The mean Ranson's score in mild cases are 1.88 and in severe cases are 4. The mean APACHE II score was 5.87 and 11.9 for mild and severe cases respectively. Comparing outcomes in patient groups based on Ranson's and APACHE II scores, it was observed that complications like Pseudo Cysts, Pancreatic Necrosis and major organ failure were more common when Ranson's score exceeded 3 and APACHE II scores exceeded 8. It can therefore be concluded that patients with Ranson's score more than 3 and APACHE II score of more than 8 are high risk patients proving the scoring systems are efficient in their own ways.

In our study Ranson's score of greater than 3 and APACHE II score of greater than 8 had the highest sensitivity, specificity and accuracy. And hence both the systems are highly efficient in diagnosing the severe acute pancreatitis compared to diagnosing mild cases.

In our study the sensitivity, specificity, positive predictor value, negative predictive value of Ranson's and APACHE II scores are comparable.

	SENSITIVITY %	SPECIFICITY %	POSITIVE PREDICTIVE VALUE %	NEGATIVE PREDICTIVE VALUE%
<b>RANSON'S SCORING</b>	<b>87.5</b>	<b>97.2</b>	<b>95.5</b>	<b>92.1</b>
<b>APACHE II SCORING</b>	<b>83.3</b>	<b>86.1</b>	<b>80</b>	<b>88.6</b>

**Table no 1:** Prediction of severity by both scoring systems

	Ranson's Scoring System				
	Present Study	Larvin et al	Wilson et al <sup>54</sup>	Su Mi woo et al	Constantinos Chatzicostas et al
<b>Sensitivity</b>	<b>87.5</b>	<b>75</b>	<b>87</b>	<b>89.5</b>	<b>82</b>
<b>Specificity</b>	<b>97.2</b>	<b>68</b>	<b>71</b>	<b>96</b>	<b>74</b>
<b>PPV</b>	<b>95.5</b>	<b>37</b>	<b>49</b>	<b>94.4</b>	<b>48</b>
<b>NPV</b>	<b>92.1</b>	<b>91</b>	<b>94</b>	<b>92.3</b>	<b>93</b>

**Table no 2:** Comparison of Ranson's score efficiency with other studies

	APACHE II Scoring System				
	Present Study	Larvin et al	Wilson et al	Su Mi woo et al	Constantinos Chatzicostas et al
<b>Sensitivity</b>	<b>83.3</b>	<b>71</b>	<b>68</b>	<b>78.9</b>	<b>58</b>
<b>Specificity</b>	<b>86.1</b>	<b>91</b>	<b>67</b>	<b>76</b>	<b>78</b>
<b>PPV</b>	<b>80</b>	<b>67</b>	<b>40</b>	<b>71.4</b>	<b>43</b>
<b>NPV</b>	<b>88.6</b>	<b>93</b>	<b>87</b>	<b>82.6</b>	<b>86</b>

**Table no 3:** Comparison of APACHE II score efficiency with other studies

The above table shows that both Ranson's and APACHE II scoring systems shows higher sensitivity and specificity in our study compared to other studies. Several theories may explain how the Ranson's score performed as good as the APACHE II scoring system. First, the Ranson's score has always been a gold standard predictor of outcome in patients with acute pancreatitis whereas the APACHE II score was developed to study the outcome of wide variety of disease processes. Secondly, we studied a relatively a very small population of patients in which the proportion of severe pancreatitis was quite high. A larger study from multiple centres might prove different results for the same study. Thirdly, the Ranson's scoring system worked out well as alcohol intake was primary etiology as Ranson's scoring system was derived using data from a predominantly alcoholic patient population.

**Assessment of severity of disease:**

There are several scoring systems present for evaluation of severity and to predict the outcome of the disease. Among them very few have been recognized and followed all over the world. They are

- 1) Computed Tomography Severity Index (CTSI)
- 2) Ranson's scoring system
- 3) Apache II scoring system
- 4) Glasgow scale
- 5) Atlanta's criteria
- 6) Sequential organ failure assessment (SOFA) score

Every scoring system is unique and the main difference among each is the investigations which are needed for the evaluation. And some scoring systems can be used only after 48 hours after the onset of the disease. Severity of the disease using Computed Tomography Severity Index (CTSI), Ranson's scoring system and Apache II scoring system are discussed here

**1) Computed Tomography Severity Index (CTSI):**

CT Finding	Score
Normal pancreas	<b>0</b>
Focal or diffuse pancreatic enlargement	<b>1</b>
Intrinsic pancreatic alterations with peri-pancreatic fat inflammatory changes	<b>2</b>
Single fluid collection	<b>3</b>
Two or more fluid collections or gas adjacent to the pancreas	<b>4</b>
<b>Pancreatic necrosis :</b>	
Pancreatic necrosis - None	<b>0</b>
Pancreatic necrosis - ≤30%	<b>2</b>
Pancreatic necrosis - 30% - 50%	<b>4</b>
Pancreatic necrosis - >50%	<b>6</b>

**Table no:4** Computed Tomography Severity Index (CTSI)

In this scoring system results are predicted according to the score. Usually more than 7 is predicted as severe.

CTSI Score	Mortality ( In percentage)	Morbidity ( In percentage)
<b>0-3</b>	<b>3</b>	<b>8</b>
<b>4-6</b>	<b>6</b>	<b>35</b>
<b>7-10</b>	<b>17</b>	<b>92</b>

**Table no: 5** Prediction of Computed Tomography Severity Index (CTSI)

**2) Ranson's Scoring System:**

Ranson's scoring system is first developed in 1974<sup>38</sup>. This system is most common method used in assessment of severity of acute pancreatitis.

**Table no: 6** Prediction of mortality according to Ranson's score

For Non Gallstone pancreatitis	For Gallstone pancreatitis
<b>At admission</b> Age > 55 years WBC > 16,000/mm <sup>3</sup> Blood glucose > 200 mg/dL Serum LDH > 350 IU/L Serum AST > 250 U/Dl	<b>At admission</b> Age > 70 years WBC > 18,000/mm <sup>3</sup> Blood glucose > 220 mg/dL Serum LDH > 400 IU/L Serum AST > 250 U/dL
<b>After 48 hours</b> Hematocrit fall > 10 points BUN elevation > 5 mg/dL Serum calcium < 8 mg/dL Arterial PO <sub>2</sub> < 60 mm Hg Base deficit > 4 mEq/L Estimated fluid sequestration > 6 L	<b>After 48 hours</b> Hematocrit fall >10 points BUN elevation >2 mg/dL Serum calcium <8 mg/dL Base deficit >5 mEq/L Estimated fluid sequestration >4 L

If the score is more than or equal to three in the above table the patient is predicted to have high mortality and morbidity and classified as severe pancreatitis.

**3) APACHE II Scoring System:**

The abbreviation says Acute Physiology And Chronic Health evaluation. It is a scoring system based on fourteen criteria. Score of more than eight indicates severity. The main disadvantage is that this system is not specific for Pancreatitis but has great advantage in diagnosing severity of the disease. The main advantage of this system over Ranson's scoring system is prediction can be done within 24 hours of admission rather than after 48 hours. The other advantage is that severity can be assessed throughout the disease and prognosis also can be assessed after interventions. Several changes has been made and the new APACHE III has been formulated and an additional of other five criterias were taken into consideration. APACHE O is another clinical assessment method where obesity is also considered.

Physiological variable	High abnormal range					Low abnormal range			
	4	3	2	1	0	1	2	3	4
Points	4	3	2	1	0	1	2	3	4
Temperature rectal c°	>41	39 - 40.9		38.5 - 38.9	36 - 38.4	34 - 35.9	32 - 33.9	30-31.9	<29.9
Mean Arterial pressure - mm Hg	>160	130 - 159	110 - 129		70 - 109		50 - 69		<49
Heart rate (Ventricular response)	>180	140 - 179	110 - 139		70 - 109		55 - 69	40 - 54	<39
Respiratory rate	>50	35 - 49		25 - 34	12 - 24	10 - 11	6 - 9		<5
Oxygenation PaO <sub>2</sub>	>500	350 - 499	200 - 349		<200	61 - 70		55 - 60	<55
Aeterial pH	>7.7	7.6 - 7.69		7.5 - 7.59	7.33 - 7.49		7.25 - 7.32	7.15 - 7.24	< 7.15
Serum HCO <sub>3</sub> (mEq/L)	>52	41 - 51.9		32 - 40.9	22 - 31.9		18 - 21.9	15 - 17.9	< 15
Serum sodium (mEq/L)	>180	160 - 179	155 - 159	150 - 154	130 - 149		120 - 129	111 - 119	<110
Physiological variable	High abnormal range					Low abnormal range			
Points	4	3	2	1	0	1	2	3	4
Serum Creatinine (mg/dl)	>3.5	2 - 3.4	1.5 - 1.9		0.6 - 1.4		< 0.6		
Hematocrit %	>60		50 - 59.9	46 - 49.9	30 - 45.9		20 - 29.9		< 20
WBCs * 10 <sup>3</sup>	>40		20 - 39.9	15 - 19.9	3 - 14.9		1 - 2.9		<1
Glasgow coma scale	Score = 15 minus actual GCS								

The above table is considered along with age <44 years -0 points, 45 to 54 years - 2 points, 65 to 74 years- 5 points, > 75 years- 6 points.

**Table No: 7** Showing APACHE II scoring system

Total of score above eight is considered as severe acute pancreatitis.

**Age Distribution in Study Population:**

			Complications		Total
			Yes	No	
Age Group	< 30 Years	Count	6	12	18
		% of Total	10.0%	20.0%	30.0%
	31 - 60 Years	Count	16	24	40
		% of Total	26.7%	40.0%	66.7%
	> 60 Years	Count	2	0	2
		% of Total	3.3%	0%	3.3%
Total		Count	24	36	60
		% of Total	40.0%	60.0%	100.0%

**Table no:8** Age distribution in study population

**Sex Distribution In Study Population**

			Complications		Total
			Yes	No	
Sex	Male	Count	21	33	54
		% of Total	35.0%	55.0%	90.0%
	Female	Count	3	3	6
		% of Total	5.0%	5.0%	10.0%
Total		Count	24	36	60
		% of Total	40.0%	60.0%	100.0%

**Table No: 9** Sex distribution in study population

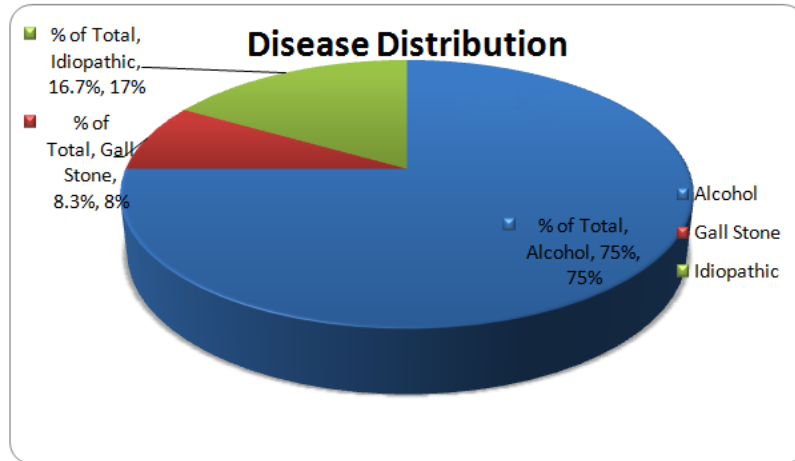
Among the 60 patients, 54 persons (90 %) were male and 6 persons (10 %) were females. This indicates male dominance in the distribution of the disease. This is mainly due to prevalence of alcohol intake in male population in our country.

**Disease Distribution Based On Etiology**

			Complications		Total
			Yes	No	
Etiology	Alcohol	Count	18	27	45
		% of Total	30.0%	45.0%	75.0%
	Gall Stone	Count	2	3	5
		% of Total	3.3%	5.0%	8.3%
	Idiopathic	Count	4	6	10
		% of Total	6.7%	10.0%	16.7%
Total		Count	24	36	60
		% of Total	40.0%	60.0%	100.0%

**Table no: 10** Disease distribution based on etiology

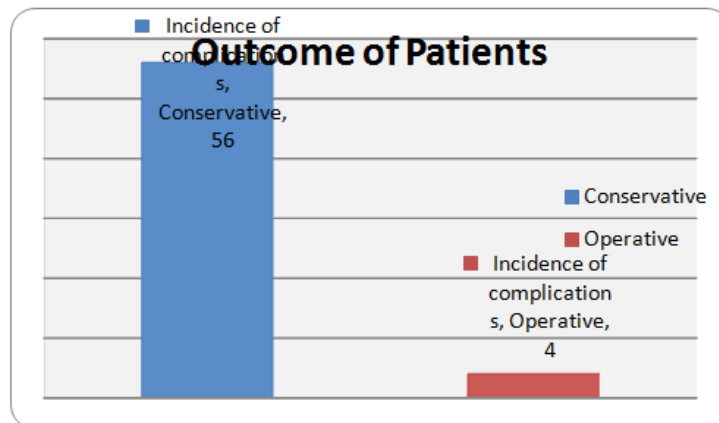
Among the 60 patients, 45 (75 %) of them had alcohol induced pancreatitis, 5 (8.3 %) of them had Gallstone induced pancreatitis and for the rest 10 (16.7 %) of them the etiology cannot be identified by routine investigations.



Graph No:1 Etiology of Acute Pancreatitis

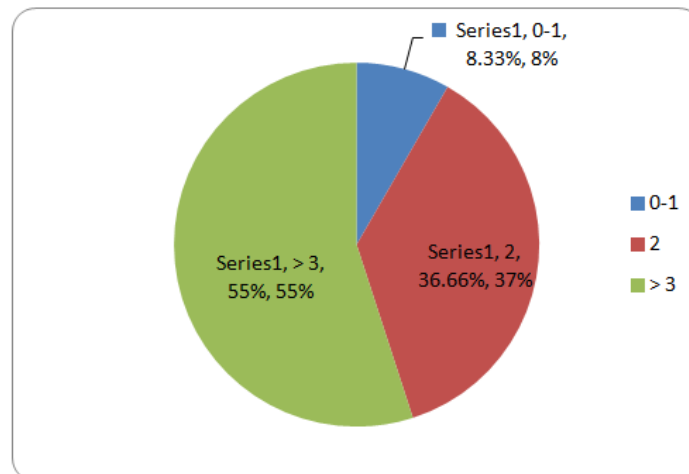
**Outcome Of Patients**

Among the 60 patients admitted in the wards, around 56 (93.3 %) were treated conservatively with intravenous fluids and antibiotics. And most of them did not need any surgical management. Around 24 (40 %) landed in complication such as SIRS (Systemic Inflammatory Response Syndrome), Acute kidney failure, Pseudocyst, Pancreatic necrosis etc but no mortality was present. Among the 24, only 4 (6.7%) patients needed surgical management and was proceeded for the same.



Graph No:2 Outcome of Patients

**Outcome Based on Ranson's Scoring System**



Graph No:3 Outcome based on Ranson's scoring

The Ranson's score was calculated for all the patients based on history and biochemical examination. According to Ranson's score, a score of about 3 or more then 3 is considered to be associated with increased mortality and complication rate.

The Ranson's score was 0 to 1 in about 5 patients, which is around 8.33 percent of the admitted population.

The Ranson's score was 2 in about 22 patients, which is around 36.66 percent of the admitted population.

The Ranson's score was 3 or more in about 33 patients, which is around 55 percent of the patients taken for the study, where it indicates higher complication and mortality rates.

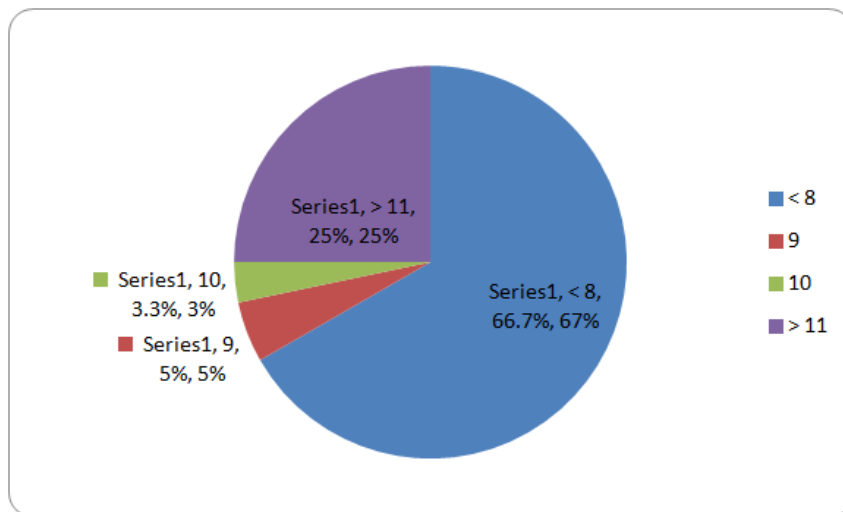
			Complications		Total
			Yes	No	
Ranson's Score (>=3)	Complication	Count	22	11	33
		% of Total	36.7%	18.3%	55.0%
	No Complication	Count	2	25	27
		% of Total	3.3%	41.7%	45.0%
Total	Count	24	36	60	
	% of Total	40.0%	60.0%	100.0%	

**Table no:11** Comparison table of Ranson's score with complication rate

The Ranson's score was calculated and found that around 33 (55 %) patients will have high mortality and complication as the Ranson's score was more than 3 . Among them 22 (36.7 %) developed complication. And 11 (18.3%) did not develop any complication of total population.

The Ranson's score was found to be 2 or less than the same in around 27 (45 %) cases. Among them 2 (3.3 %) developed complication and 25 (41.7 %) did not develop any complication of total population.

**Outcome Based On Apache Ii Scoring System**



**Graph No:4** Outcome based on APACHE II scoring

The APACHE II score was calculated for all the patients based on history and biochemical examination. According to APACHE II score, a score of above 8 is considered to be associated with increased mortality and complication rate.

The APACHE II score was 8 or less than the same in about 40 patients, which is around 66.7 percent of the study population.

The APACHE II score was 9 in about 3 patients, which is around 5 percent of the admitted population.

The APACHE II score was 10 in about 2 patients, which is around 3.33 percent of the patients taken for the study.

The APACHE II score was 11 or more in about 15 patients, which is around 25 percent of the admitted population.

According to APACHE II score more than 8 was found in 20 patients taken for study.



			Complications		Total
			Yes	No	
APACHE II Score	Complication	Count	19	1	20
		% of Total	31.7%	1.7%	33.3%
	No Complication	Count	5	35	40
		% of Total	8.3%	58.3%	66.7%
Total	Count	24	36	60	
	% of Total	40.0%	60.0%	100.0%	

**Table No: 12** Comparison table of APACHE II score with complication rate

**Prediction of severity by both scoring systems:**

	SENSITIVITY %	SPECIFICITY %	POSITIVE PREDICTIVE VALUE %	NEGATIVE PREDICTIVE VALUE%
<b>RANSON'S SCORING</b>	<b>87.5</b>	<b>97.2</b>	<b>95.5</b>	<b>92.1</b>
<b>APACHE II SCORING</b>	<b>83.3</b>	<b>86.1</b>	<b>80</b>	<b>88.6</b>

**Table no: 13** Prediction of severity by both scoring systems:

According to the study, Ranson's scoring system has higher sensitivity of 87.5 percent and high specificity of 97.2 percent compared to 83.3 percent sensitivity and 86.1 percent specificity in APACHE II. The positive predictive value is 95.5 percent and negative predictive value of 92.1 percent in Ranson's compared to 80 percent and 88.6 percent respectively in APACHE II. Hence Ranson's scoring system is more efficient based on the study, compared to APACHE II scoring system.

**VI. Conclusion**

From this study, we can conclude Ranson's scoring system is equally as good as APACHE II scoring system, in predicting the severity of acute pancreatitis. Ranson's scoring system is a simple, cheap, easy to remember/recollect and easy to calculate too. Above all this ranson's scoring system was developed specifically for acute pancreatitis. In developing countries like India, where cost effectiveness is an important factor, Ranson's scoring system can be used in place of APACHE II scoring system along with imaging findings particularly CT for CT severity index. The Ranson's scoring system accurately predicts the outcome in patients with acute pancreatitis and compares favourably with almost all physiological scoring systems available for prediction of severity and outcome for acute pancreatitis, the only disadvantage being a 24 hour delay.

The Ranson's scoring system is a simple scoring system, wherein the laboratory tests required are simple, routine and more readily available, the only disadvantage being a 24 hour delay. According to our study, the Ranson's scoring system accurately predicts the outcomes in patients with acute pancreatitis compared with the physiological scoring systems i.e APACHE II scoring system in the prediction of disease severity for acute pancreatitis. Finally, according to the study, Ranson's scoring system proved to be as reliable and better prognostic indicator in predicting the severity and outcome of acute pancreatitis.

**VII. Summary**

In the present study:

- ❖ 60 cases of acute pancreatitis were studied.
- ❖ Middle aged patients who were in the age group of 31 to 60 years, with the mean age of 36.91
- ❖ Most of the patients were male with incidence rate of 90 %.
- ❖ Alcohol intake was the predominant etiology for acute pancreatitis, which is around 75 % of patients of total study.
- ❖ Common complications were pseudocyst of pancreas and pancreatic necrosis in the present study which were found with imaging modalities.
- ❖ Mean Ranson's score for mild and severe cases were 1.88 and 4 respectively; Mean APACHE II score for mild and severe cases were 5.87 and 11.9 respectively.
- ❖ Ranson's score of more than 3 and APACHE II score of more than 8 and CT severity index more than 7 had the best accuracy for predicting severity of acute pancreatitis.
- ❖ 6.66 % of patients were treated surgically.
- ❖ Mortality rate was nil in the present study.
- ❖ Sensitivity, Specificity, Positive Predictor Value and Negative Predictor Value were 87.5 %, 97.2 %, 95.5 %, 92.1 % respectively for Ranson's scoring system.

- ❖ Sensitivity, Specificity, Positive Predictor Value and Negative Predictor Value were 83.3 %, 86.1 %, 80%, 88.6 % respectively for APACHE II scoring system.

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