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"Comparative Study of Ranson's versus APACHE II Scoring, predicting clinical outcome in patients with Acute pancreatitis at tertiary care centre in Jharkhand",

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Abstract
Objective*- To assess the severity of acute pancreatitis using Ranson's scoring system and APACHE II scoring system. and to compare these two scoring systems with respect to their accuracy in predicting the outcome in cases of acute pancreatitis.*
Materials and method- *A time bound prospective study was conducted on patients admitted with acute pancreatitis. Patients were subjected to detailed clinical examination, laboratory investigations and radiological imaging for patient evaluation and diagnosis*
Results- *Ranson's scoring system is not inferior to APACHE II scoring system in predicting the severity of acute pancreatitis.*
Conclusion-*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.*
Keywords-*Pancreatitis, APACHE, Ranson's*

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I. Introduction

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"[1]The pancreas has endocrine and exocrine functions; the exocrine glands, via the major papilla release digestive enzymes in to the duodenum via the pancreatic and bile ducts. Premature activation of exocrine enzymes in the pancreas causes inflammation. Acute pancreatitis is the sudden onset of reversible inflammation, whereas chronic pancreatitis is a progressive disorder characterized by ongoing inflammation and destruction that may occur insidiously. Acute pancreatitis (AP) is an increasingly common abdominal disorder presenting as major surgical challenge to general surgeons worldwide. It is a complex process which varies from mild self limiting inflammation to rapidly deteriorating condition which poses a serious threat to life. 48 population based cohort studies (ten on acute pancreatitis) were identified, with a total study population of 296 million individuals and 119000 patients with pancreatic disease. Global estimates of incidence and mortality for acute pancreatitis was 33.74 cases per 100000 person-years and 1.60 deaths per 100000 person-years.[2] Based on severity, acute pancreatitis can be acute oedematous; acute persistent; or acute hemorrhagic necrotizing. Early identification of patients at risk of developing a severe attack has great importance for instituting therapeutic interventions and improved outcome. Using the Atlanta criteria, acute pancreatitis is diagnosed when a patient presents with two of three findings, including abdominal pain suggestive of pancreatitis, serum amylase and/or lipase level at least three times the normal level, and characteristic findings on imaging. Acute pancreatitis can vary from mild (mortality rate less than 1%; typically resolves in several days) to severe (mortality rate up to 30%). Mortality rate are highest in patients with hemorrhagic pancreatitis, multi organ dysfunction or failure, and necrotizing pancreatitis. In necrotizing pancreatitis, infection or abscess substantially increases the mortality rate.

According to the Atlanta Classification, severe acute pancreatitis (SAP) is defined as an AP associated with local and/or systemic complications. Atlanta classification is a clinically based classification defining AP,

severity, and complications. Development of organ dysfunction within 72 hours of symptom onset is defined as an early severe acute pancreatitis (ESAP). Early severe acute pancreatitis is characterized by a short course, progressive MODS, early hypoxemia, increased incidence of necrosis, infection, and abdominal compartment syndrome (ACS).[3] Multiorgan dysfunction syndrome, the extent of pancreatic necrosis, infection, and sepsis are the major determinants of mortality in AP.[4] Pancreatic necrosis is considered as a potential risk for infection, which represents the primary cause of late mortality. Occurrence of acute respiratory (ARF), cardiovascular (CVF), and renal failures (RF) can predict the fatal outcome in SAP.[5] A wide range of mortality (20%-60%) has been reported in SAP.

Severe acute pancreatitis implies the presence of organ failure, local complication, or pancreatic necrosis associated disruption of the pancreatic blood supply.[3] several prognostic markers have been developed for severity stratification in acute pancreatitis. Multifactorial scoring systems incorporating clinical and biochemical criteria for severity assessment have been in use for some decades. These include the 11 criteria described by Ranson's et al. in the 1970s,[4] the Glasgow score (eight criteria),[5] MOSS score (12 criteria), BISAP score (5 criteria), and the acute physiology and chronic health evaluation (APACHE II) score (14 criteria).[6] The sensitivity and specificity of these scoring systems to predicting severe acute pancreatitis range between 55% and 90%, depending on the cut-off number and the timing of scoring.[7] Limitations of these scoring systems have been either the inability to obtain a complete score until at least 48 hours into the illness (Ranson's and Glasgow scores) or the complexity of the scoring system itself (APACHE II). The APACHE-II score has not been developed specifically for acute pancreatitis but has been proven to be an early and reliable tool. Ideal predicting criteria should, therefore, be simple, non-invasive, accurate and quantitative and assessment tests are easily available.

II. Materials and Method

A time bound prospective study was conducted on patients admitted with acute pancreatitis during the study period .All the patients were subjected to detailed clinical examination, laboratory investigations and radiological imaging. Diagnosis of Pancreatitis was done on the basis of Atlanta Diagnostic Criteria for Pancreatitis

Inclusion Criteria

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

Exclusion Criteria

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

After considering both inclusion and exclusion criteria, total number of patients included in the study were 60.All the 60 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.

Methods of Statistical Analysis

Independent t test 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 and MedCalc.

III. Results

Table no 1: Outcome of patients based on different cut-off Ranson's score

Ranson's score	Uncomplicated outcome	Complicated outcome			
		Local Complication			Systemic Complication
		Pseudo Cyst	Pancreatic Necrosis	Hemorrhagic Pancreatitis	SIRS
≤ 3	37	1	0	0	0
> 3	1	7	8	4	2
> 5	0	0	1	0	1

Table no 2 : Outcome of patients based on different cut-off APACHE II

APACHE II score	Uncomplicated outcome	Complicated outcome			
		Local Complication			Systemic Complication
		Pseudo Cyst	Pancreatic Necrosis	Hemorrhagic Pancreatitis	SIRS
≤ 8	37	1	0	0	0
> 8	1	7	8	4	2
> 12	0	3	3	2	1

Table no 3: Prediction of severity by Ranson's score

Ranson's Score	Sensitivity	Specificity	PPV	NPV	Accuracy
≥3	100	55.26	56.41	100	71.7
≥4	95.45	97.37	95.45	97.37	96.7
≥5	54.54	100	100	79.16	83.4

Table no 4: Prediction of severity by APACHE II score

APACHE II Score	Sensitivity	Specificity	PPV	NPV	Accuracy
≥8	100	86.84	81.48	100	91.7
≥9	95.45	97.36	95.45	97.36	96.7
≥10	81.81	100	100	90.47	93.3
≥11	72.72	100	100	86.36	90

Table no 5: Prediction of major organ failure and pancreatic collection by Ranson's score

Ranson's Score	Sensitivity	Specificity	PPV	NPV	Accuracy
Pancreatic Collection	95.45	97.36	95.45	97.36	96.66
Major Failure Organ	100	65.5	90.90	100	66.6

Table no 6: Prediction of major organ failure and pancreatic collection by APACHE II score

APACHE II Score	Sensitivity	Specificity	PPV	NPV	Accuracy
Pancreatic Collection	95.45	97.36	95.45	97.36	96.66
Major Failure Organ	100	65.5	90.90	100	66.6

Table no 7: Prediction of severity by the two scoring systems

	Sensitivity	Specificity	PPV	NPV	Accuracy
Ranson' s Score	95.45	97.36	95.45	97.36	96.66
APACHE II Score	95.45	97.36	95.45	97.36	96.66

IV. Discussion

In this study we compare the classical and simple Ranson's scoring system with the more cumbersome APACHE II scoring system. We have classified the severity of acute pancreatitis in this study based on the Atlanta criteria.Out of the 60 cases in this study, 38 patients (63.5%) had mild acute pancreatitis and 22 patients (36.5%) 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[15] 20 % of all the cases were severe. Mortality in our study was 3.3 % and mortality in the study by Larvin et al[8] was 7.6%. Mortality was less 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 and severe cases was 2.34 and 4.63 respectively. The mean APACHE II score was 5.07 and 11.86 for mild and severe cases respectively.

Comparing outcomes in patient groups based on a range of Ranson's and APACHE II scores, it was observed that complications like Pseudo Cysts, Pancreatic Necrosis, major organ failure and deaths were more common when Ranson' s score exceeded 3 and APACHE II scores exceeded 8. Contrary to expectation Pseudo Cyst was observed in one patient whose Ranson' s and APACHE II scores were 3 and 8 respectively. These patients presented to hospital later than 48 hours 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 APACHE II score of more than 8 are high risk patients.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 for the prediction of severity of acute pancreatitis.

In our study the Ranson's and APACHE II scoring systems were very sensitive for the prediction of systemic complications (100%) but less sensitive for prediction of local complications (95.45%). This is

comparable to the study by Larvin et al,[8] 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 APACHE II scores are comparable

Table No 8: Accuracy of Ranson' s and APACHE II scoring systems

	Sensitivity	Specificity	PPV	NPV	Accuracy
Ranson's Score	95.45	97.36	95.45	97.36	96.66
APACHE II Score	95.45	97.36	95.45	97.36	96.66

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

Table No. 9 –Comparison of Ranson's and APACHE II scoring systems with Larvin & Wilson et al

	Ranson's Scoring System			APACHE II Scoring System		
	Present study	Larvin et al	Wilson et al	Present study	Larvin et al	Wilson et al
Sensitivity	95.45	75	87	95.45	71	68
Specificity	97.36	68	71	97.36	91	67
PPV	95.45	37	49	95.45	67	40
NPV	97.36	91	94	97.36	93	87
Accuracy	96.66	69	75	96.66	87	68

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 APACHE II scores were also higher in the present study compared to the other studies.

Table No 10 – Comparison of Ranson's and APACHE II scoring systems with Su Mi Woo & Constantinos et al

	Ranson's Scoring System			APACHE II Scoring System		
	Present study	Su Mi Woo et al	Constan-tinos et al	Present study	Su Mi Woo et al	Constan-tinos et al
Sensitivity	95.45	89.50	82	95.45	78.9	58
Specificity	97.36	96	74	97.36	76	78
PPV	95.45	94.4	48	95.45	71.4	43
NPV	97.36	92.3	93	97.36	82.6	86
Accuracy	96.66	93.2	76	96.66	77.3	73

The sensitivity, specificity, positive predictive value, negative predictive value, accuracy in the present study were higher than the studies by Su Mi Woo et al et al and Constantinos et al. In the study by Su Mi Woo et al and Constantinos et al the sensitivity and specificity of Ranson's were higher than that of the APACHE II scoring system, whereas in the present study the sensitivity and specificity of Ranson's is the same as that of the APACHE II scoring system.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 specific predictor of outcome in patients with pancreatitis whereas the APACHE II 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 a 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 24 hour 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

V. 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 hour delay.

The Ranson's scoring system proved to be as powerful a prognostic model as the more complicated APACHE II scoring system even in the present era of advanced investigations.

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