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COMPARISON OF RANSON, GLASGOW IMRIE AND BISAP V/S MODIFIED ATLANTA SCORE IN ASSESSING SEVERITY OF ACUTE PANCREATITIS.

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Abstract:

Background: Acute Pancreatitis is one of the most common reasons to visit an ER with wide spectrum of severity. It requires assessment of severity for better management and to avoid complications. Few studies have been done to assess the severity scoring systems in their ability to predict severe acute pancreatitis. Hence, we aim to compare the various scoring systems in order to find out which is the best in predicting the outcome in acute pancreatitis.

Method: Demographic, radiographic and laboratory data was collected retrospectively of patients with Acute Pancreatitis who were admitted in district Wenlock hospital, Mangalore between January-June 2022. Modified Atlanta, Ranson, BISAP, Glasgow imrie score of all patients was calculated. and statistically analysed for correlation between each pair of scoring systems.

Results: Of 107 patients, Male gender formed 96.3%(103), Females formed 3.7% (4)of the patients suffering from Acute Pancreatitis. Ranson, BISAP and Glasgow score, all three showed a strong association with Modified Atlanta Score according to the Fishers exact test($p<0.05$).
Ranson score with an AUC of 0.881 suggests that a Ranson score of 2 with sensitivity of 90% and specificity of 78.7% was a cut off score in our study in predicting the severity of Acute Pancreatitis. Similarly, a BISAP score close to 2 with AUC of 0.766 was a cut off point in predicting severity

with a sensitivity of 70% and specificity of 83.1%. A Glasgow imrie score of 2 was a cut off point with AUC 0.860 in predicting severity of acute pancreatitis with a sensitivity of 80% and specificity of 78.7%.

Conclusion: Our study demonstrated that a higher score on these scoring systems correlated with greater severity of the disease. A cut off score of 2 on the Ranson scoring system demonstrated the highest sensitivity of 90% and highest correlation with the modified Atlanta score.

Keywords:Severity, scoring systems , predictors, acute pancreatitis, severe acute pancreatitis.

Introduction:

Acute Pancreatitis is one of the most common reasons to visit an ER and presents in a wide spectrum of severity. Some affected individuals may experience mild symptoms while others may face lethal morbidity in terms of a systemic inflammatory response which may lead to multiple organ dysfunction syndrome (MODS) [1]. Clinically, the condition presents with severe epigastric pain radiating to the back which may be associated with episodes of nausea and vomiting. Most patients present withing 12-24 hours of onset of symptoms. On a per abdomen examination, we may find diffuse abdominal tenderness and guarding [2 In India, chronic alcohol consumption is the most common cause followed by gallbladder stones.

[3]. Other causes of Pancreatitis include trauma to the pancreas, scorpion sting, mumps viral infection, autoimmune causes, steroids usage, hypertriglyceridemia, post endoscopic retrograde pancreaticocholangiography and use of certain drugs. The pathophysiology of acute pancreatitis involves acinar cell injury leading to intra-acinar activation of trypsinogen to trypsin leading to a cascade of activation of digestive enzymes leading to autodigestion of pancreas. Multiple other theories like mitochondrial dysfunction, oxidative stress, endoplasmic stress, impaired autophagy are also being considered in the pathophysiology. [4] Assesing the severity of acute pancreatitis is crucial in an emergency setting as the management depends on it. Several severity scores exist for determining the severity of acute pancreatitis like Ranson, Glasgow, CT severity index, CRP levels at admission and after 48 hours, Bedside index for severity in acute pancreatitis, Acute physiological and chronic health evaluation (APACHE-II). Knowing which tool is the best to assess the severity has been a task and very few studies have been done on the same. [5] The Ransons scoring involves assessment of a patient on admission and after 48 hours. One point each is given on admission for a White blood cell count, age more than 55 years, blood glucose levels, AST levels and LDH. At 48 hours after admission, the parameters considered are a dip in hematocrit more than 10%, an increase in Blood urea nitrogen, a fall in serum calcium levels, arterial pO2 less than 60 mm Hg, a base deficit and fluid requirement more than 6L. If the score is 3 or more than 3, it indicates severe acute pancreatitis.

The Glasgow imrie score for acute pancreatitis on admission considers age more than 55 years, an increase in the total leucocyte count, an increase inblood sugar levels, blood urea nitrogen more than 16 mmol/L and PaO2 less than 60 mm Hg. Within 48 hours, the score considers decrease in

serum calcium levels, serum albumin less than 32g/L, increase in serum LDH and an AST/ALT level more than 200 units/L. If three or more factors are present the disease is considered to be severe. The BISAP (Bedisde index for severity in acute pancreatitis) considers Blood urea nitrogen, a Glasgow coma score of less than 15, evidence of a systemic inflammatory response syndrome, age more than 60 years, on imaging if there is evidence of a pleural effusion. Each of these factors is given one point, 3 or more points for a patient indicates higher mortality. The APACHE-II score considers a number of parameters like rectal temperature, mean arterial pressure, heart rate, respiratory rate, blood oxygenation, arterial pH, electrolytes (sodium, potassium, bicarbonate), serum creatinine, hematocrit, total leucocyte count and the Glasgow coma scale of the patient. Diagnosing acute pancreatitis involves clinical symptoms like epigastric abdominal pain radiating to the lower back, biochemically amylase and lipase levels more than three times the upper limit of normal and imaging features suggestive of acute pancreatitis. However, imaging is only done if the symptoms don't resolve within 48 hours or to assess for complications. Treatment includes fluid resuscitation early on which decreases the risk of SIRS and MODS, nutrition which can be enteral since it maintains the intestinal barrier thus decreasing risk of translocation of bacteria and infection. However, if the patient is unable to take orally, nasogastric/nasojejunal feeds can be initiated. Antibiotic prophylaxis is not recommended. Cholecystectomy should be performed on initial admission in case of biliary pancreatitis as it decreases the incidence of recurrence [6]

Aims and Objectives:

1) To study the accuracy of various severity scores in assessing the severity of acute pancreatitis
2) To compare the the various severity scores in assessing the severity of acute pancreatitis.

Materials and methods:

Demographic, radiographic and laboratory data was collected retrospectively for 107 patients with Acute Pancreatitis who were admitted to our institution between January-June 2022 on Microsoft excel. After completion of data collection, data was imported to SPSS version 25. Modified Atlanta Score, Ranson score, BISAP score, Glasgow imrie score of all patients was calculated.In addition risk factors like age, gender, co-morbidities, serum amylase and lipase levels, history of previous acute pacnreatitis episode, length of hospital stay, etiology,LDH on admission, WBC on admission, RBS on admission, Calcium after 48 hours, hematocrit after 48 hours, partial pressure of Oxygen at 48 hours, BUN at 48 hours, Base deficit, Glasgow coma score on admission, Systemic inflammatory response syndrome and development of pleural effusion. Severe acute pancreatitis was defined according to the Modified Atlanta score.Continues baseline descriptive variables were expressed as mean with standard deviation (SD) and were compared using the Mann-Whitney test. Categorical variables were expressed as absolute numbers and proportions. Bivariate relationship for categorical variables were assessed using odds ratio (OR) calculated based on Pearson's c2 test or Fisher's exact test. Spearman rank correlation analysis was used for evaluation of the correlation between each pair of scoring systems.

$n = [(Z\ 1\text{-}a/2 + Z\ 1\text{-}b\ )/\ C]\ 2$

$C = 0.5 \ln [\ (1 + r)/\ (1\text{-}r)\ ]$

$r = 0.58$

Z 1-a /2 -! at 95 % confidence interval

Z 1-b ! 0.84 at 80% power

r = correlation co-efficiant

Results:

Patient characteristics People under the age of 40 years contributed to 67.2% (72)of those suffering from Acute Pancreatitis (33.6% (36)were 30 years and below and 33.6% (36)were between 31-40 years), followed by patients in the age group of 41-50 years contributing to 22.4% (24). Male gender formed 96.3%(103) and Females formed 3.7% (4)of the patients suffering from Acute Pancreatitis. Patients with comorbidities formed 31.8%(34) of the study. 46 patients (43%) were people with the first attack of Acute Pancreatitis
whereas 57% (61) had history of a previous attack. Length of hospital stay was 6-10 days for a majority 42.1% (45) of patients, 1-5 days for 35.5% (38) of patients, 11-20 days for 15.9% (17) patients.Ethanol consumption contributed to 83.2% (89) of the etiology, followed by Biliary causes 7.5% (8). Other causes were trauma (1.9%) and Hypertriglyceridemia (0.9%).

In terms of severity of Acute Pancreatitis, 11.2% (12) patients had severe Acute Pancreatitis according to the Modified Atlanta Score and 88.8%(95) had Mild-Moderate Acute Pancreatitis. Majority of the patients 45.5% (46) had a Ranson score of 0, 43.5% (44) had a score of 1-2. According to the Ranson scoring system, 4% (4) patients had Severe Acute Pancreatits and were at a higher mortality risk, whereas according to the BISAP score, 2% (2) patients had severe Acute Pancreatitis.6 Patients (6.1%) had severe Acute Pancreatitis according to the Glasgow-imrie score.

According to the Modified Atlanta Scoring system, 8.3% (3) patients under the age of 30 years had Severe Acute Pancreatitis, 27.8% (10) had moderate and 63.9% (23) had severe Acute Pancreatitis. Amongst the patients with Severe Acute Pancreatitis , 66.7% (8) were in the age group of 31-40 years and amongst those with moderate and mild acute pancreatitis, 33.3% (11) and 27.4% (17) were in the age group of 31-40 years respectively.

In terms of gender, 25% (1) female had moderate and 75%(3) had mild acute pancreatitis according to the Modified Atlanta Score. Amongst the male gender, 11.7%(12) had had severe acute pancreatitis and 31.1%(32) and 57.3%(59) had moderate and mild acute pancreatitis respectively

Comorbidities were present in 50% (6) with severe acute pancreatitis according to the modified atlanta score, 38.2%(13) with moderate and 44.1%(15) with mild acute pancreatitis. Amongst patients with mild acute pancreatitis, 75.8%(47) had no comorbidities.

Amongst patients with severe acute pancreatitis, 66.7%(8) had a history of a previous episode of acute pancreatitis. Patients with no previous history of acute pancreatitis, 65.6% (40)suffered from mild acute pancreatitis.

Length of hospital stay was 6-10 days for 66.7%(30) patients with mild acute pancreatitis and 11-20 days for 47.1%(8) patients with moderate acute pancreatitis. Amongst patients with hospital stay of over 20 days, 42.9%(3) suffered from severe acute pancreatitis.

In terms of etiology, 91.7%(11) patients with severe acute pancreatitis had chronic alcohol consumption as the causative factor, however 53.9%(48) patients with alcohol consumption suffered from a mild attack of acute pancreatitis. Amongst the patients with biliary causes as the etiological factor, 75%(6) had mild acute pancreatitis in accordance with the Modified Atlanta Score.

Mortality was recorded in 45.5% (5) patients with severe acute pancreatitis, 36.4%(4) patients with moderate and 18.2%(2) with mild acute pancreatitis.

Mortality had a strong correlation with severity of acute pancreatitis in accordance with the Chi square test with a p value of 0.000 ($p<0.05$)

Association with severity

		severity (mod Atlanta)								
		Severe			Moderate			Mild		
		Count	Column N %	Row N %	Count	Column N %	Row N %	Count	Column N %	Row N %
Age	30 and below	3	25.0%	8.3%	10	30.3%	27.8%	23	37.1%	63.9%
	31 - 40	8	66.7%	22.2%	11	33.3%	30.6%	17	27.4%	47.2%
	41 - 50	1	8.3%	4.2%	8	24.2%	33.3%	15	24.2%	62.5%

	Above 50	0	0.0%	0.0%	4	12.1 %	36.4%	7	11.3 %	63.6%
Gender	F	0	0.0%	0.0%	1	3.0%	25.0%	3	4.8%	75.0%
	M	12	100.0 %	11.7 %	32	97.0 %	31.1%	59	95.2 %	57.3%
co-morbidities	Present	6	50.0%	17.6 %	13	39.4 %	38.2%	15	24.2 %	44.1%
	Absent	6	50.0%	8.2%	20	60.6 %	27.4%	47	75.8 %	64.4%
H/o previous attack	No	4	33.3%	6.6%	17	51.5 %	27.9%	40	64.5 %	65.6%
	Yes	8	66.7%	17.4 %	16	48.5 %	34.8%	22	35.5 %	47.8%
length of hosp stay(days)	1 - 5	5	41.7%	13.2 %	10	30.3 %	26.3%	23	37.1 %	60.5%
	6 - 10	2	16.7%	4.4%	13	39.4 %	28.9%	30	48.4 %	66.7%
	11 - 20	2	16.7%	11.8 %	8	24.2 %	47.1%	7	11.3 %	41.2%
	Above 20	3	25.0%	42.9 %	2	6.1%	28.6%	2	3.2%	28.6%
etiology	Alcohol	11	91.7%	12.4 %	30	90.9 %	33.7%	48	77.4 %	53.9%
	Biliary	1	8.3%	12.5 %	1	3.0%	12.5%	6	9.7%	75.0%
	Hypertriglyceridemia	0	0.0%	0.0%	0	0.0%	0.0%	1	1.6%	100.0 %
	others	0	0.0%	0.0%	0	0.0%	0.0%	1	1.6%	100.0 %
	Trauma	0	0.0%	0.0%	2	6.1%	100.0 %	0	0.0%	0.0%
	unknown	0	0.0%	0.0%	0	0.0%	0.0%	6	9.7%	100.0 %
Mortality	No	6	54.5%	6.5%	29	87.9 %	31.5%	57	96.6 %	62.0%
	Yes	5	45.5%	45.5 %	4	12.1 %	36.4%	2	3.4%	18.2%

Fig 1: Comparing various Risk factors with the severity of acute pancreatitis in accordance with the Modified Atlanta Score.

severity (mod Atlanta) with Following parameters	chi square(C)/Fishers exact test(F)	p value	
Age	F	0.253	NS
Gender	F	0.697	NS
co-morbidities	C	0.113	NS
H/o previous attack	C	0.101	NS
length of hosp stay(days)	F	0.052	NS
Etiology	F	0.274	NS
Mortality	C	0.000	HS

Fig2 : Assessing association between various risk factors and severity of Acute Pancreatitis according to the Modified Atlanta Score. Only Mortality showed strong association with severity ($p<0.05$)

Association of score with severity

Amongst patients with mild acute pancreatitis according to the Modified Atlanta score, 50.8%(30) had a Ranson score of 0, 30.5%(18) had a Ranson score of 1, 15.3%(9) had a Ranson score of 2 and 3.4%(2) had a Ranson score of 3. No one with mild acute pancreatitis had a Ranson score of 4 and above. All (4))patients with a score of 4 and above on the Ranson scoring system had severe acute pancreatitis according to the Modified Atlanta score and amongst patients with severe acute pancreatitis 30%(3) had a Ranson score of 4 and 10%(1)had a Ranson score of 5.

According to the BISAP score, 72.9%(35) patients with a BISAP score of 0 had mild acute pancreatitis according to the Modified Atlanta Scoring system and 50% with a score of 3 and more had severe acute pancreatitis.

In terms of Glasgow scoring system, 60%(3) with a score of 4 had severe acute pancreatitis and 70.4%(19) with a score of 1 had mild acute pancreatitis

severity (mod Atlanta) with Following parameters	chi square(C)/Fishers exact test(F)	p value	
Ranson score	F	0.000	HS
BISAP score	F	0.003	HS
Glasgow score	F	0.000	HS
Ranson score	F	0.000	HS
BISAP score	F	0.091	NS
Glasgow score	F	0.000	HS

Fig 3: Results of association amongst the various scoring systems and Modified Atlanta score according to the Fisher Exact test.

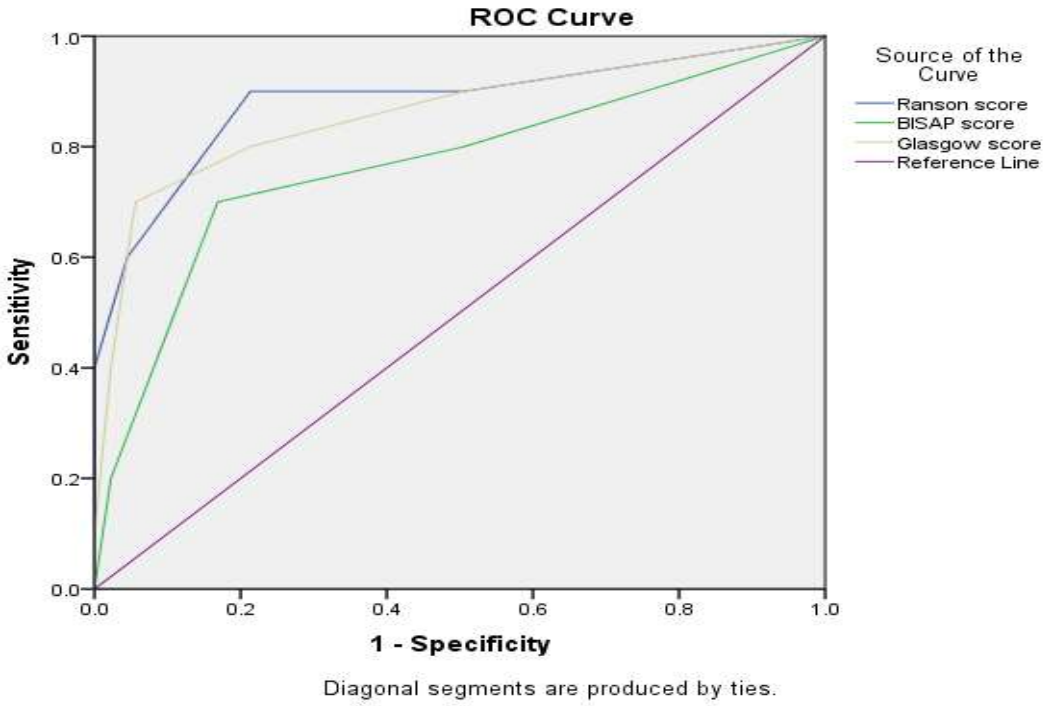

Fig 4: ROC analysis : Ranson score with an AUC of 0.881 suggests that a Ranson score of 2 with sensitivity of 90% and specificity of 78.7% was a cut off score in our study in predicting the severity of Acute Pancreatitis. Similarly, a BISAP score close to 2 with AUC of 0.766 was a cutoff point in predicting severity with a sensitivity of 70% and specificity of 83.1%.

A Glasgow imrie score of 2 was a cutoff point with AUC 0.860 in predicting severity of acute pancreatitis with a sensitivity of 80% and specificity of 78.7%.

Spearman Correlations

	N	Correlation	p	
severity (mod Atlanta) & Ranson score	101	.455	.000	sig
severity (mod Atlanta) & BISAP score	102	.403	.000	sig
severity (mod Atlanta) & Glasgow score	99	.416	.000	sig

		severity (mod Atlanta)					
		Severe			Mild-Moderate		
		Count	Column N %	Row N %	Count	Column N %	Row N %
Ranson score	Severe	4	40.0%	100.0%	0	0.0%	0.0%
	Less severe	6	60.0%	6.2%	91	100.0%	93.8%
BISAP score	Severe	1	10.0%	50.0%	1	1.1%	50.0%
	Less severe	9	90.0%	9.0%	91	98.9%	91.0%
Glasgow score	Severe	4	40.0%	66.7%	2	2.2%	33.3%
	Less severe	6	60.0%	6.5%	87	97.8%	93.5%

Fig 5 : According to the Spearman Rank Correlation Coefficient, correlation of Ranson, BISAP and Glasgow with Modified Atlanta score ($p<0.05$

Discussion:

Acute Pancreatitis is a common clinical condition presenting with varying severity. Some patient with Acute Pancreatitis present only with mild self limiting symptoms while some present with severe acute pancreatitis requiring immediate admission and treatment. According to a study up to 25% patients suffer a severe attack and between 30 and 50% patients die. According to the study we conducted, 11.2% (12) patients had severe acute pancreatitis and 88.8%(95) had mild-moderate acute pancreatitis according to the Modified Atlanta Score. When we compared this severity in terms of Ranson scoring system, 4%(4) had severe acute pancreatitis and 2%(2) had severe acute pancreatitis according to the BISAP scoring system, while according to the Glasgow-imrie scoring system, 6.1%(6) had severe acute pancreatitis.

Mortality was as high as 45.5%(5) in patients with severe acute pancreatitis

Pathophysiology of Acute Pancreatitis involves a pro-inflammatory environment in the body which develops a complex cascade of immunological events. The numero uno event considered at present is the premature activation of trypsinogen to trypsin which leads to premature activation of digesting enzymes secreted by the acinar cells in the pancreas. [1]

The etiology of acute pancreatitis can vary based on geographical locations. In our study, alcohol consumption contributed to 83.2%(89) of the patients suffering from acute pancreatitis followed by biliary causes contributing to 7.5%(8). Other causes like hypertriglyceridemia and trauma contributed to 0.9%(1) and 1.9%(2) respectively. Unknown factors leading to acute pancreatitis contributed to 6.5%(7) of the study population. In patients with severe acute pancreatitis, 91.7%(11) had chronic alcohol consumption as the causative factor however 53.9%(48) patients with alcohol consumption suffered from mild acute pancreatitis and those with biliary cause as the causative factor, 75%(6) had mild acute pancreatitis according to the modified Atlanta score. [2]

In our study population, mean age of patients developing acute pancreatitis was 36 years. Comorbid conditions were found in 73% patients with acute pancreatitis in Europe whereas 50% in those from India, Latin America and North America. Comorbid condition were found in 31.8%(34) and were absent in 68.2%(73) patients in our study. In our study, 45.5% patients with severe acute pancreatitis died during the hospital stay. [3]

In our study, according to the modified Atlanta score 11.2%(12) patients developed severe acute pancreatitis whereas 10.9%(11) had severe acute pancreatitis according to Ranson score. According to BISAP, 4% (4) had severe acute pancreatitis and according to Glasgow imrie score, 11.2% (12) had severe acute pancreatitis [4]

In a study with a meta-analysis which included 1300 patients with Acute Pancreatitis, Ranson score had an overall sensitivity of 75%, specificity of 77%. In another study, the sensitivity of Ranson score was 85.7, however specificity was low at 44.4%. The AUC for Ranson score was 0.69 (95% CI: 0.62-0.76) whereas for BISAP it was 0.74(95% CI: 0.61-0.76). In our study, Ranson score had an AUC of 0.881 with a score of 2 predicting severity with a sensitivity of 90% and specificity of 78.7% (P = 0.000; , <0.05). BISAP score of 2 predicted severity with a sensitivity of 70% and specificity of 83.1% (P= 0.006; <0.05) with AUC of 0.766. Glasgow imrie score of 2 predicted severity of acute pancreatitis with a sensitivity of 80% and specificity of 78.7% with AUC of 0.860. [5]

Another study demonstrated that the AUC for Ranson score was significantly larger than other scoring systems (AUC = 0.817) with a score predicting severity of greater than or equal to 3. According to this study Ranson score achieved the highest sensitivity and lowest false negative rate. Similarly our study demonstrated that the Ranson scoring system had a sensitivity of 90% and False negative rate of 10% with AUC of 0.88. [6]

Another study demonstrated that mortality was 37.5% in severe Acute Pancreatitis, 2.3% in mild and 13.6% overall. In our study, according to the Modified Atlanta score, 45.5% patients with severe acute pancreatitis and 12.1% patients with moderate acute pancreatitis had mortality. Amongst those with mild acute pancreatitis, 3.4% developed mortality [7]

Rapid, reliable and validated means of predicting patient outcome from rapid clinical assessment are essential in the ER for predicting severity of acute pancreatitis. In that regard, BISAP score and other single variable predictors may assist in decision making due to their ease of use and applicability within 24 hours. In our study, BISAP score with an AUC of 0.766 demonstrated a sensitivity of 70% and specificity of 83.1% (P=0.006; <0.05) for a score of 2. [8]

Another study demonstrated Glasgow imrie score as the best classifier of acute pancreatitis on admission. Our study showed that 6.1% (6)patients had severe acute pancreatitis according to Glasgow imrie score. AUC for Glasgow imrie score was 0.860 in our study with a sensitivity of 80% and specificity of 78.7% for a score of 2 (P = 0.000 ; < 0.05). [9]

A study conducted by Park J et al showed that BISAP score of 2 and above was statistically significant in predicting the severity of acute pancreatitis, organ failure and mortality. AUC for BISAP predicting severe pancreatitis and death were 0.80 and 0.86, respectively which was similar to Ranson (0.74,0.74). The study thus found that BISAP predicts severity better than Ranson score. However, in our study, Ranson with an AUC of 0.881and a sensitivity of 90% with a score of 2 showed higher statistical significance in predicting severity than BISAP (AUC = 0.766) with sensitivity of 70% and specificity of 83.1% for a score of 2 in predicting severity.[10]

Another study showed that BISAP predicted outcome of acute pancreatitis which was comparable to APACHE-II, however BISAP predicted all three outcomes namely severity, development of infected pancreatic necrosis and mortality with the same cut off of . Hence the study concluded that BISAP scoring system was a robust scoring system. Similarly in our study, a cut off score of 2 in the BISAP scoring system showed statistical significance. However, Ranson score showed the greatest statistical significance with an AUC of 0.881 and sensitivity of 90%. [11]

Conclusion:

Acute Pancreatitis is a common cause of visit to an ER and hence its diagnosis and timely management is imperative. Diagnosis as well as assessment of severity of Acute Pancreatitis which dictates management is a multipronged approach with multiple scoring systems. The Ranson scoring system is one of the earliest predictive models but is difficult to utilize in clinical practice as it requires 5 parameters on admission and 6 after 48 hours of hospitalization. Our study demonstrated that Ranson score showed the greatest clinical significance in predicting severity of acute pancreatitis and had the strongest correlation with Modified Atlanta score with a Spearman rank correlation co-efficient of 0.455 (P=0.000; <0.05).

Diagnosis of Acute Pancreatitis is multipronged and includes clinical signs and symptoms, lab parameters, imaging modalities, etc. Scoring systems to assess severity of acute pancreatitis are also multiple and are a part of the diagnostics. Each scoring system has its own drawbacks in assessing timely severity of acute pancreatitis. Our study demonstrated that a higher score on these scoring systems correlated with greater severity of the disease. A cut off score of 2 on the Ranson scoring system demonstrated the highest sensitivity of 90% and highest correlation with the modified Atlanta score (Spearman correlation = 0.455; P=0.000).

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