ASSESSMENT OF SCORING SYSTEMS IN PREDICTING THE SEVERITY OF ACUTE PANCREATITIS

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ABSTRACT

BACKGROUND

Acute pancreatitis is defined as an acute condition presenting with abdominal pain and is usually associated with raised pancreatic enzyme levels in the blood or urine as a result of pancreatic inflammation. Acute pancreatitis can be classified as mild or severe.

The aim of the study is to assess the accuracy of Ranson's score, APACHE score, Glasgow severity scale, PANC 3 score in predicting the severity of acute pancreatitis.

MATERIALS AND METHODS

A prospective study was done for a period of two years from November 1, 2013, to October 31, 2015, in patients diagnosed as acute pancreatitis. A detailed history and physical examination was carried out and diagnosis of acute pancreatitis was made. All the study cases underwent relevant investigations. Based on the results, the Ranson's score, APACHE II score, Glasgow severity score and PANC 3 score were calculated. The APACHE II was taken as gold standard scoring system and other severity scores were compared to it.

RESULTS

In our study of 60 patients, the sensitivity of Ranson's criteria was greatest (100%), then followed by Glasgow severity index and PANC 3 criteria. The specificity and PPV was greatest for PANC 3 criteria. The NPV was highest for Ranson's, while the accuracy in predicting acute pancreatitis was highest for Glasgow severity index.

CONCLUSION

Acute pancreatitis can present in mild and severe form, mainly a clinical diagnosis supplemented by biochemical and radiological findings. It is extremely important to differentiate severe form of acute pancreatitis from the mild form, so that appropriate intensive treatment can be started in cases of severe pancreatitis. Ranson and Glasgow severity index required multiple data and the patient had to be evaluated after 48 hours to get a clear picture of the severity of the acute pancreatitis. The Ranson's had the highest sensitivity and NPV. The PANC 3 criteria was cost-effective and time saving. It had highest specificity and PPV in our study. We can conclude from our study that the PANC 3 criteria can be used not as a substitute, but as a method to be used in combination with Ranson's criteria because of its high specificity, PPV and accuracy.

KEYWORDS

Acute Pancreatitis, APACHE II, Glasgow Severity Index, Ranson's Score, PANC 3.

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BACKGROUND

Acute pancreatitis is defined as an acute condition presenting with abdominal pain and is usually associated with raised pancreatic enzyme levels in the blood or urine as a result of pancreatic inflammation. Acute pancreatitis can be classified as mild or severe.[1]

The disease ranges from mild self-limiting inflammation of pancreas to critical disease characterised by infected pancreatic necrosis, multiple organ failure and a high risk of mortality.

Worldwide, the incidence of acute pancreatitis ranges from 5 to 80/1,00,000 population.[2]

Approximately, 30% of patients develop severe acute pancreatitis, which is associated with mortality of 14-25%, whereas the mild acute pancreatitis is associated with mortality of 0 to 1%.[3]

The overall improvement in outcome for patients with acute pancreatitis has been due to combination of factors

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that include improvements in intensive care medicines, imaging techniques, severity prediction and selection of patients for endoscopic retrograde cholangiopancreatography and surgery.[4,5]

Aims and Objectives

To assess the accuracy of Ranson's score, APACHE score, Glasgow severity scale, PANC 3 score in predicting the severity of acute pancreatitis.

MATERIALS AND METHODS

This prospective study was carried out on patients presenting our department with symptoms of pain in epigastrium radiating to back associated with nausea and vomiting and a serum amylase or serum lipase of at least three times the upper limit of normal. The study was done for a period of two years from November 1, 2013, to October 31, 2015, in patients diagnosed to be of acute pancreatitis. A detailed history and physical examination was carried out and diagnosis of acute pancreatitis was made.

Inclusion Criteria

- Pain in epigastrium radiating to back.
- Level of pancreatic enzymes greater than three times the upper limit of normal.
- Patients greater than 18 years of age.
- Onset of pain less than 48 hours before admission.

Exclusion Criteria

- Not willing to participate in study.
- Chronic pancreatitis.
- Attack of acute on chronic pancreatitis.
- Pregnancy.
- Patients with comorbid conditions like heart failure, lung pathology, kidney and liver failure.
- Anaemia.
- Pleural effusion preceding the attack of acute pancreatitis.

All the study cases underwent routine laboratory investigations alongside LDH, serum calcium and ABG radiology investigations included chest x-ray and ultrasound abdomen and pelvis. Based on the results, the Ranson's score, APACHE II score, Glasgow severity score and PANC 3 score were calculated. The APACHE II was taken as gold standard scoring system and all other severity scores were compared to it.

Descriptive and inferential statistical analysis was carried out.

Sensitivity, specificity, PPV, NPV and accuracy are computed to find the predictive potential of severe pancreatitis.

Patient Factors

Age distribution of patients studied in two levels of APACHE II.

In our study, the maximum patients were in the age group of 31-40 years (26%). In a study by Khanna et al,[6] the maximum patients were in the age group of 21-30 years (23.6%), followed by 41-50 (22.2%) and 31-40 (16.7%). The difference in age group is not statistically significant in our study when verified using Fisher exact test (p>0.05) (Table 1).

Age in years	APACHEII		Total
	Mild pancreatitis	Severe pancreatitis	
<20	2(5%)	0(0%)	2(3.3%)
20-30	9(22.5%)	4(20%)	13(21.7%)
31-40	17(42.5%)	9(45%)	26(43.3%)
41-50	9(22.5%)	4(20%)	13(21.7%)
51-60	2(5%)	2(10%)	4(6.7%)
>60	1(2.5%)	1(5%)	2(3.3%)
Total	40(100%)	20(100%)	60(100%)

Table 1. Age Distribution

Aetiology of acute pancreatitis studied in two levels of APACHE II.

In our study, the aetiology in majority of our cases was due to alcohol intake - 40 (66.7%), followed by gallstones 17 (28.3%). In a study by Woo et al,[7] the majority of patients were in the group with alcohol as aetiology, followed by idiopathic and then biliary. In another study by Khanna et al,[6] the maximum cases were of biliary aetiology (61.1%), followed by alcohol (18.0%). In our study, the difference was not statistically significant as per Fisher exact test (p>0.05) (Table 2).

Etiology	APACHEII		Total
	Mild pancreatitis	Severe pancreatitis	
Alcohol	26(65%)	14(70%)	40(66.7%)
Gallstones	13(32.5%)	4(20%)	17(28.3%)
Hypertriglyceridemia	0(0%)	1(5%)	1(1.7%)
Idiopathic	1(2.5%)	1(5%)	2(3.3%)
Total	40(100%)	20(100%)	60(100%)

Table 2. Aetiology of Acute Pancreatitis

Disease Factors

Serum amylase and serum lipase in acute pancreatitis studied in two levels of APACHE II.

In our study, the mean value of serum amylases in severe pancreatitis was 945.95 ± 210.82, while in mild pancreatitis the mean value was 516.40 ± 163.93.

The mean value of serum lipase in severe pancreatitis was 1090 ± 177.51, while in mild pancreatitis, the mean value was 641.43 ± 144.07.

In a study by Maher et al,[8] the mean value of serum amylase and serum lipase in cases of severe pancreatitis were 731 ± 176 and 903 ± 96. The mean values in cases of mild pancreatitis were 638 ± 81 and 711 ± 47.

The values were significant in our study (p<0.001) as per Chi-square test/Fisher exact test. Our study showed that increased values were associated with severe pancreatitis (Table 3).

	APACHEII		Total (n=60)	P value
	Mild pancreatitis (n=40)	Severe pancreatitis (n=20)		
Amylase				
➢ <500	20(50%)	0(0%)	20(33.3%)	<0.001**
➢ 500-1000	19(47.5%)	14(70%)	33(55%)	
➢ >1000	1(2.5%)	6(30%)	7(11.7%)	
Lipase				
➢ <500	4(10%)	0(0%)	4(6.7%)	<0.001**
➢ 500-1000	35(87.5%)	6(30%)	41(68.3%)	
➢ >1000	1(2.5%)	14(70%)	15(25%)	

Table 3. Amylase and Lipase Levels in Two Levels of APACHE II

Blood glucose in acute pancreatitis studied in two levels of APACHE II.

The mean blood glucose levels in our study were 234.50 ± 60.21 for severe pancreatitis and 145.00 ± 27.34 for mild pancreatitis. The values were statistically significant as per Chi-square/Fisher exact test (p<0.001).

In a study by Maher et al,[8] the mean blood sugar levels for severe pancreatitis were 273 ± 31 and for mild pancreatitis were 149 ± 3 (p value = 0.01). This shows an association between severe pancreatitis and elevated blood glucose levels (Table 4).

	APACHEII		Total	P value
	Mild pancreatitis	Severe pancreatitis		
Blood glucose	145.00±27.34	234.50±60.21	174.83±58.92	<0.001**

Table 4. Blood Glucose in Relation to APACHE II

Haematocrit in acute pancreatitis studied in two levels of APACHE II.

The mean haematocrit level in the severe pancreatitis was 48.49 ± 3.65. In case of mild pancreatitis, the level was 40.61 ± 3.65. The values were statistically significant as per Chi-square/Fisher exact test (p<0.001).

In a study by Maher et al,[8] the haematocrit was 46.1 ± 5.9 in severe pancreatitis, while in mild pancreatitis, the level was 41.8 ± 4.2 (p value = 0.001). This correlates with the findings of our study that increased levels of haematocrit are associated with cases of severe pancreatitis (Table 5).

	APACHEII		Total	P value
	Mild pancreatitis	Severe pancreatitis		
Hematocrit	40.61±3.65	48.49±2.41	43.24±4.97	<0.001**

Table 5. Haematocrit in Two Levels of APACHE II

BMI in acute pancreatitis studied in two levels of APACHE II. In our study, the mean BMI in severe cases was 27.90 ± 3.32, while in mild cases, the mean BMI was 22.85 ± 2.71. The values were statistically significant as per Chi-square/Fisher exact test.

As per Maher et al,[8] the mean BMI in severe cases was 30.9, while in mild cases, it was 25.4 (p value = 0.007). This showed relationship between BMI and severity of pancreatitis (Table 6).

	APACHEII		Total	P value
	Mild pancreatitis	Severe pancreatitis		
BMI (kg/m^2)	22.85±2.71	27.90±3.32	24.53±3.76	<0.001**

Table 6. BMI in Two Levels of APACHE II

Scoring Systems

Ranson's criteria and Glasgow score.

The mean Ranson and Glasgow in our study for severe disease were 4.00 ± 0.73 and 2.95 ± 0.94. In cases of mild disease, the mean values were 2.15 ± 0.77 and 1.60 ± 0.59. The values in our study were statistically significant.

In a study by Woo et al,[7] the mean Ranson and Glasgow values for severe disease were 4 and 3. In cases of mild disease, the mean values were 2 and 1 (Table 7).

	APACHEII		Total	P value
	Mild pancreatitis	Severe pancreatitis		
Ranson's criteria	2.15±0.77	4.00±0.73	2.77±1.16	<0.001**
Glasgow	1.60±0.59	2.95±0.94	2.05±0.96	<0.001**

Table 7. Ranson's and Glasgow Scores in Two Levels of APACHE II

Comparing the Scoring Systems

In our study, the Ranson's criteria was associated with sensitivity of 100%, specificity of 77.50%, positive predictive value of 68.97% and negative predictive value of 100%, the accuracy was 85% for severe pancreatitis. The 'p' value was <0.001.

On comparing the results of our study with other studies, the sensitivity of the Ranson's criteria according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 89.5%, 83.9% and 91.2%. The study by Simoes et al was closest to the sensitivity value for severe pancreatitis in our study.

The specificity of the Ranson's criteria according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 96%, 78% and 74.4%. The study by Khanna et al[6] was closest to the specificity value for severe pancreatitis in our study.

The positive predictive value of the Ranson's criteria according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 94.4%, 74.3% and 57.4%. The study by Khanna et al[6] was closest to the positive predictive value for severe pancreatitis in our study.

The negative predictive value of Ranson's criteria according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 92.3%, 86.5% and 95.7%. The study by Simoes et al was closest to the negative predictive value for severe pancreatitis in our study.

The accuracy of predicting the severe pancreatitis according to Woo et al[7] and Khanna et al[6] was 93.2% and 80.6% (Table 8).

Variables / Our study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Ransons criteria- Values >= 3	100.00	77.50	68.97	100.00	85.00	<0.001
Woo et al [60]	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
Ransons criteria	89.5	96	94.4	92.3	93.2	<0.001
Khanna et al [63]	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
Ransons criteria	83.9	78.0	74.3	86.5	80.6	
Simoes et al [61]	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
Ransons criteria	91.2	74.4	57.4	95.7		<0.001

Table 8. Comparison of Ranson's Score Results in Our Study with Other Studies

In our study, the Glasgow severity index was associated with sensitivity of 65%, specificity of 97.5%, positive predictive value of 92.86%, negative predictive value of 84.78% and the accuracy was 86.67%. The 'p' value was <0.001 (Table 9).

Variables / Our study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Glasgow severity index value>= 3	65.00	97.50	92.86	84.78	86.67	<0.001
Woo et al [60]	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Glasgow severity index	63.2	92	85.7	76.7	79.6	<0.001
Khanna et al [63]	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Glasgow severity index	71.0	78.0	71.0	78.0	75.0	
Simoes et al [61]	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
Glasgow severity index	73.5	71.1	49.0	87.7		<0.001

Table 9. Comparison of Results of Glasgow in Our Study with Our Studies

On comparing the results of our study with other studies, the sensitivity of the Glasgow severity index according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 63.2%, 71.0% and 73.5%.

The study by Woo et al was closest to the sensitivity value for severe pancreatitis in our study.

The specificity of the Glasgow severity index according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 92%, 78% and 71.1%. The study by Woo et al was closest to the specificity value for severe pancreatitis in our study.

The positive predictive value of Glasgow severity index according to Woo et al,[7] Khanna et al,[6] Simoes et al[9] was 85.7%, 71.0% and 49.0%. The study by Woo et al was closest to the positive predictive value for severe pancreatitis in our study.

The negative predictive value of Glasgow severity index according to Woo et al,[7] Khanna et al[6] and Simoes et al[9] was 76.7%, 78% and 87.7%. The study by Simeos et al was closest to the negative predictive value for severe pancreatitis in our study.

The accuracy of predicting severe pancreatitis according to Woo et al[7] and Khanna et al[6] was 79.6% and 75%. The study by Woo et al was closest to the accuracy value for severe pancreatitis in our study (Table 10).

Variables / Our study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
PANC 3	45.00	100.00	100.00	78.43	81.67	<0.001
Fakuda et al [62]	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
PANC 3	31.25	100	100	81.66	83.07	
Brown et al [54]	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	P value
PANC 3	69	99	99	78		

Table 10. Comparison of Results of PANC 3 Criteria in Our Study with Other Studies

In our study, the PANC 3 criteria was associated with sensitivity of 45%, specificity of 100%, positive predictive value of 100% and negative predictive value of 78.43%, the accuracy of predicting severe disease was 81.67%.

On comparing the results of our study with other studies, the sensitivity of the PANC 3 criteria according to Fakuda et al[10] and Brown et al[11] was 31.25% and 69%. The study by Fakuda et al was closest to our value in terms of sensitivity for severe pancreatitis.

The specificity of PANC 3 criteria according to Fakuda et al[10] and Brown et al[11] was 100% and 99%. The results of both the studies in terms of specificity were similar to the value of our study.

The positive predictive value of PANC 3 criteria according to Fakuda et al[10] and Brown et al[11] was 100% and 99%. The results of both the studies in terms of PPV were similar to the value of our study.

The negative predictive value of PANC 3 criteria according to Fakuda et al[10] and Brown et al[11] was 81.66% and 78%. The result of Brown et al was closest to our value of NPV for severe pancreatitis.

The accuracy of PANC 3 criteria according to Fakuda et al[10] was 83.07 and was close to our value of accuracy for severe pancreatitis (Table 11).

Variables	Sensitivity %	Specificity %	PPV %	NPV %	Accuracy %	P value
Ransons criteria- Values >= 3	100.00	77.50	68.97	100.00	85.00	<0.001**
Glasgow severity index value>= 3	65.00	97.50	92.86	84.78	86.67	<0.001**
PANC 3	45.00	100.00	100.00	78.43	81.67	<0.001**

Table 11. Comparison of Various Scoring Systems

In our study, the Ranson's criteria had a sensitivity of 100% as compared to Glasgow severity index and PANC 3 criteria, which had sensitivity values of 65% and 45%. This indicates that Ranson's had more ability to identify proportion of those patients who had severe pancreatitis.

The specificity of the PANC 3 criteria was 100% in our study, while the specificity in case of Glasgow severity index was 97.5%, which was followed by Ranson's, which had a specificity of 77.5%. This showed that the PANC 3 criteria were capable of ruling out the cases, which did not have severe pancreatitis correctly in comparison to Ranson's and Glasgow severity index.

The Positive Predictive Value (PPV) of the PANC 3 criteria was 100% in our study, while the PPV for Glasgow severity index was 92.86%, followed by Ranson's, which had a PPV of 68.97%. This indicated that patient classified as severe pancreatitis by PANC 3 criteria had more probability of having severe pancreatitis in comparison to Glasgow and Ranson's. The Negative Predictive Value (NPV) of the Ranson's criteria was 100%, while the NPV for Glasgow severity index and PANC 3 criteria were 84.78% and 78.43%. This shows those classified as mild pancreatitis by Ranson's had more chances of having mild pancreatitis in comparison to Glasgow severity index and PANC 3 criteria.

The accuracy of Glasgow severity index in our study was 86.67%, while that of Ranson's was 85%. The accuracy of PANC 3 criteria in our study was around 81.67%. All the three scoring systems were fairly equal to each other in terms of accuracy.

The main limitation of our study was the limited number of patients that could be evaluated. The study requires a larger sample size to have more accurate values. Many of the patients were having acute on chronic pancreatitis and were excluded from the study as per the exclusion criteria.

DISCUSSION

Acute pancreatitis is serious and can be fatal if not treated on time. Our study included 60 patients who presented with acute pancreatitis in M.V.J. MC and RH over a span of 2 years. The patients were sorted into severe and mild acute pancreatitis on the basis of APACHE II score. The other scoring systems used were Ranson's, Glasgow severity index and PANC 3 criteria to assess the severity of acute pancreatitis.

The data we obtained was tabulated and percentage calculated wherever necessary. Student's t-test (two-tailed, independent) was used to find the significance of study parameters on continuous scale between two groups (intergroup analysis) on metric parameters. Chi-square/Fisher exact test was used to find the significance of study parameters on categorical scale between two groups. Sensitivity, specificity, PPV, NPV and accuracy are computed to find the predictive potential of severe pancreatitis.

CONCLUSION

Acute pancreatitis is a common condition associated with acute abdomen. The disease can present in mild form in one to fulminating processes with multi-organ failure. It is mainly a clinical diagnosis supplemented with biochemical and radiological findings.

Various scoring methods like Ranson's, APACHE II, BISAP, Glasgow severity index and PANC 3 criteria are used to classify the patients in severe and mild pancreatitis.

Our study showed that Ranson's was the most sensitive while the PANC 3 criteria was the least sensitive for severity of acute pancreatitis.

The specificity and PPV of the PANC 3 criteria were highest of all the scoring systems, and for the Ranson's, the value were lowest.

The NPV was highest for Ranson's and least for PANC 3 criteria.

The Ranson criteria required multiple data and took 48 hours of time to get the data to gauge the severity of acute pancreatitis.

The Glasgow severity index also required multiple data can be gauged after 48 hours.

The PANC 3 criteria was easy to measure, cost-effective and showed strict accuracy to predict a severe acute pancreatitis condition. There was no incidence of false positive for PANC 3 criteria in the current study.

We can conclude from our study that the PANC 3 criteria can be used not as a substitute, but as a method to be used in combination with Ranson's criteria because of its high specificity, PPV and accuracy.

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