

## Original Article

# Assessment of PANC3 Score in Predicting Severity of Acute Pancreatitis

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ABSTRACT

**Introduction:** Acute pancreatitis is inflammatory process of the pancreas associated with local and systemic complications. At present, there are lots of scores (such as Ransons, APACHE II, bedside index for severity in acute pancreatitis) that help us in predicting severity at the time of admission but these are time consuming or require complex calculation and are costly. **Material and Methods:** PANC3 Scoring System is one of the better systems because the three criteria used (hematocrit, body mass index, and pleural effusion) are simple, easy to assess, readily available, and economic. In this prospective study, 100 cases were evaluated to see the prospects of PANC3 scoring in predicting the severity of acute pancreatitis as decided by modified Marshals score. **Results:** The results showed that PANC3 score had a 96.43% specificity, 75% sensitivity, 80% positive predictive value, and 95.29% negative predictive value. **Conclusion:** Hence, the PANC3 score is a cost-effective, promising score that helps in predicting the severity of acute pancreatitis leading to prompt treatment and early referral to higher center.

**KEYWORDS:** APACHE score, PANC3 score, pancreas, pancreatitis, Ranson's score

## INTRODUCTION

Pancreatitis is defined as inflammation of the pancreas. It is one of the most common causes of acute abdomen encountered in emergency. Severe acute pancreatitis occurs in 10%–20% of patients and mortality results, despite critical care, in 10%–25% patients.<sup>[1,2]</sup> Acute pancreatitis was classified in 1992 as mild and severe acute pancreatitis in the original Atlanta classification. In 2013, a revised Atlanta classification was formulated which classified pancreatitis into mild, moderate, and severe based on the duration of organ failure. Organ failure (defined by modified Marshall score) present for more than 48 h was considered as severe acute pancreatitis and if present <48 h was termed as moderate acute pancreatitis.<sup>[3]</sup>

Over time, a lot of scoring systems have been developed such as Ransons, APACHE II, bedside index for severity in acute pancreatitis (BISAP) to predict the severity of acute pancreatitis. These scoring systems either take more than 48 h to evaluate (Ransons, computed tomography severity index) are difficult to memorize and cumbersome (APACHE II) or are costly and not widely available (C-reactive protein [CRP], trypsinogen activation peptide [TAP]). Based on these problems, a

retrospective study done by Brown *et al.* in 2007 found out that combining parameters such as hematocrit, body mass index (BMI), and pleural effusion led to posttest likelihood of disease to be 99% and hence the term PANC3 score was coined.<sup>[4]</sup> In our study, PANC3 score, which does not utilize any sophisticated scoring and is economic to the patients, is being evaluated as scoring system for triaging patients according to severity early in the course of disease for better outcomes.

## MATERIALS AND METHODS

Acute pancreatitis was defined as two or more of the following:

1. Characteristic abdominal pain
2. Increased levels of serum amylase and/or lipase three times the normal value
3. Ultrasound of the abdomen demonstrating changes consistent with acute pancreatitis.

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The patients who met the criteria defined above and had onset of pain <48 h were included in the study. Patients who presented with organ failure at presentation or within 24 h were not included as they were already in severe pancreatitis. In addition, patients with acute on chronic pancreatitis or recurrent attack of acute pancreatitis were not included in the study. Patients with comorbid conditions such as cardiac failure, liver failure, and renal failure were excluded from the study.

PANC3 score was determined at the time of admission of the patient, and numbers of factors that are positive in the patient were determined so as to predict severity. The three factors in PANC3 score are:

1. Hematocrit of >44%
2. BMI of >30 kg/m<sup>2</sup> and
3. Chest X-rays that reveals pleural effusion.

Modified Marshall scoring system was used in the 2012 revision of the Atlanta classification (According to the revised Atlanta classification 2012 by Peter A Banks and Acute pancreatitis classification working group)<sup>[3]</sup> to assess the severity of acute pancreatitis on the basis of organ Failure (score of 2 or more in any system).

Modified Marshall score was applied at 24 h, 48 h, and 7 days to check the development of organ failure and to classify it as transient or persistent. Mild acute pancreatitis was defined as no organ failure with no local or systemic complications. Moderately, severe acute pancreatitis was defined as organ failure that resolves within 48 h (transient organ failure). Severe acute pancreatitis defined as persistent organ failure (>48 h).<sup>[3]</sup> The PANC3 parameters were measured, and it was seen if the patients with all the three parameters positive had severe acute pancreatitis or not.

Statistical analysis was done using proportions. The sensitivity, specificity, positive predictive value (PPV) negative predictive value (NPV), and diagnostic accuracy were determined for PANC3 Score using the following formulae.

$$\text{Sensitivity} = \frac{A}{A + C} \times 100$$

$$\text{Specificity} = \frac{D}{B + D} \times 100$$

$$\text{Positive predictive value} = \frac{A}{A + B} \times 100$$

$$\text{Negative predictive value} = \frac{D}{C + D} \times 100$$

$$\text{Diagnostic accuracy} = \frac{A + D}{\text{Total number of cases}} \times 100$$

A = True positive

B = False positive

C = False negative

D = True negative

### Distribution of diagnostic statistics used in the study

Test	Criteria		
	Severe acute pancreatitis	Mild or moderate pancreatitis	Total
PANC3 (all factors positive)	A (TP)	B (FP)	A+B
PANC3 (all factors not positive)	C (FN)	D (TN)	C+D
Total	A+C	B+D	N

TP: True positive, FN: False negative, FP: False positive, TN: True negative

### Statistical software

The statistical software, namely, SPSS 11.0 (IBM corporation, Chicago USA) and SYSTAT 8.0 (Systat Software Inc., Cranes Software International Limited, Bangalore, India). were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables, etc.

## RESULTS

Out of the total 100 cases, 59% cases were mild acute pancreatitis, 25% cases were moderate acute pancreatitis, and 16% cases were severe type. The majority of patients belonged to 30–45 years age group, with mean age of presentation of severe acute pancreatitis being 47.3 years. It was seen all types of pancreatitis were more common in males as compared to females. The most common etiology that we encountered was alcohol intake (50% cases), and gallstones were the 2<sup>nd</sup> most common cause.

Individual parameters were calculated at the time of admission. The mean BMI (weight in kg/height in m<sup>2</sup>) of patients were 25.036 kg/m<sup>2</sup> in mild type, 26.083 kg/m<sup>2</sup> in moderate type, and 30.997 kg/m<sup>2</sup> in severe type. Pleural effusion was seen in 18 patients. The majority of patients (87.5%) of severe acute pancreatitis had pleural effusion. The hematocrit was calculated, and the mean hematocrit in patients of mild, moderate, and severe acute pancreatitis was 35.5%, 41%, and 45.91%, respectively.

These three parameters of PANC3 score were combined for predicting severe acute pancreatitis. Out of the 16 cases of severe acute pancreatitis, 12 (75%) had all three parameters positive, two (12.5%) had two

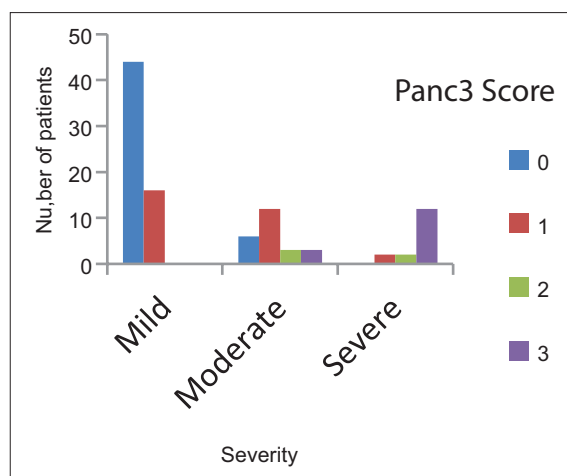


Figure 1: PANC3 score in different types of pancreatitis

Table 1: PANC3 score’s ability to predict severe acute pancreatitis

	Severe pancreatitis	Other pancreatitis
PANC3 score 3	12	3
PANC3 score <3	4	81

Table 2: Results of study conducted by Cho *et al.* in 2015 regarding various scoring systems predicting severity of pancreatitis

	Sensitivity	Specificity	PPV	NPV
Ranson	85.7	44.3	18.8	95.3
BISAP	61.9	72.1	25.0	92.7
APACHE-II	81.0	65.7	26.2	95.8
CRP 24	53.3	94.3	66.7	90.4

PPV: Positive predictive value, NPV: Negative predictive value, CRP: C-reactive protein, BISAP: Bedside index for severity in acute pancreatitis

Table 3: Results of study conducted by Khanna *et al.* in 2013 comparing various scoring systems

	Sensitivity	Specificity	PPV	NPV	Accuracy
Ranson	83.9	78.0	74.3	86.5	80.6
Glasgow	71.0	78.0	71.0	78.0	75.0
MOSS	77.4	56.1	57.1	76.7	65.3
APACHE II	80.6	82.9	78.2	85.0	81.9
SIRS	80.6	65.9	64.1	81.8	72.2
BISAP	74.2	68.3	63.4	77.8	70.8
CTSI	65.4	50.0	54.8	60.9	57.4
IL-6	93.1	96.8	96.4	93.8	95.0
CRP	86.2	100	100	88.6	93.3
Procalcitonin	86.4	75.0	79.2	83.3	81

BISAP: Bedside index for severity in acute pancreatitis, SIRS: Systemic inflammatory response syndrome, CTSI: Computed tomography severity index, CRP: C-reactive protein, IL-6: Interleukin-6, PPV: Positive predictive value, NPV: Negative predictive value, MOSS: Multiple Organ System Score

parameters positive, and two (12.5%) had just one parameter positive [Figure 1]. All patients had at least one parameter positive and hence the abnormal PANC3 score. Figure 1 shows the distribution of type of pancreatitis according to number of PANC3 parameters positive. Out of the 16 cases of severe acute pancreatitis, two died on the 4<sup>th</sup> day of admission. Fourteen patients stayed in the Intensive Care Unit for minimum 10 days, and all of them required ventilator support.

The sensitivity of PANC3 score was 75%, and the specificity was 96.43%. The PPV was 80%, and the NPV was 95.29% in predicting severe acute pancreatitis. The diagnostic accuracy is 93%. The Chi-square statistic is 53.78. Table 1 shows the PANC3 score’s ability to predict severe acute pancreatitis.

## DISCUSSION

Prediction of severity is an essential step in the management of acute pancreatitis. Approximately 15%–30% patients present with severe disease,<sup>[5,6]</sup> and the early recognition of such patients is essential to avoid morbidity and mortality associated with the attack. 50% mortality associated with severe acute pancreatitis can be reduced to 8% by early recognition of a case.<sup>[7]</sup>

Various markers have been evaluated to predict the outcome of acute pancreatitis, which are markers of severity, early prediction, pancreatic necrosis and infective pancreatic necrosis, and mortality.<sup>[8]</sup> Multifactorial scoring system using Ranson, Glasgow, APACHE II, and clinical data such as age, etiology and obesity, blood urea nitrogen, lactate dehydrogenase and evidence of pancreatic necrosis, age, chronic health status, and inflammatory markers all were used to predict the severity of pancreas.

In 2015, Cho *et al.* did a study comparing different scoring systems and published the results as shown in Table 2.<sup>[9]</sup>

In 2013, Khanna *et al.* did a comparison of Ranson, Glasgow, BISAP, systemic inflammatory response syndrome, Multiple Organ System Score, APACHE-II, and other scores in predicting severity, organ failure, pancreatic necrosis, and mortality in the Indian scenario. The results are shown in Table 3.<sup>[10]</sup>

In our study, 100 patients were evaluated over a period of 1 year. The severity of the patients was classified according to the revised Atlanta classification into three groups mild, moderate, and severe. Although the revision of classification added another category “moderate acute pancreatitis” theoretically, practically, it was still treated as mild acute pancreatitis.<sup>[3]</sup> Of the 100 patients, 59% cases were mild acute pancreatitis, 25% were moderate, and 16% were severe. These findings are comparable with that

**Table 4: Comparison of 2 studies done on PANC3 score**

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Fukuda <i>et al.</i> <sup>[17]</sup>	31.25	100	100	81.66	83.07
Present study	75	96.43	80	95.29	93

PPV: Positive predictive value, NPV: Negative predictive value

of the rest of the world.<sup>[6]</sup> The mean age for presentation in mild group was 44.7 years, and 42.5 in moderate group, and 47.35 in severe group. The majority of patients were in 30–45 years groups. The mean age of presentation was in the 4<sup>th</sup> decades of life. The mean age of presentation in world literature was 6<sup>th</sup> decades.<sup>[11]</sup> The difference is probably explained due to alcohol being common in this part of world. The mean age of presentation for severe group was slightly more than the other two groups.

The majority of patients in our study were male (62%). Severe acute pancreatitis was more common in males as compared to females with a ratio of 3:1. It has been studied that gallstone pancreatitis tends to occur more common in female subjects 1:3 when compared to male, and alcohol is more common for pancreatitis in male 6:1.<sup>[12]</sup>

The most common etiology in our study was alcohol-induced pancreatitis. It was seen in 50% of patients. Second, most common etiology was gallstones (40%). Ten out of 16 patients of severe acute pancreatitis were due to alcohol-induced pancreatitis. Although world literature supports the fact that severity has no relation with cause,<sup>[13]</sup> the difference here might be attributed to more common alcohol consumption in this part of the world.

Obesity was seen mainly in cases of severe acute pancreatitis with mean BMI of 30.997 kg/m<sup>2</sup>. The mean BMI of mild and moderate group was 25.063 kg/m<sup>2</sup> and 26.804 kg/m<sup>2</sup>. These findings are supported by literature, which state that severity of an attack is influenced by BMI of patient.<sup>[14]</sup>

Pleural effusions on X-rays were seen in 87.5% of severe acute pancreatitis cases in our study. These findings were similar to that observed by Heller *et al.*, who in their study found abnormal chest radiograph in 84.2% of their patients.<sup>[15]</sup>

In pancreatitis fluid, sequestration into extravascular space due to leaky capillary channels leads to significant fluid depletion and hemoconcentration. There tends to be increase in hematocrit value in such patients. Hematocrit >44% and failure to fall in this measure after 24 h has been shown to be related to the development of pancreatic necrosis and predict organ failure. In our study, the mean hematocrit of patients having mild, moderate, and severe pancreatitis was 35.5%, 41%, and

45.9%, respectively. Hence, as observed by Brown *et al.*, the hemoconcentration can be used as a predictor of severity.<sup>[16]</sup>

Using these three factors combined that is hematocrit of >44%, pleural effusion, and BMI >30 kg/m<sup>2</sup> evaluation was done in our study to predict the severity on admission. The predictions were compared to what was observed by modified Marshall score to see if the patient actually went into the respective predicted category. PANC3 score was devised by Brown *et al.* in a retrospective study on 393 patients. They found out that all three factors combined had a posttest likelihood ratio of 99% of developing severe acute pancreatitis.<sup>[4]</sup>

In our study, the sensitivity of PANC3 score was 75%, and the specificity was 96.43%. The PPV was 80%, and the NPV was 95.29% in predicting severe acute pancreatitis. The Chi-square statistic is 53.78. The diagnostic accuracy is 93%. These scores are comparable to that observed by Fukuda *et al.*,<sup>[17]</sup> [Table 4] who did a study on 65 patients and found out that PANC3 score had a specificity of 100%; PPV of 100%; and NPV of 81.66%. The difference in results is probably due to small size of their study and less number of patients with severe acute pancreatitis. Although the results of our study are promising, the limitation to its generalizability is the small number of cases. In addition, conducting such studies at a tertiary care hospital may have limitations, as the patients seen are not reflective of type of patients seen at local clinic or community hospital.

## CONCLUSION

Assessment of severity of pancreatitis helps in better outcome of the patient in terms of morbidity and mortality, as we can give early and advanced care to those in need (that is cases of acute severe pancreatitis).

Various scoring systems are in use to assess the severity and each one has its pros and cons. Some have better predictability but have to wait for 48 h. For full scoring, others can be used to assess the severity at admission and have good predictability but very cumbersome to use and not universally available. The single best marker for predicting severity has yet to be found though serum CRP, TAP, etc., are being studied.

PANC3 scoring system is one of the better systems because the three criteria used are simple, easy to assess,

available at every health-care center, and cost of assessing is low compared to other systems. Using PANC3 at admission to predict severity is specific and sensitive as most of as the present study states its sensitivity to be 75%, specificity to be 96.43%, PPV to be 80%, and NPV to be 95.29%.

The ultimate goal of any scoring system or markers is to predict the patients with severe attack early in the course of disease and be able to interrupt the cascade of inflammatory response leading to MODS and ultimately death. PANC3 scoring system is such an effort to prolong the life of patients by early detection and prompt treatment, its easy to use cost-effective and hence can be used in peripheral/rural centers for early referral.

No ethical issues were faced during the trial as the course of treatment was not changed.

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### Conflicts of interest

There are no conflicts of interest.

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