PANC-3 score in predicting the severity of acute pancreatitis

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ABSTRACT

Background: Acute pancreatitis (AP) presents as acute abdomen, Inflammatory process of pancreas associated with local and systemic complications. Many scores (such as Ranson's, APACHE II, and Bedside index for severity in AP) that help us in predicting severity at the time of admission, but these are time consuming and require complex calculation and are not economically cheap. Our aim here is to analyze the simplified stratification system of PANC3 SCORE and its assessment in predicting severity of AP as decided by Modified Marshall Score. **Aims and Objectives**: PANC-3 score in predicting the severity of acute pancreatitis. **Materials and Methods**: PANC3 Scoring system is simple, easy to access readily available and economic, as it involves these criteria (hematocrit, body mass index, and pleural effusion). It is a prospective study in which 100 patients were evaluated with PANC3 Scoring, who were diagnosed with AP and admitted to the department of general surgery, Mysore Medical College and Research Institute. **Results**: The results showed that PANC3 score had a 96.25% specificity, 70% sensitivity, 82.35% positive predictive value, and 92.77% negative predictive value. **Conclusion**: PANC3 SCORE is cost effective, can be determined at the time of admission, thus early prediction of disease severity and early referral to higher center.

Key words: Acute pancreatitis; APACHE score; PANC3 SCORE

INTRODUCTION

Acute pancreatitis (AP) is defined as an acute pancreatic inflammation due to activation of digestive enzymes present in the interior of the gland, which affect the pancreas, adjacent tissues, and other organs.[1,2] One of the most common causes of acute abdomen encountered in emergency. The mortality rates vary from 1% in the mild form to 20–30% in the severe form, corresponding to the 14th main cause of death of gastrointestinal origin.[3,4] The diagnosis of AP requires at least the presence of two of the three following criteria:

- Abdominal pain consistent with the disease
- Biochemical evidence of pancreatitis (serum amylase and/or lipase greater than three times the upper limit of normal) and
- Characteristic findings from abdominal imaging.[5]

In 2012, two new classifications systems of AP were published: Determinant-Based Classification of AP Severity (DBC) and the Revised Atlanta Classification 2012 (RAC). The novel DBC was based on a global web-based survey and a dedicated international symposium with contributors from different disciplines: E-mail invitations were delivered to 528 pancreatologists from 55 countries, and 240 pancreatologists from 49 countries participated in the survey. During the 2011 World Congress of the International Association of Pancreatology (Kochi, India), around 100 participants discussed the proposed classification and tried to agree on the definitions.[6] The RAC has three categories: Mild, moderately severe, and severe, according to organ failure (organ failure as defined by modified Marshall Score) and local or systemic complications. The DBC added a fourth category: Critical, based on two main determinants

of mortality: (peri) Pancreatic necrosis and organ failure (Table 1).[7]

A number of scoring systems have developed such as Ransons, APACHE II, Bedside index for severity in AP (BISAP) to predict the severity of AP. These scoring systems either take more than 48 h to evaluate, difficult to memorize and cumbersome or costly and not widely available.

Based on above problems, a retrospective study done by Brown et al., in 2007, found that combining parameters such as hematocrit, body mass index (BMI), and pleural effusion led to post-test likelihood of disease to be 99% and hence the term "PANC3 score" was coined.[8] PANC3 score, which does not utilize any sophisticated scoring parameters, is economic and easy scoring system for triaging patients according to severity early in the course of disease, at the time of admission, for better outcomes.

Aims and objectives

The aim and objective of the current study was to use PANC-3 criteria for early prediction of severity of Acute Pancreatitis.

MATERIALS AND METHODS

This is a prospective analytical observational study, carried out in the Department of General surgery, Mysore Medical College and Research Institute, Mysore. From patient admitted during time period from January 2020 to June 2021. The study was pre-approved by the Institutional Ethics Committee for the final permission.

Table 1: Definition of severity in AP

Revised Atlanta Classification (RAC)	Determinant-based classification (DBC)
Mild AP	Mild AP
No organ failure	No organ failure
No local or systemic complications	No (peri) pancreatic necrosis
Moderately severe AP	Moderate AP
Transient organ failure (<48 h)	Transient organ failure and/OR
Local or systemic complications without persistent organ failure	Sterile (peri) pancreatic necrosis
Severe AP	Severe AP
Persistent single or multiple organ failure (>48 h)	Persistent organ failure OR Infected (peri) pancreatic necrosis
	Critical AP
	Persistent organ failure AND Infected (peri) pancreatic necrosis

AP: Acute pancreatitis

Inclusion criteria

The patients who met the criteria defining AP above and had onset of pain <48 h before admission were included in the study.

Exclusion criteria

- Patients presented with organ failure at presentation or within 24 h of admission (They were already in severe pancreatitis)
- History of pancreatic carcinoma
- Acute on chronic pancreatitis
- Recurrent attack of AP
- Patients with comorbid conditions such as cardiac failure, liver failure, and renal failure
- Illness that could compound the interpretation of investigations such as presence of pleural effusion on chest radiographs preceding development of AP such as known anemia, congestive heart failure, and pregnancy.

PANC3 score was determined at the time of admission of the patient, and number 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/m² and
3. Chest Xrays that reveals pleural effusion.

Modified Marshall scoring system was used in the 2012 revision of the Atlanta classification (According to the RAC 2012 by Peter A Banks and AP classification working group)[9] to assess the severity of AP 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 AP was defined as no organ failure with no local or systemic complications. Moderately, severe AP was defined as organ failure that resolves within 48 h (transient organ failure). Severe AP defined as persistent organ failure (>48 h).[5] The PANC3 parameters were measured, and it was seen if the patients with all the three parameters positive had severe AP or not.

Statistical analysis

It 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.

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

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

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

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

The distribution of diagnostic statistics used in the study test is tabulated in Table 2.

RESULTS

Among 100 patients, 55% cases were mild AP, 25% cases were moderate AP, and 20% cases were severe type Figure 1.

The three parameters of PANC3 score were combined for predicting severe AP. The majority of patients belonged to 35–55 years age group, with mean age of presentation of severe AP being 48 years. The distribution of different types of acute pancreatitis in PANC3 Score, in our study, is shown in Figure 2.

The majority of patients (84) in our study were male (84%). The most common etiology that we encountered was alcohol intake (70% cases), and gallstones were the next common cause. The mean BMI of patients were 25.076 kg/m² in mild type, 26.093 kg/m² in moderate type, and 30.867 kg/m² in severe type. Pleural effusion was seen in 25 patients, out of which 17 patients of severe acute pancreatitis had pleural effusion (85%). The hematocrit was calculated, and the mean hematocrit in patients of mild, moderate, and severe acute pancreatitis was 34.5%, 42.63%, and 46.81%, respectively. Out of the 20 cases of severe acute pancreatitis, 14 (70%) had all three parameters positive, 4 (20%) had two parameters positive, and 2 (10%) had just one parameter positive.

Out of the 20 cases of severe acute pancreatitis, 2 died on the 4th day of admission and 1 died on 5th day of admission. 17 patients stayed in the Intensive Care Unit for minimum 10 days, and all of them required ventilator support. The sensitivity of PANC3 score was 70%, and the specificity was 96.25%, PPV was 82.35%, and the NPV was 92.77% in predicting severe acute pancreatitis. The diagnostic accuracy is 91%.

Distribution of type of pancreatitis according to number of PANC3 parameters positive is shown in Table 3.

DISCUSSION

Prediction of severity is an essential step in the management of acute pancreatitis. Approximately 15–30% patients present with severe disease, and the early recognition of such patients is essential to avoid morbidity and mortality associated with the attack.[3,4] About 50% mortality associated with severe acute pancreatitis can be reduced to 8% by early recognition.[9]

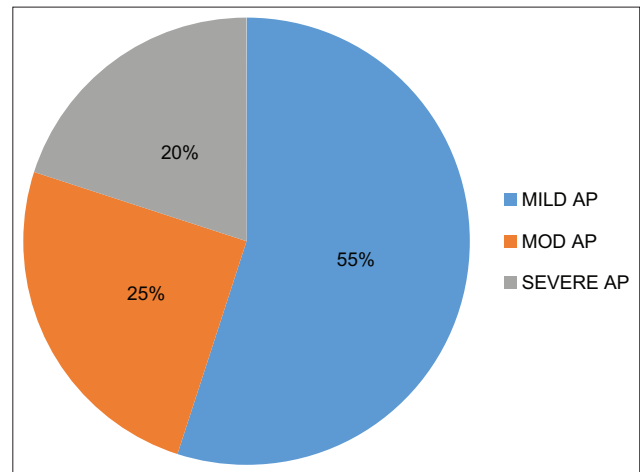According to Atlanta 1992 criteria, severe pancreatitis forms are those that fall under the following criteria:

Figure 1: Distribution of types of pancreatitis
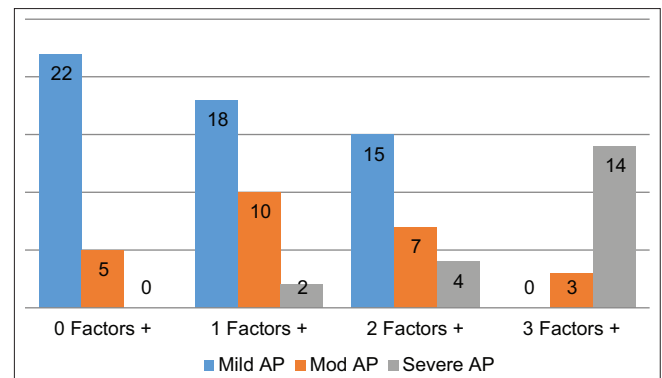
Figure 2: The distribution of different types of acute pancreatitis in PANC3 Score

Table 2: Distribution of diagnostic statistics

Tests	Criteria		Total
	Severe acute pancreatitis	Mild-moderate acute pancreatitis	
PANC3 (all factors positive)	A=true positive	B=false positive	A+B
PANC3 (all factors not positive)	C=false negative	D=true negative	C+D
Total	A+C	B+D	n=Total sample size

Ranson's score ≥3, Apache II ≥8, organic dysfunction (shock, SBP <90 mmHg, renal failure, and creatinine >2 mg/dl after hydration), local complication (necrosis, pseudocyst, or abscess), and systemic complication (DIC, platelets <100,000/mm³, fibrinogen <100 mg/dl, degradation fibrinogen products >80 mcg/ml, and calcium <7.5 mg/dl).[10]

Based on reviews published, new definitions for the classification of severity of acute pancreatitis, introducing concepts of mild acute pancreatitis which is characterized by the absence of local complications and organ failure, moderate acute pancreatitis characterized by the presence of sterile pancreatic necrosis and/or transient organ failure for <48 h, severe acute pancreatitis characterized by the presence of infected pancreatic necrosis or with persistent organ failure for more than 48 h and the critical acute pancreatitis when the infected pancreatic necrosis and the persistent failure of organs are present.[7] In 2015, Cho et al., did a study comparing different scoring systems and published the results as shown in Table 4.[11]

Table 3: Distribution of type of pancreatitis according to number of PANC3 parameters positive

No of factors	Severe acute pancreatitis	Mild-moderate acute pancreatitis	Total
PANC3 (all factors positive)	14	3	17
PANC3 (all factors not positive)	6	77	83
Total	20	80	100

Table 4: Various scoring systems predicting severity of pancreatitis

Scoring system	Sensitivity	Specificity	PPV	NPV
RANSON	85.7	44.3	18.8	95.3
BISAP	61.9	72.1	25	92.7
APACHE - II	81	65.7	26.2	95.8
CRP	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.

In 2020, Venkatesh et al., did a comparison of acute physiology and chronic health evaluation ll (APACHE II), BISAP, modified Glasgow score, and Ranson score on admission and 48 h after admission, procalcitonin in predicting severity, and organ failure. The results are shown in Table 5.[12]

In the present study, 100 patients were evaluated over a period of 1 year 6 months. The severity of the patients was classified according to the RAC into three groups mild, moderate, and severe. Of the 100 patients, 55% cases were mild acute pancreatitis, 25% were moderate, and 20% were severe. The mean age for presentation in mild group was 45.7 years, and 42.3 years in moderate group, and 49.2 years in severe group. The majority of patients were in 40–55 years groups. The mean age of presentation for severe group was more than the other two groups.

Obesity was seen mainly in cases of severe acute pancreatitis with mean BMI of 30.867 kg/m². The mean BMI of mild and moderate group was 25.076 kg/m² and 26.093 kg/m². These findings are supported by the literature, which state that severity of an attack is influenced by BMI of patient.[13]

Pleural effusions on X-rays were seen in 85% 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.[14]

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 34.5%, 42.63%, and 46.81%, respectively. Hence, as observed by Brown et al., the hemoconcentration can be used as a predictor of severity.[15]

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 post-test likelihood ratio of 99% of developing severe acute pancreatitis.[8] In our study, the sensitivity of PANC3 score was 70%, and the specificity was 96.25%. The PPV was 82.35% and the NPV was

Table 5: Results of study comparing various scoring systems. 12

Scoring system	Sensitivity, %	Specificity, %	PPV, %	NPV, %	Diagnostic accuracy, %
APACHE II	48.5	36.2	27.8	58.1	40.3
BISAP	8.5	55	8.8	54.2	39.4
MGS	68.5	20.2	30.3	56	36.5
Ranson at admission	14.2	68.1	18.5	61	50
Ranson at 48 h	22.8	36.2	15.3	48	31.7
Procalcitonin	100	100	100	100	100

APACHE: Acute physiology and chronic health evaluation, BISAP: Bedside index for the severity in acute pancreatitis, MGS: Modified Glasgow score

Table 6: Comparison of two studies done on PANC3 score

Studies	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Diagnostic accuracy
Fukuda et.al	31.25	100	100	81.66	83.07
Present study	70	96.25	82.35	92.77	93

92.77% in predicting severe acute pancreatitis. The Chi-square statistic is 49.7. The diagnostic accuracy is 93%. These scores are comparable to that observed by Fukuda et al., Table 6, 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%.[16] 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.

Limitations of the study

There is limited studies and literature on PANC-3 score. Large number of case studies required to approve our conclusion.

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.

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 effective compared to other systems and hence can be used in peripheral/rural centers for early referral. 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 patient by early detection and prompt treatment.

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ABN - Concept and design of the study, prepared first draft of manuscript; M**RD -** Interpreted the results; reviewed the literature and manuscript preparation; **DS -** Concept, coordination, statistical analysis, and interpretation, preparation of manuscript and revision of the manuscript.

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