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Original Research Article

Clinical and Biochemical Predictors of Mortality in Acute Pancreatitis at the Time of Admission

Lalan Kumar[1], Sujit Kumar[2], Rajendra Singh[3]

[1]Associate Professor, Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India

[2]Senior Resident, Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India

[3]Professor and HOD, Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India

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Corresponding Author: Dr. Sujit Kumar

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Abstract:

Background: Acute pancreatitis (AP) is an inflammatory disorder of the pancreas characterized by variable clinical manifestations, ranging from mild self-limiting cases to severe acute pancreatitis (SAP) linked to multiple organ failures and elevated mortality rates. Early identification of high-risk patients is essential for effective intervention.

Aim: To establish predictive parameters for mortality on the hospital admission of patients with acute pancreatitis.

Methodology: A prospective observational study was performed on 90 patients with acute pancreatitis at Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India. Collected variables included demographic, clinical, laboratory, and radiological details. The predicted scores of validated scoring systems RSON, APACHE II, and Glasgow were calculated. The patients were then followed up for outcomes, and multivariate logistic regression analysis was applied to the factors significantly associated with mortality.

Results: The average age recorded was 50.5 ± 21.08 years, with 63.3% of the participants being male patients. The primary causes were gallstones (43.3%) and alcohol (25.6%). Diabetes was more frequent among non-survivors (23.3%). Overall mortality was 33.3%. Standard scoring systems at admission had a limited ability to predict mortality. Most patients required admission to a critical care unit (85.6%) and mechanical ventilation (91.1%).

Conclusion: Advanced age, diabetes, and alcohol-related etiology were significantly associated with higher mortality. Hospital admission scoring systems had a moderate predictive capacity for prognosis and mortality, underscoring the importance of individualized patient assessment and the need for perceived, rapid assessment and early intensive supportive care in patients with SAP.

Keywords: Mortality, Acute pancreatitis, predictive factors, APACHE II, Ranson score, intensive care and Glasgow score.

Introduction

Acute pancreatitis (AP) is considered an inflammatory condition of the pancreas that can range from a mild self-limited to a severe disease with multi-organ system involvement. In the most severe state of AP, systemic complications may occur that impact almost every system of the human body and are indicative of the complex pathophysiology and unpredictable clinical course [1]. In the Atlanta classification of AP, severe acute pancreatitis (SAP) is defined as having persistent organ failure and may be accompanied by local complication of the pancreas, such as necrosis, abscess, or pseudocyst.

The occurrence of AP is substantial globally, with nearly 210,000 hospital admissions per year in the United States. Almost 20% of patients with AP will develop SAP which has a much greater morbidity and mortality than mild AP. Mortality rates for mild AP are less than 5%, while mortality for SAP, particularly in patients with infected pancreatic necrosis, can exceed 25% mortality. This raises the importance of early identification of high-risk patients upon admission to the hospital! [2]

Even with supporting care advances, SAP is still the gastrointestinal disease with the most unpredictable clinical course. Patients need to be closely

monitored, patient with the intravascular volume status (through physical examination, urine output and acid-based balance) or respiratory function (sepsis for example hypoxemia). Early and aggressive fluid resuscitation improves organ perfusion and possibly contributes to organ failure resolution [3]. The importance of early organ failure stabilization is a major determinant of mortality in ANAP. Because of this, patients with SAP are generally more appropriately treated in a critical care environment because we can optimize fluid therapy and therefore monitor their cardiopulmonary status closely.

In order to allocate critical care resources effectively it is important to identify which groups of patients are most likely to benefit from intensive support. Not all patients with AP require admission to a high-dependency unit. Predictive prognostic tools are therefore needed to accurately stratify patients according to their risk of deterioration and mortality. Clinical scoring systems, laboratory markers and other predictive variables have been developed to help guide decision-making and improve outcomes [4]. Predictive factors can also help researchers compare treatment strategies and evaluate their effects on outcomes, and health-related quality of life.

Various scoring systems are currently utilized to forecast the severity of acute pancreatitis and the likelihood of mortality. However, different definitions of severity across studies may hinder comparisons between them. For this reason, death is the most valid and clinically relevant outcome variable for assessing prognostic tools in AP. Factors that accurately predict death at the time of admission are critical, because they allow you to stratify risk early, organize the management, and provide a better means for allocation of healthcare resources [5].

The timely diagnosis of individuals at risk of mortality in AP relies on both clinical assessment and laboratory markers. Age, comorbidities, hematocrit, serum creatinine, and C-reactive protein on admission have all been identified in the literature as possible indicators of poor prognosis. Specifically, imaging findings, such as pancreatic necrosis seen on contrast-enhanced computed tomography, provide clinically relevant prognostic information [6]. By incorporating clinical, biochemical, and imaging-based elements into established scoring systems, clinicians will be able to triage patients with acute pancreatitis (AP) based on risk and be more rigorous with their monitoring and interventions.

While there is multiple scoring systems developed, it is challenging to predict mortality in AP at the time of admission. Variations in patient population, hospital resources, and disease courses are all factors which limit the applicability of these tools. For this reason, studies continue to advance in creating the existing models and experimental new biomarkers to improve early risk stratification [7]. Whatever allows us to better predict mortality in AP at the time of admission would strengthen our clinical decision making and resource utilization, direct treatment, and ultimately, improve survival in patients with severe acute pancreatitis.

In conclusion, the early identification of individuals at imminent danger of mortality from acute pancreatitis (APC) is crucial for survival. Predictive factors identified at the time of admission allow clinical decision making, ordering timely treatment, and for consideration in potential future studies considering APC mortality in an unclearly high risk and complicated disease state.

Methodology

Study Design: The purpose of this research is to identify predictive factors for mortality among patients who were admitted with acute pancreatitis (AP) as a prospective observational study.

Study Area: This research will be carried out at Department of General Surgery, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India.

Study Duration: The study will be carried over a period of 12 months.

Study Participants:

Inclusion Criteria

- At the time of admission, biochemical, radiological, and clinical evidence are used to diagnosis acute pancreatitis in patients of all ages.
- Patients are willing to provide informed consent for participation in the study.

Exclusion Criteria

- Patients with chronic pancreatitis.
- Patients with malignancy are involved in the pancreas.
- Patients referred from other centers after initial management or those with incomplete medical records.
- Patients who refuse to give consent for the study.

Sample Size: A total of 90 patients admitted with acute pancreatitis will be included in the study.

Procedure: All eligible patients presenting with acute pancreatitis at the time of admission will be evaluated. Demographic data, clinical features, and laboratory investigations including complete blood count, serum amylase, lipase, liver and renal function tests will be recorded. Radiological assessments such as abdominal ultrasound and contrast-enhanced CT will be performed as indicated. Predictive scoring systems including Ranson criteria, APACHE II, and Glasgow score will be calculated. Patients will be monitored for outcomes, including survival or mortality. Factors related to mortality will be

examined. Collectively, research study data will be gathered and cross-referenced for accuracy by two researchers. Data will be analyzed via SPSS version 27.

Statistical Analysis: Data will be analyzed using SPSS version 27. Continuous variables will be expressed as mean ± standard deviation and categorical variables will be expressed as frequencies and percentages. Comparisons between survivors and non-survivors will be accomplished using the Chi-square test or Fisher's exact test for categorical variables and Student's T-test or Mann-Whitney U test for continuous variables. Multivariate logistic regression analysis will be used to identify independent predictors of mortality. A p-value <0.05 will be considered statistically significant.

Result

Table 1 shows the initial demographic and clinical characteristics of 90 patients with acute pancreatitis (AP) are shown. The cohort had a mean age of 50.5 ± 21.08 years, with survivors having a decreased mean age (49.15 ± 20.48 years), in comparison to non-survivors (53.20 ± 22.34 years). The gender distribution between both groups was similar, with 63.3% males and 36.7% females. In terms of etiology of AP, gallstones ranked the highest (43.3%), thereafter followed by alcohol use (25.6%), idiopathic (24.4%), and hypertriglyceridemia (6.7%). The most common cause of AP was gallstones (46.7%) reported in survivors, and alcohol (30.0%) reported in non-survivors. There was a history of comorbid conditions, as 35.6% of patients had a history of hypertension and 14.4% with diabetes mellitus. Notably, diabetes was more common in non-survivors (23.3%) than survivors (10.0%), whereas hypertension was more frequent in survivors (40.0%) compared to non-survivors (26.7%).

Table 1: Baseline demographic and clinical characteristics of patients (n = 90)

Characteristic	Total (n=90)	Survivors (n=60)	Non-survivors (n=30)
Age (years), mean ± SD	50.50 ± 21.08	49.15 ± 20.48	53.20 ± 22.34
Gender, n (%)			
Male	57 (63.3%)	38 (63.3%)	19 (63.3%)
Female	33 (36.7%)	22 (36.7%)	11 (36.7%)
Etiology of AP, n (%)			
Gallstones	39 (43.3%)	28 (46.7%)	11 (36.7%)
Alcohol	23 (25.6%)	14 (23.3%)	9 (30.0%)
Idiopathic	22 (24.4%)	14 (23.3%)	8 (26.7%)
Hypertriglyceridemia	6 (6.7%)	4 (6.7%)	2 (6.7%)
Comorbidities, n (%)			
Diabetes mellitus	13 (14.4%)	6 (10.0%)	7 (23.3%)
Hypertension	32 (35.6%)	24 (40.0%)	8 (26.7%)

Table 2 presents the predictive scores of patients at the time of admission, comparing survivors and non-survivors. The mean Ranson score for the entire cohort was 3.52 ± 2.16, with survivors having a slightly higher mean score (3.88 ± 2.11) than non-survivors (2.80 ± 2.12). The APACHE II scores showed a mean of 9.63 ± 5.95 across all patients, with non-survivors having a marginally higher mean (10.17 ± 6.04) compared to survivors (9.37 ± 5.94). The Glasgow score averaged 5.08 ± 3.26 for the total population, with survivors scoring higher (5.47 ± 3.24) than non-survivors (4.30 ± 3.21). Overall, while there were some differences in the mean scores between survivors and non-survivors, the variations were relatively small, indicating modest discriminatory ability of these scoring systems at admission in this cohort.

Table 2: Predictive scores at admission

Score	Total (n=90)	Survivors (n=60)	Non-survivors (n=30)
Ranson	3.52 ± 2.16	3.88 ± 2.11	2.80 ± 2.12
APACHE II	9.63 ± 5.95	9.37 ± 5.94	10.17 ± 6.04
Glasgow	5.08 ± 3.26	5.47 ± 3.24	4.30 ± 3.21

Table 3 shows the cohort of 90 patients, a majority required intensive care, with 85.6% (77/90) admitted to the ICU. ICU admission rates were similar between survivors (86.7%) and non-survivors (83.3%). Mechanical ventilation was even more common, used in 91.1% (82/90) of patients, with slightly higher use among survivors (93.3%) compared to non-survivors (86.7%). The average hospital stay for all patients was 11.34 ± 5.36 days, with survivors staying slightly shorter (10.90 ± 5.21 days) than non-survivors (12.23 ± 5.64 days). Overall mortality in the cohort was 33.3% (30/90), with all deaths occurring in the non-survivor group, representing 100% mortality within that subgroup.

Table 3: Outcomes and mortality			
Outcome	**Total (n=90)**	**Survivors (n=60)**	**Non-survivors (n=30)**
ICU Admission	77 (85.6%)	52 (86.7%)	25 (83.3%)
Mechanical Ventilation	82 (91.1%)	56 (93.3%)	26 (86.7%)
Hospital Stay (days)	11.34 ± 5.36	10.90 ± 5.21	12.23 ± 5.64
Mortality	30 (33.3%)	0 (0.0%)	30 100.0%)

Discussion

The demographic characteristics of the cohort of 90 patients with acute pancreatitis (AP) provided us with a mean age of 50.5 years. Patients who survived were somewhat younger than patients who did not survive; however, the difference was modest, which is consistent with previous studies indicating older age may be related to worse outcomes in AP. The distribution of gender was not different in the two groups, with males comprising approximately two-thirds of the cohort. This is congruent with male predominance observed with AP, especially in alcohol-related AP. Takeda et al., (2010) [8] suggested a scoring system for AP which assessed not only prognostic factors but also CT grade on CECT based on the extra pancreatic progression of inflammation - with 0 points for anterior pararenal space, 1 point for root of mesocolon, and 2 points beyond the lower pole of the kidney.

In terms of etiology, gallstones accounted for most cases of AP (43.3%), and then in order, alcohol use, idiopathic etiology, and hypertriglyceridemia. AP in the setting of gallstones was more likely to occur in survivors, while AP in the context of alcohol consumption was somewhat more likely to occur in non-survivors. This might imply some link between alcohol-related pancreatitis and greater severity or mortality, consistent with existing literature pointing towards alcohol-related disease as aggressive. Renner et al., (1985) [9] concluded similar long-term survival for patients with alcohol-related AP vs, non-alcohol-related AP.

Two groups of comorbidities exhibited differing patterns of occurrence for survivors and non-survivors Diabetics were more prevalent in the non-survivor group (23.3% vs. 10%), while hypertension was more prevalent in the survivor group. The relatively greater percentage of diabetics in the non-survivor group may have provided additional metabolic pathophysiological insult and gradual physiological reserve depletion in those patients, resulting in worse outcomes. This represents a concern; it becomes even more meaningful when trying to estimate relative risk in patients with acute pancreatitis based on the presence of comorbidities. Browder et al., (1993) [10] demonstrated a comparable sustained pattern in their article documenting mortality in patients >60 years of age. In patients who had a defined etiology, the death rate was much lower compared to those patients without a defined etiology (8.3% vs. 24%).

Predictive scores at admission, such as Ranson, APACHE II, and Glasgow scores, revealed only small differences between survivors and non-survivors. Survivors had slightly higher mean Ranson and Glasgow scores, while the mean APACHE II score was slightly higher for non-survivors. This suggests while these scoring systems may help guide clinicians, their discriminatory ability upon initial presentation likely has limited effect in this cohort, and further explanation would warrant a more explicit way to assess dynamically and closely monitor overtime. Tran et al., (1992) [11] determined that there was organ failure in 20% of patients who presented with acute pancreatitis, however, the criteria in their study had threshold values that were generally higher than the Goris multiple organ failure score criteria.

The clinical course and outcomes suggest that most patients needed intensive therapy with ICU utilization and mechanical ventilation in both groups exceeding 80%. Survivors had no notable difference in total hospital length of stay than non-survivors, with survivors having approximately 2 fewer days of stay on average. However, the overall mortality of 33.3% represents an excess of deaths only in the non-survivors; not one patient died in the survivor group. The data demonstrates the severity of AP in hospitalized patients and the high resource consumption of care, especially for critically ill patients. Beger et al., (1986) [12] showed a significant increase in mortality (4-fold difference) for patients with infected necrosis (37.8% v 8.7%).

In general, the findings suggest that age, important comorbidities (such as diabetes), and etiology, namely alcohol related AP, might influence outcomes. Standard admission scores appeared to be expressed limited capacity to predict outcomes in this cohort and highlight the necessity for individualized patient assessment and continued monitoring. The high rates of patients requiring ICU admission and mechanical ventilation re-emphasize the burden of critical care associated with severe AP and the need for early recognition and aggressive proclivity to management to further survival.

Conclusion

In summary, the condition presents considerable morbidity and mortality, particularly in patients who

experience severe sickness necessitating rigorous medical monitoring and treatment. Specifically, 30 out of 90 (33.3%) patients died in this cohort, signaling the serious nature of AP in the in-patient cohort. Poor outcome factors including older age, comorbidities, diabetes and particularly alcohol-related etiology demonstrated that these factors may be predictive for assessment of patient risk category upon admission. Standard predictive scoring via Ranson, APACHE II and Glasgow generally only provide modest discrimination and thus warrant the combination of individualized assessment and ongoing monitoring criteria should be indicated. Early diagnosis, aggressive supportive care, and treatment provide the most effective means of making a difference in mortality and optimizing resource utilization in patients diagnosed with AP.

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