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Pattern of Organ Failure in Acute Pancreatitis: A Cross-Sectional Study from Northeast India

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Abstract: ***Background: Organ failure is the principal determinant of severity and mortality in acute pancreatitis. This study evaluated the frequency and pattern of respiratory, renal, and cardiovascular failure and their in-hospital outcomes. Methods: This hospital-based cross-sectional observational study with prospective in-hospital outcome ascertainment included 40 consecutive adults with acute pancreatitis admitted to Assam Medical College and Hospital, Dibrugarh, from October 2024 to September 2025. Acute pancreatitis was diagnosed using the Revised Atlanta criteria. Organ failure was defined as a Modified Marshall score of at least 2; dysfunction persisting for more than 48 hours was classified as persistent organ failure. Exact tests were used for exploratory comparisons. Results: Organ failure occurred in 12 patients (30.0%). Respiratory failure was the most frequent pattern (10/40, 25.0%), followed by renal failure (8/40, 20.0%) and cardiovascular failure (3/40, 7.5%). Seven patients (17.5%) had multiple-organ failure and 7 (17.5%) had persistent organ failure. All 12 patients with organ failure required intensive care, compared with none without organ failure (p<0.001). Four patients died, all in the organ-failure group; overall mortality was 10.0%, and mortality among patients with organ failure was 33.3% (p=0.005). Exploratory associations were observed with age group, etiology, diabetes mellitus, and hypertension, although estimates were limited by the small sample and sparse cells. Conclusion: Organ failure affected a substantial proportion of patients with acute pancreatitis, with respiratory dysfunction being the most common manifestation. Organ failure was associated with intensive care admission and in-hospital mortality. Early identification and repeated assessment of high-risk patients may improve clinical care allocation and surveillance.***

Keywords: acute pancreatitis; organ failure; persistent organ failure; Modified Marshall score; respiratory failure; multiple organ dysfunction

1. Introduction

Acute pancreatitis is an acute inflammatory disorder with a variable clinical course, ranging from self-limited pancreatic inflammation to persistent organ failure and death. The Revised Atlanta Classification identifies persistent organ failure as the defining feature of severe acute pancreatitis and distinguishes it from transient organ failure that resolves within 48 hours [1]. Current clinical guidance emphasizes early recognition of patients at risk of deterioration and repeated assessment during the initial phase of illness [2].

Systemic organ injury in acute pancreatitis results from an amplified inflammatory response, endothelial dysfunction, capillary leak, impaired microcirculation, and tissue hypoperfusion. The respiratory, renal, and cardiovascular systems are formally assessed by the Modified Marshall scoring system. Respiratory failure may result from alveolar-capillary injury; renal failure may reflect hypovolemia, inflammation, altered renal perfusion, and tubular injury; and cardiovascular failure reflects severe vasodilation, capillary leak, and shock [3].

The prognosis depends on the presence, duration, and extent of organ failure. Persistent dysfunction and involvement of multiple organ systems are associated with increased mortality [4-6]. Describing organ-failure patterns in a tertiary-care population can support triage, serial monitoring, and critical-care planning. This study therefore aimed to identify the types and patterns of organ failure among adults admitted with acute pancreatitis in Northeast India. Secondary objectives were to estimate overall and persistent organ failure, examine exploratory associations with selected demographic and clinical variables, and assess intensive care unit admission and in-hospital mortality.

2. Materials and Methods

Study design and setting

This was a hospital-based cross-sectional observational study with prospective in-hospital assessment of organ-failure persistence and clinical outcomes. It was conducted in the Department of Medicine, Assam Medical College and Hospital, Dibrugarh, Assam, India, from October 2024 to September 2025.

Sample size and sampling

A sample size of 40, calculated at 95% confidence with 10% absolute precision using the anticipated frequency of respiratory failure as the basis. Consecutive sampling was used; all eligible patients presenting during the study period were approached until the target sample was reached.

Participants

Adults aged 18 years or older who were admitted within 72 hours of symptom onset and fulfilled the diagnostic criteria for acute pancreatitis were eligible after providing written informed consent. Exclusion criteria were chronic liver disease, known chronic pancreatitis, pre-existing severe renal, cardiac, or respiratory disease, albumin supplementation before admission, pregnancy or lactation, active malignancy, immunosuppressive therapy, and refusal or withdrawal of consent. The albumin-related criterion

formed part of the parent thesis protocol, which also assessed admission serum albumin.

Diagnostic criteria and data collection

Acute pancreatitis was diagnosed when at least two of the following were present: typical acute epigastric pain, serum amylase and/or lipase at least three times the upper limit of normal, and imaging findings consistent with acute pancreatitis [1]. Demographic characteristics, etiology, smoking and alcohol-use status, diabetes mellitus, hypertension, laboratory findings, imaging findings, intensive care requirement, and in-hospital outcome were recorded using a structured case-record form.

Assessment of organ failure

Organ failure was assessed using the Modified Marshall scoring system [1]. A score of at least 2 in any system defined organ failure: respiratory failure was defined by a PaO2/FiO2 ratio of 300 or less, renal failure by serum creatinine of at least 1.9 mg/dL, and cardiovascular failure by systolic blood pressure below 90 mmHg despite fluid resuscitation. Failure resolving within 48 hours was classified as transient; failure persisting for more than 48 hours was classified as persistent. Single-organ failure involved one system, whereas multiple-organ failure involved two or more systems.

Ethical considerations

The protocol was reviewed and recommended by the Institutional Ethics Committee (H), Assam Medical College, Dibrugarh, on 27 September 2024. The formal decision was communicated in letter No. AMC/EC/2026/93 dated 6 March 2026. Written informed consent was obtained from all participants. Confidentiality was maintained, and the study was conducted in accordance with the Declaration of Helsinki.

Statistical analysis

Data were analyzed using IBM SPSS Statistics, version 26. Categorical variables are presented as frequencies and percentages. Because several contingency tables contained sparse or zero cells, Fisher's exact test was used for 2 x 2 comparisons and the Fisher-Freeman-Halton exact test for larger tables. All tests were two-sided, with $p<0.05$ considered statistically significant. Subgroup analyses were exploratory, p-values were not adjusted for multiple comparisons, and multivariable modeling was not performed because only 12 organ-failure events occurred. ROC analysis was not included in this organ-failure-pattern manuscript.

3. Results

Baseline characteristics and exploratory associations

Forty patients were included. Twenty-nine (72.5%) were male and 11 (27.5%) were female. Twenty-eight patients (70.0%) were aged 30-45 years, 6 (15.0%) were aged 46-60 years, and 6 (15.0%) were aged 61-75 years. Etiology was idiopathic in 14 (35.0%), alcohol-related in 13 (32.5%), gallstone-related in 12 (30.0%), and hypertriglyceridemia-related in 1 (2.5%). Sixteen patients (40.0%) had diabetes mellitus and 18 (45.0%) had hypertension.

Organ failure occurred in all 12 patients older than 45 years and in none of the 28 patients aged 30-45 years (exact $p<0.001$). Etiology also showed an exploratory association with organ failure (exact $p=0.004$), but the comparison contained sparse and zero cells, including only one patient with hypertriglyceridemia. Organ failure was more frequent among patients with diabetes mellitus (56.2% vs. 12.5%, $p=0.005$) and hypertension (61.1% vs. 4.5%, $p<0.001$). Sex, smoking, and current alcohol consumption were not significantly associated with organ failure (Table 1).

Table 1: Baseline characteristics according to organ-failure status (n=40)

Variable	No organ failure, n (%)	Organ failure, n (%)	Total, n	Exact p
Age group (years)				
30-45	28 (100.0)	0 (0.0)	28	<0.001[a]
46-60	0 (0.0)	6 (100.0)	6	
61-75	0 (0.0)	6 (100.0)	6	
Sex				
Female	7 (63.6)	4 (36.4)	11	0.704[b]
Male	21 (72.4)	8 (27.6)	29	
Etiology				
Alcohol-related	7 (53.8)	6 (46.2)	13	0.004[a]
Gallstone-related	7 (58.3)	5 (41.7)	12	
Hypertriglyceridemia	0 (0.0)	1 (100.0)	1	
Idiopathic	14 (100.0)	0 (0.0)	14	
Smoking				
No	21 (77.8)	6 (22.2)	27	0.154[b]
Yes	7 (53.8)	6 (46.2)	13	
Current alcohol consumption				
No	21 (77.8)	6 (22.2)	27	0.154[b]
Yes	7 (53.8)	6 (46.2)	13	
Diabetes mellitus				
No	21 (87.5)	3 (12.5)	24	0.005[b]
Yes	7 (43.8)	9 (56.2)	16	
Hypertension				
No	21 (95.5)	1 (4.5)	22	<0.001[b]
Yes	7 (38.9)	11 (61.1)	18	

Note: Percentages are row percentages. [a] Fisher-Freeman-Halton exact test; [b] Fisher's exact test. Analyses are exploratory and unadjusted for multiple comparisons.

Frequency and pattern of organ failure

Overall, 12 patients (30.0%) developed organ failure. Respiratory failure was the most frequent pattern, occurring in 10 patients (25.0%), followed by renal failure in 8 (20.0%) and cardiovascular failure in 3 (7.5%). System-specific counts were not mutually exclusive. Five patients (12.5%) had single-organ failure and 7 (17.5%) had multiple-organ failure. Five patients (12.5%) had transient organ failure and 7 (17.5%) had persistent organ failure (Table 2).

Table 2: Frequency and pattern of organ failure (n=40)

Clinical parameter	n	%
Any organ failure	12	30
Respiratory failure	10	25
Renal failure	8	20
Cardiovascular failure	3	7.5
Single-organ failure	5	12.5
Multiple-organ failure (2 or more systems)	7	17.5
Transient organ failure (48 hours or less)	5	12.5
Persistent organ failure (more than 48 hours)	7	17.5

Note: System-specific organ failures are not mutually exclusive. Organ failure was defined as a Modified Marshall score of at least 2.

Intensive care admission and mortality

Twelve patients (30.0%) required intensive care admission, and all belonged to the organ-failure group. No patient without organ failure required intensive care ($p<0.001$). Four patients died during hospitalization, giving an overall mortality of 10.0%. All deaths occurred among the 12 patients with organ failure; mortality was 33.3% in the organ-failure group and 0% in the group without organ failure ($p=0.005$) (Table 3).

Table 3: Association of organ failure with intensive care admission and in-hospital mortality

Outcome	No organ failure (n=28), n (%)	Organ failure (n=12), n (%)	Total (n=40), n (%)	Exact p
ICU admission				
Required	0 (0.0)	12 (100.0)	12 (30.0)	<0.001
Not required	28 (100.0)	0 (0.0)	28 (70.0)	
In-hospital outcome				
Survived	28 (100.0)	8 (66.7)	36 (90.0)	0.005
Died	0 (0.0)	4 (33.3)	4 (10.0)	

Note: P-values are from two-sided Fisher's exact tests. ICU, intensive care unit.

4. Discussion

In this cohort of 40 adults with acute pancreatitis, 30.0% developed organ failure and 17.5% developed persistent organ failure. Respiratory failure was the most common manifestation, followed by renal and cardiovascular failure. Organ failure was closely associated with resource use and outcome: every patient with organ failure required intensive care, and all in-hospital deaths occurred in this group.

The observed organ-failure proportion was higher than the approximate one-fifth described across many unselected acute pancreatitis populations, although estimates vary with case mix, referral patterns, timing, and definitions [3,7]. As a tertiary referral center, the study hospital may have received a greater proportion of clinically severe cases. The exclusion of patients with pre-existing severe cardiac, renal, or respiratory disease, however, may have reduced organ dysfunction attributable to baseline illness.

Respiratory failure affected one-quarter of the cohort and was the predominant pattern. The lung is vulnerable to inflammatory mediator release, endothelial injury, capillary leak, and altered alveolar permeability in severe pancreatitis. Renal failure may result from hypovolemia, systemic inflammation, altered renal microcirculation, and shock, whereas cardiovascular failure represents advanced circulatory compromise [3]. These findings support serial assessment of oxygenation, renal function, urine output, and hemodynamic status.

Persistent organ failure occurred in 17.5% of patients and multiple-organ failure in 17.5%. Persistent organ failure defines severe acute pancreatitis under the Revised Atlanta Classification [1]. Previous studies have shown that the duration, number, type, and sequence of failed organ systems influence mortality [4-6]. The overall mortality in this study was 10.0%, while mortality among patients with organ failure was 33.3%. Because only four deaths occurred, this estimate is imprecise and should not be generalized; nevertheless, it supports the clinical importance of standardized organ-failure assessment [8].

Age group, etiology, diabetes mellitus, and hypertension showed exploratory associations with organ failure. These results require cautious interpretation. The age comparison showed complete separation, with no organ failure in patients aged 30-45 years and organ failure in every patient older than 45 years. The etiologic table also contained sparse and zero cells. Diabetes and hypertension may reflect reduced physiological reserve or vascular comorbidity, but the study was not powered for multivariable adjustment and cannot establish independent causation.

The complete overlap between organ failure and intensive care admission likely reflects both disease severity and local triage practice. It should not be interpreted as evidence that organ failure alone determines intensive care admission in other settings. Current guidance recommends frequent reassessment and escalation of supportive care when organ dysfunction or clinical deterioration develops [2].

5. Strengths and Limitations

Strengths include consecutive enrollment, standardized diagnostic criteria, and classification of the three organ systems using the Modified Marshall score. Important limitations are the single-center design, small sample, only 12 organ-failure events, sparse cells, absence of multivariable adjustment, and lack of correction for multiple comparisons. The study did not evaluate the sequence of individual organ failures, pancreatic necrosis, infection, treatment effects, or post-discharge outcomes. The cross-sectional design with prospective in-hospital outcome ascertainment supports description and association but not causal inference.

6. Conclusion

This study found that organ failure occurred in a substantial proportion of patients with acute pancreatitis, with respiratory dysfunction being the most common manifestation. Persistent and multiple-organ failure each occurred in 17.5% of the cohort. Organ failure was associated with intensive care admission and in-hospital mortality. Older age and selected comorbidities appeared associated with organ failure, but these exploratory findings require validation in larger prospective studies.

References

[1] Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis-2012: revision of the Atlanta classification and definitions by international consensus. Gut. 2013;62(1):102-111. doi:10.1136/gutjnl-2012-302779.

[2] Tenner S, Vege SS, Sheth SG, Sauer B, Yang A, Conwell DL, et al. American College of Gastroenterology guidelines: management of acute pancreatitis. Am J Gastroenterol. 2024;119(3):419-437. doi:10.14309/ajg.0000000000002645.

[3] Garg PK, Singh VP. Organ failure due to systemic injury in acute pancreatitis. Gastroenterology. 2019;156(7):2008-2023. doi:10.1053/j.gastro.2018.12.041.

[4] Johnson CD, Abu-Hilal M; UK Working Party on Acute Pancreatitis. Persistent organ failure during the first week as a marker of fatal outcome in acute pancreatitis. Gut. 2004;53(9):1340-1344. doi:10.1136/gut.2004.039883.

[5] Machicado JD, Gougol A, Tan X, Gao X, Paragomi P, Pothoulakis I, et al. Mortality in acute pancreatitis with persistent organ failure is determined by the number, type, and sequence of organ systems affected. United European Gastroenterol J. 2021;9(2):139-149. doi:10.1002/ueg2.12057.

[6] Schepers NJ, Bakker OJ, Besselink MG, Ahmed Ali U, Bollen TL, Gooszen HG, et al. Impact of characteristics of organ failure and infected necrosis on mortality in necrotising pancreatitis. Gut. 2019;68(6):1044-1051. doi:10.1136/gutjnl-2017-314657.

[7] Mederos MA, Reber HA, Girgis MD. Acute pancreatitis: a review. JAMA. 2021;325(4):382-390. doi:10.1001/jama.2020.20317.

[8] Wu BU, Johannes RS, Sun X, Tabak Y, Conwell DL, Banks PA. The early prediction of mortality in acute pancreatitis: a large population-based study. Gut. 2008;57(12):1698-1703. doi:10.1136/gut.2008.152702.