Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Intervention related outcomes in acute necrotising pancreatitis: a retrospective study

Sunil Kumar Jena
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Ratender Kumar Singh
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Sangam Yadav
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Vijay Sundarsingh
Father Muller Medical College Hospital
Banani Poddar
bananip@hotmail.com

Sanjay Gandhi Post Graduate Institute of Medical Sciences
Mohan Gurjar
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Afzal Azim
Sanjay Gandhi Post Graduate Institute of Medical Sciences
Arvind Kumar Baronia
Sanjay Gandhi Post Graduate Institute of Medical Sciences

Research Article

Keywords: Acute necrotizing pancreatitis, interventions, step-up approach, renal replacement therapy, length of stay

Posted Date: June 12th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9814866/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Objective:

Acute necrotizing pancreatitis (ANP) has a high mortality rate. This study aimed to evaluate mortality in ANP patients managed either by step-up approach and/or surgical intervention, compared to those managed conservatively.

Methods:

This retrospective observational study was conducted in the ICU of a teaching hospital in North India. Consecutive adult patients (≥ 18 years) with ANP with ICU stay of ≥24 hours were included. Patients were divided into three groups based on CT severity score and the outcomes, i.e., ICU mortality, organ supports required and length of stay (LOS) were compared.

Results:

110 patients with ANP, median age 36.5 years, 82% males with etiology biliary (53.6%) and alcohol (31%), were included. Interventions for pancreatic necrosis were required in 59% of patients, while 10% had vascular complications. There were no patients with mild pancreatitis (P1), 31 patients with moderately severe disease (P2) and 79 with severe disease (P3).

In P2, 4 patients died (12.9%); all were in the ‘no intervention’ group. In P3, 54 patients died (68.3%). This was significantly higher in patients who received ‘no intervention’ as compared to those managed with a 'step-up' or 'step-up + surgery' approach (p=0.017 using log rank test).

In P3, patients requiring intervention had significantly higher rates of renal replacement therapy (77.6% vs. 52.3%, p=0.03); other organ supports were similar.

Interventions were associated with a significantly longer ICU LOS in all patients.

Conclusion:

Conservative management in moderate ANP had a better survival. In severe ANP, ‘step-up’ approach resulted in the best survival.

Introduction

Severe pancreatic inflammation or acute pancreatitis, is linked to high rates of morbidity, mortality and economic constraint on healthcare infrastructure.[1] Acute necrotizing pancreatitis (ANP) is defined as necrotic involvement of > 30% of pancreatic gland.[2, 3] ANP has been associated with high mortality rate; due to the presence of persistent systemic inflammatory response and multi-organ dysfunction.[4] Acute necrotic collections (ANC) develop from ANP within a period of < 4 weeks and may require drainage, if infected.[5] Approximately 20% of the patients with ANP develop walled off necrosis (WON) which is

associated with high mortality approaching approximately 40% in some sub groups.[6] WON that becomes symptomatic or infected needs intervention via drainage which can be achieved either surgically or percutaneously.[7] The traditional approach of open necrosectomy to treat the infectious necrosis was challenged by the Dutch pancreatitis study group.[6] Using the step-up approach consisting of percutaneous drainage and minimally invasive surgery in necrotising pancreatitis, they found that less invasive percutaneous drainage had a better outcome as measured by a composite end point of either major complications or death.

A retrospective study evaluating a small population of acute pancreatitis patients with WON found that those who had undergone interventions by a protocolized approach had a lower incidence of adverse events and ICU stay as compared to those who had no protocols followed.[8] The smaller sample size and methodology of the study leave a lot of possibilities for speculation. There is still a lacuna in the management of ANP with complications of necrosis. So, we planned this study to compare the mortality in ANP patients subjected to step up approach and/or surgery as compared to those who required no intervention.

Materials and methods

Recruitment:

We conducted a retrospective, single-center observational study in a mixed ICU of a tertiary care teaching hospital in North India. Consecutive adult patients (age >18 years) admitted to the ICU with acute necrotizing pancreatitis (ANP) for more than 24 hours were included; the study period was from July 2015 to June 2018.

Ethics approval and consent to participate:

The Institute's ethics committee approved the study (IEC code: 2017-200-DM-EXP). Waiver of consent was granted by the Institutional ethics Committee, Sanjay Gandhi Post-graduate Institute of Medical Sciences in view of retrospective nature of the study. Data of the patients who had opted for limitation of therapy (comfort care) was excluded.

The patient details were retrieved from ICU flowcharts and electronic record of the hospital information system. Details of their demographics, severity of illness, aetiology of pancreatitis, life supportive therapies in the ICU, complications and details of any intervention/s required were noted. ‘Vasopressor days’ was defined as use of vasoactive agents for > 6 hours in a day whereas ‘MV days’ were defined as requirement of ventilatory support either invasive or non-invasive for > 6 hours in a day.

To maintain homogeneity and account for possible confounders we divided the patients’ data into three groups based on the severity of the disease according to CT severity index (CTSI).[3] The groups were P1 (CTSI 0-3), P2 (CTSI 4-6) and P3 (CTSI 7-10) respectively. ‘Step-Up’ approach was defined as percutaneous drain insertion, drain upsizing, new drain at different site with/without video-assisted retro-

peritoneal debridement (VARD). Any patient who required laparotomy was labelled as ‘Step-Up + Surgery’ group.

The primary outcome measured in these three groups was ICU mortality and the secondary outcomes included organ supports i.e. mechanical ventilator free days, vasopressor free days, need for renal replacement therapy (RRT) and ICU length of stay. Further, we compared the mortality in each group according to the interventions (step-up approach and/or surgery vs no interventions).

Statistical analysis

All continuous data are expressed as median with interquartile range. The chi-square test or Fischer’s exact test was used to compare the categorical values between the groups. Non -parametric tests were used to compare the continuous variables. Kaplan–Meier estimates were calculated for the probability of survival among pancreatitis patients undergoing various interventions. The significance was calculated with the use of the log-rank test. All statistical analysis was performed by SPSS software, version 25, and p value < 0.05 was considered significant.

Results

A total of 110 patients with ANP were included in our study. The median age of the study cohort was 36.5 years (27.75-50 years) with 81.8 % of them being males. The median severity of illness in the patients as represented by Acute Physiology and Chronic Health Evaluation (APACHE II) and Sequential Organ Failure Assessment (SOFA) score was 15 (12-20) and 8 (6-12) respectively. The aetiology was mainly biliary, seen in 59 (53.6%) patients followed by alcohol which was seen in 34 (30.9%) patients. Median days of pancreatitis at the time of admission was 10 (5.75-17) days. Organ support in the form of MV days and vasopressor days were 11.5 days and 10.5 days respectively.

There were no patients in P1 group, group P2 had 31 patients (28.1%) and P3 had 79 patients (71.8 %). Baseline characteristics, severity of illness, organ supports in the ICU on the basis of disease severity (CTSI) are shown in Table 1. APACHE II score, SOFA score, procalcitonin, mechanical ventilator days and vasopressor days were significantly higher in patients of P3 group. The patients with biliary and alcoholic aetiology for pancreatitis were more often in the P3 group (i.e., higher CTSI score). Days of pancreatitis at the time of admission to ICU was significantly higher in patients with higher CTSI score.

Interventions were required in 65 patients (59.1%), and 45 patients (40.9%) were managed conservatively. 50 patients (45.4%) underwent percutaneous drain placement, while 15 patients (13.6%) required surgery. Among the 15 patients requiring surgery, only 3 underwent surgery without prior drain placement. The median number of interventions was 1 (0-3), and the median day of the first intervention was 21 (15-28).

The details of patients in group P2 are shown in Table 2a. In group P2, 19 (61.3%) patients required mechanical ventilation, and 29 (93.5%) required vasopressors. Seven patients (29%) required renal

replacement therapy and all were in the ‘intervention’ sub group. Regarding complications, abdominal compartment syndrome was not observed in any patient, while only one patient developed a vascular complication in the ‘no intervention’ sub group. Median MV-free days were 6 and 17, and vasopressor-free days were 5.5 and 15 in the ‘no intervention’ and ‘intervention’ sub groups, respectively; the difference between the groups was statistically significant.

The details of patients in group P3 are shown in Tables 2b and 2c. In group P3, 74 (93.7%) required MV, 79 (100%) required vasopressors, and 56 (70.8%) required RRT. ACS and vascular complications were seen in 51 (64.5%) and 10 (12.6%) patients, respectively. Comparing the two subgroups, the ‘intervention’ group had significantly higher RRT requirement [45 (77.6%) vs 11 (52.3%); p = 0.02], abdominal compartment syndrome [45 (77.6%) vs 6 (28.6%); p < 0.01], and vascular complications [10 (17.2%) vs 0; p = 0.04] than the ‘no intervention’ group. However, MV-free days and vasopressor-free days in group P3 were similar between the ‘intervention’ and ‘no intervention’ groups.

A granular subgroup analysis of group P3 underscored a striking correlation between management strategy and clinical complications. The need for renal replacement therapy (RRT) was most pronounced in the 'surgical' cohort, reaching 93.3% (14/15), compared to 72.1% (31/43) in the 'step-up' group and 52.3% (11/21) in the 'no intervention' group (p = 0.03). This trend persisted regarding abdominal compartment syndrome (ACS), where the 'surgical' group exhibited a significantly higher incidence (93.3%) than both the 'step-up' (72.1%) and 'no intervention' (28.5%) cohorts (p < 0.01). Notably, while vascular complications were absent in patients receiving no intervention, they were disproportionately prevalent in the 'surgical' group compared to the 'step-up' group (33.3% vs. 11.6%; p = 0.01), highlighting the need for surgical intervention in this high-risk population with complications.

The median length of stay was shorter in ‘no intervention’ sub groups of P2 and P3. The median LOS in group P2 was 13.75 days with 7.5 (5-13.75) days and 20 (13-23) days in ‘no intervention’ and ‘intervention’ sub- groups respectively. The median LOS in group P3 was 21.5 days with 10 (8-17.5) days and 33 (21.25-46.5) days in ‘no intervention’ and ‘intervention’ sub- groups respectively.

We experienced 52.7 % (58 patients) mortality in our study cohort. Mortality was higher in group P3 group as compared to P2 group [54/79 (68.3%) vs 4/31 (12.9%)]. In group P2 there was no statistically significant difference in mortality between the patients who underwent intervention versus those who did not. [nil vs 4/24 (16.6%)](Table 2a). K-M (Kaplan-Meier) analysis could not be done because of absence of event (death) in group P2 with intervention.

In group P3, on K-M analysis, mortality was higher (lower survival) in ‘no intervention’ group as compared to ‘intervention’ group [Figure 1, p=0.015]. On further analysis based on the type of intervention in group P3, it was observed that mortality was highest among patients who were in ‘no intervention’ group as compared to ‘step-up+surgery’ group and it was lowest in ‘step-up’ group (Figure 2). This was statistically significant on log rank test (p=0.01)

Discussion

In a cohort of critically ill patients with acute necrotizing pancreatitis; the main aetiology being biliary (n = 59,53.6%) followed by alcohol (n =34,31%), a significant proportion (59%) required interventions for drainage of pancreatic necrosis. Vascular complications requiring interventions were noted in 11 patients (10%). Among patients with moderate severity of pancreatitis (P2), ICU mortality was similar irrespective of intervention. However, in patients with severe pancreatitis (P3), ICU mortality was significantly higher in patients who were not subjected to any intervention as compared to 'step-up+ surgery' and 'step-up' group. With regards to the secondary outcomes, the patients with severe disease who required interventions had significantly more requirement of renal support. The length of stay was significantly higher in patients who required interventions.

A review of existing Indian literature indicates that alcohol is the primary etiology for acute pancreatitis, followed by gallstones.[9,10] Regarding disease severity, most studies in the Indian population report cases within the mild and moderate categories as per the computed tomography severity index (CTSI) scores.[9,11] Notably, an extensive literature review yielded limited data regarding organ support requirements or vascular complications in patients with ANP reported from this region.

In our study, we observed an overall mortality rate of 52.7%, which is notably higher than the 30–39% reported in recent literature.[12] This discrepancy can likely be attributed to our status as a tertiary care referral centre; we frequently admit the most critically ill patients with acute necrotizing pancreatitis (ANP). This increased severity is evidenced by the high admission APACHE II and SOFA scores, with median scores of 15 and 8 respectively. Furthermore, the significant delay in patient referrals, with a median of 8 days in group P2 and 11 days in group P3, likely contributed to the higher observed mortality.

In patients with moderately severe disease, we observed that mortality between 'intervention' and 'no intervention' were similar; which may foster a more conservative approach of management in this population sub-type. HC Van Santvoort et al. in their study of 639 patient in 21 Dutch hospitals and Fatima Mannan et al. in their study of 110 patients, showed that 62% and 86% of patients with necrotizing pancreatitis respectively; were treated conservatively and had low mortality.[6,13]

In patients with severe disease, the Kaplan-Meier analysis revealed that probability of survival was lowest in 'no intervention' as compared to 'step-up + surgery' group; and this was highest in the 'step-up' group. In other words, in patients with severe pancreatitis, 'step-up' approach yielded the best survival and it will be unwise to follow a conservative approach in these patients. Among the interventions group, our data aligns with the most recent recommendations from the Dutch pancreatitis group and American Gastroenterology Association; where 'step-up' approach had better survival as compared to the surgical group.[6,14] Contrary to our findings and the guidelines, Aparna D et al in their study of 77 patients of ANP with an average CTSI score of 8; found that 61% patients could be managed conservatively.[15] This is perhaps due to the fact that most patients in Aparna D et al study were in moderately severe category (76.6%) as per the revised Atlanta guideline of 2012 which denotes only transient organ failure of < 48 hours, whereas our population in group P3 (71.8%) had a higher APACHE II score (10 in P2 and 18 in P3)

with high organ supports (ranging from 64.5% for renal to 93% for respiratory). Hence, as reflected in our data, in patients with higher CTSI and APACHE II scores, conservative management is less favourable and they may need some intervention (step-up or surgery) in the 3rd week of illness.

Length of stay in ICU in both groups P2 & P3 were significantly higher in 'intervention' group as compared to the 'no intervention' group. Obaitan I et al showed that organ dysfunction on admission or during stay and interventions during hospital stay were significantly associated with prolonged LOS.[16] In our study we also reciprocate similar findings in both groups. In group P2, there was increased length of stay in 'intervention' group whereas organ dysfunction was similar between 'no-intervention" and 'intervention' groups. However, in group P3 along with 'intervention', organ dysfunction i.e. MV days, vasopressor days, RRT requirement, ACS and vascular complications were all higher in the group with longer LOS (10 days vs 33 days). The median LOS, reported by some recent trials on acute necrotizing pancreatitis; is approximately 20 days.[17] We found a wide range of LOS in both groups i.e. P2 and P3 (median LOS of 10 days vs median LOS of 26 days; p =0.03, respectively) and could find some association of higher CTSI at admission with a longer LOS as compared to one with lower CTSI score at admission . Also, we could establish that 'intervention', irrespective of disease severity at admission, was associated with increased LOS.

When considering organ supports in pancreatitis patients, we are mostly concerned about three major organ systems, namely cardiac, respiratory and renal system.[18] In group P2, significantly higher MV free days and vasopressor free days in 'intervention' group indicated a decrease in the need for organ support due to timely drainage of necrotic collections. Unlike in the above group, in group P3, MV free days and vasopressor free days were similar between the groups indicating that in severe ANP, organ function was severely affected irrespective of the intervention. We found the RRT requirement was significantly higher in 'intervention' group. Previous studies have found a correlation between extent of necrosis and organ failure; which we were also able to establish by noting the need for more organ supports as evidenced by lesser MV free days, lesser vasopressor free days and higher RRT requirement in group P3 vs group P2.[19,20] The findings of our study hint that though organ support is higher in the ANP with higher CTSI; intervention in this group may only be associated with renal dysfunction and not necessarily respiratory and cardiovascular dysfunction. This specific association between intervention and renal dysfunction, independent of respiratory or cardiovascular failure, merits a multifaceted explanation. First, the kidneys are uniquely susceptible to intra-abdominal hypertension (IAH); even transient fluctuations in pressure during procedural interventions can impair renal venous outflow and compromise the glomerular filtration gradient. Second, patients requiring intervention frequently undergo repeated contrast-enhanced computed tomography (CECT) to guide drainage or debridement. This cumulative contrast load, often administered in the setting of systemic inflammation, may precipitate a 'second hit' of acute kidney injury. Finally, the anatomical proximity of the kidneys to the retroperitoneal space suggests a localized 'organ-crosstalk'; the direct spread of activated pancreatic enzymes and toxic peripancreatic fluid collections likely induce significant microvascular injury and oxidative stress within the renal

parenchyma. Together, these factors create a selective nephrotoxic environment that persists even when other systemic parameters are successfully stabilized by intensive care.

Strengths:

In our limited knowledge, the idea of this study is novel as it assesses the effects of interventions on different categories of ANP, namely moderate and severe. This study analyses the impact of ANP in the Indian population, which is under represented in the world literature. It deals with a sick population of acute pancreatitis patients who had multiorgan failure and required a large number of interventions. It gives an insight into the behaviour of the disease and intervention associated mortality in low- and middle-income countries (LMIC).

Limitations:

There were several limitations to our study. Firstly, the retrospective study design introduces many barriers. Secondly, ours is a tertiary referral centre for severe pancreatitis and this would have introduced selection bias in the study. Thirdly, the small sample size, especially in moderate severity group, may make generalization of the results a bit ambitious. Fourthly, the impact of complications like vascular and ACS on mortality were not assessed. Fifthly, only one parameter like CTSI was used to grade the severity, a more robust classification of the disease with inclusion of SOFA and APACHE II scores might have helped in establishing a stronger causation. Future multicenter observational studies with larger populations are required to confirm the findings of our study.

Conclusion

Our study reiterates that conservative management with supportive therapies in moderate ANP is a feasible option with regards to survival. In severe ANP group, however, survival was best in ‘step-up’ group as compared to ‘step-up + surgery’ and ‘no intervention’ group. LOS was significantly prolonged in the ‘intervention’ group irrespective of the disease severity. Among organ failures, we found that ‘intervention’ was associated with higher renal dysfunction when compared to respiratory and cardiac systems.

Abbreviations

ANP - Acute necrotizing pancreatitis

ANC - Acute necrotic collections

WON - walled off necrosis

CTSI - CT severity index

APACHE II - Acute Physiology and Chronic Health Evaluation

SOFA - Sequential Organ Failure Assessment score

VARD - video-assisted retro-peritoneal debridement

ERCP – Endoscopic retrograde Cholangiopancreatography

MV- Mechanical Ventilation

RRT - Renal replacement therapy

ACS – Abdominal Compartment Syndrome

LOS – Length of stay

K-M analysis – Kaplan-Meier analysis

Declarations

Institutional ethics committee, Sanjay Gandhi Post-graduate Institute of Medical Sciences. IEC code: 2017-200-DM-EXP approved the study. Waiver of consent was granted by the Institutional ethics Committee, Sanjay Gandhi Post-graduate Institute of Medical Sciences in view of retrospective nature of the study

Consent for publication- Not applicable

Availability of data and materials- The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding- None

Acknowledgements- Departments of gastro surgery, gastro-medicine and intervention radiology who helped us manage these patients. Department of Biostatistics, which evaluated and reviewed our statistics for the study.

IEC approval certificate reference Number- 2017-200-DM-EXP

Notation of prior abstract publication/presentation- A modified version of this study was presented at the Annual congress of the Society of Critical Care Medicine held at Phoenix between January 21-23, 2024 at the ‘research snapshot’.

Acknowledgement of all authors' contribution(s) to the research and manuscript-

-	CONTRIBUTORS							
	SKJ	RKS	SY	VSS	BP	MG	AA	AKB
Literature search	√	√	√	√	√	√	√	□
Data acquisition	√	√	√	√	√	□	□	□
Study Design	√	√	□	□	√	□	□	√
Statistical analysis	√	√	√	√	√	√	√	□
Manuscript preparation	√	√	√	□	√	□	√	□
Manuscript review	√	√	√	√	√	√	√	√

Summary conflict of interest statements- No conflicts exist for Dr. Sunil Kumar Jena, Dr. Ratender Kumar Singh, Dr Sangam Yadav, Dr. Vijay SundarSingh Subbiah, Dr Banani Poddar, Dr. Mohan Gurjar, Dr. Afzal Azim, Dr. Arvind Kumar Baronia.

References

1. Iannuzzi JP, King JA, Leong JH et al. Global incidence of acute pancreatitis is increasing over time: a systematic review and meta-analysis. Gastroenterology. 2022 Jan 1;162(1):122-34.
2. PA B. Acute Pancreatitis Classification Working Group. Classification of acute pancreatitis-2012: revision of the Atlanta classification and definitions by international consensus. Gut. 2013;62:102-11.
3. Ahmed MA, Ahemad MT, Ahmed MM. Assessment of acute pancreatitis using the CT severity index and modified CT severity index. Trop J Radiol Imag. 2020;2(4):42-7.
4. Buter A, Imrie CW, Carter CR et al. Dynamic nature of early organ dysfunction determines outcome in acute pancreatitis. British Journal of Surgery. 2002 Mar;89(3):298-302.
5. Werge M, Novovic S, Schmidt PN, Gluud LL. Infection increases mortality in necrotizing pancreatitis: a systematic review and meta-analysis. Pancreatology. 2016 Sep 1;16(5):698-707.
6. Van Santvoort HC, Bakker OJ, Bollen TL et al. A conservative and minimally invasive approach to necrotizing pancreatitis improves outcome. Gastroenterology. 2011 Oct 1;141(4):1254-63.
7. Freeman ML, Werner J, Van Santvoort HC et al. Interventions for necrotizing pancreatitis: summary of a multidisciplinary consensus conference. Pancreas. 2012 Nov 1;41(8):1176-94.
8. Baroud S, Chandrasekhara V, Storm AC et al. A protocolized management of walled-off necrosis (WON) reduces time to WON resolution and improves outcomes. Clinical Gastroenterology and Hepatology. 2023 Sep 1;21(10):2543-50.
9. Reddy MS, Ramana PV, Bhavani C et al. A study on etiology, severity, management and outcome of acute pancreatitis in tertiary care teaching hospital. Int J Res Rev. 2020;7:534-44.
10. Jagatheesan, S., & John, N. A randomized controlled trial of acute pancreatitis in Thanjavur medical college: an institutional experience. International Surgery Journal. 2023; 10:1471–1476.

11. Konda N, Venkateswarluº D, Rao BT et al. Clinical approach, diagnosis and medical management of acute. International Journal of Research in Medical Sciences. 2023 Jul;11(7):2631.
12. Rashid MU, Hussain I, Jehanzeb S et al. Pancreatic necrosis: complications and changing trend of treatment. World journal of gastrointestinal surgery. 2019 Apr 27;11(4):198.
13. Mannan F, Gill RC, Sohail AA et al. Acute necrotizing pancreatitis: Has conservative management replaced surgery? Perspective from a tertiary care centre in Pakistan: A cross-sectional study. Annals of Medicine and Surgery. 2021 Mar 1;63.
14. Baron TH, DiMaio CJ, Wang AY et al. American Gastroenterological Association clinical practice update: management of pancreatic necrosis. Gastroenterology. 2020 Jan 1;158(1):67-75.
15. Aparna D, Kumar S, Kamalkumar S. Mortality and morbidity in necrotizing pancreatitis managed on principles of step-up approach: 7 years experience from a single surgical unit. World journal of gastrointestinal surgery. 2017 Oct 27;9(10):200.
16. Obaitan I, Wehbe H, Easler JJ et al. Factors predictive of hospital length of stay in patients with an index episode of acute necrotizing pancreatitis. Pancreatology. 2024 Feb 1;24(1):32-40.
17. Maatman TK, Mahajan S, Roch AM et al. High rates of readmission in necrotizing pancreatitis: natural history or opportunity for improvement?. Journal of Gastrointestinal Surgery. 2019 Sep 15;23(9):1834-9.
18. Husu HL, Valkonen MM, Leppäniemi AK et al. Occurrence and Risk Factors of Infected Pancreatic Necrosis in Intensive Care Unit–Treated Patients with Necrotizing Severe Acute Pancreatitis. Journal of Gastrointestinal Surgery. 2021 Sep 1;25(9):2289-98.
19. Isenmann R, Rau B, Beger HG. Bacterial infection and extent of necrosis are determinants of organ failure in patients with acute necrotizing pancreatitis. British journal of surgery. 1999 Aug 1;86(8):1020-4.
20. Garg PK, Madan K, Pande GK et al. Association of extent and infection of pancreatic necrosis with organ failure and death in acute necrotizing pancreatitis. Clinical Gastroenterology and Hepatology. 2005 Feb 1;3(2):159-66.

Tables

Table 1: Baseline characteristics, severity of illness, organ supports in the ICU, interventions and outcomes on the basis of disease severity (CTSI)

All data is represented as median (inter-quartile) range and n = number of patients; N = total number of study cohort patients; $p < 0.05$ is considered significant. APACHE II - Acute Physiology and Chronic Health Evaluation; and SOFA - Sequential Organ Failure Assessment score (SOFA) score. MV - mechanical

Groups	Total (N=110)	P2 (n = 31)	P3 (n =79)	p-value
Age (years)	36.5 (27.75-50)	39 (27-55)	36 (28-50)	0.77
APACHE II	15 (12-20)	10 (10-14)	18 (13-22)	**<0.001**
SOFA	8 (6-12)	4 (4-7)	9 (6-12)	**0.003**
Procalcitonin (ng/ml)	3.44 (1-12.5)	0.95 (0.43-7.9)	4.8 (1.3 -13.07)	**0.011**
Biliary	59 (53.6)	13 (41.9)	46 (58.2)	**0.035**
Alcohol	34 (30.9)	8 (25.8)	26 (32.9)	
Idiopathic	10 (9.1)	5 (16.1)	5 (6.3)	
Post ERCP	3 (2.7)	2 (6.5)	1 (1.3)	
Others	4 (3.6)	3 (9.7)	1 (1.3)	
Days of pancreatitis at admission	10 (5.75-17)	8 (3 – 11)	11 (6 – 21)	**0.027**
Days of pancreatitis for first intervention	21 (15-28)	16 (15-24)	21 (15-28)	0.60
Need for MV	93 (84.5%)	19 (61.3%)	74 (93.7%)	
MV days	11.5 (2.7-25.2)	2 (0-9)	19 (6-30)	**<0.001**
Need for vasopressors	108 (98.2%)	29 (93.5%)	79 (100%)	
Vasopressor days	10.5 (3-24.25)	2 (1-7)	16 (6-28)	**<0.001**
Interventions (n, %)	65 (59.1)	7 (22.5)	58 (73.4)	**<0.001**

TABLE 2a: Group P2 ICU supports and outcome related parameters based on interventions; Mechanical Ventilation (MV) days, Renal Replacement Therapy (RRT) requirement, Abdominal compartment syndrome (ACS), Length of ICU stay (LOS)

Parameters	No intervention (n =24)	Intervention (n =7)	p-value
RRT requirement (%)	7 (29)	0	0.10
Vascular complication	1 (4.1)	0	0.58
MV free days	6 (3-7.75)	17 (10-20)	**0.003**
Vasopressor free days	5.5 (3-8)	15 (12-18)	**0.017**
LOS (days)	7.5 (5 – 13.75)	20 (13-23)	**0.01**
Mortality at 90 days (%)	4 (16.6)	0	0.27

Data in days are represented as median (inter-quartile) range; n = number of patients; p value <0.05 is considered significant

TABLE 2b: Group P3 ICU supports and outcome related parameters based on interventions. Mechanical Ventilation (MV) days, Renal Replacement Therapy (RRT) requirement, Abdominal compartment syndrome (ACS), Length of ICU stay (LOS).

Parameters	No intervention (n = 21)	Intervention (n = 58)	p-value
RRT requirement (%)	11 (52.3)	45 (77.6)	**0.02**
ACS (%)	6 (28.6)	45 (77.6)	**< 0.01**
Vascular complication	0	10 (17.2)	**0.04**
LOS (days)	10 (8-17.5)	33 (21.25-46.5)	**< 0.01**
MV free days	6 (0-9.5)	0 (0-15.25)	0.73
Vasopressor free days	4 (0-11)	7.5 (0-22.25)	0.24

Data in days are represented as median (inter-quartile) range; n = number of patients, p value <0.05 is considered significant.

TABLE 2c: Group P3 outcome related parameters based on type of intervention.

Parameters	No intervention (n =21)	Step-up (n = 43)	Surgical (n = 15)	p-value
RRT requirements (%)	11 (52.3)	31 (72.1)	14 (93.3)	**0.03**
ACS (%)	6 (28.5)	31 (72.1)	14 (93.3)	**< 0.01**
Vascular complication (%)	0	5 (11.6)	5 (33.3)	**0.01**

n = number of patients, RRT- Renal replacement therapy, ACS- Abdominal compartment syndrome.

Figures

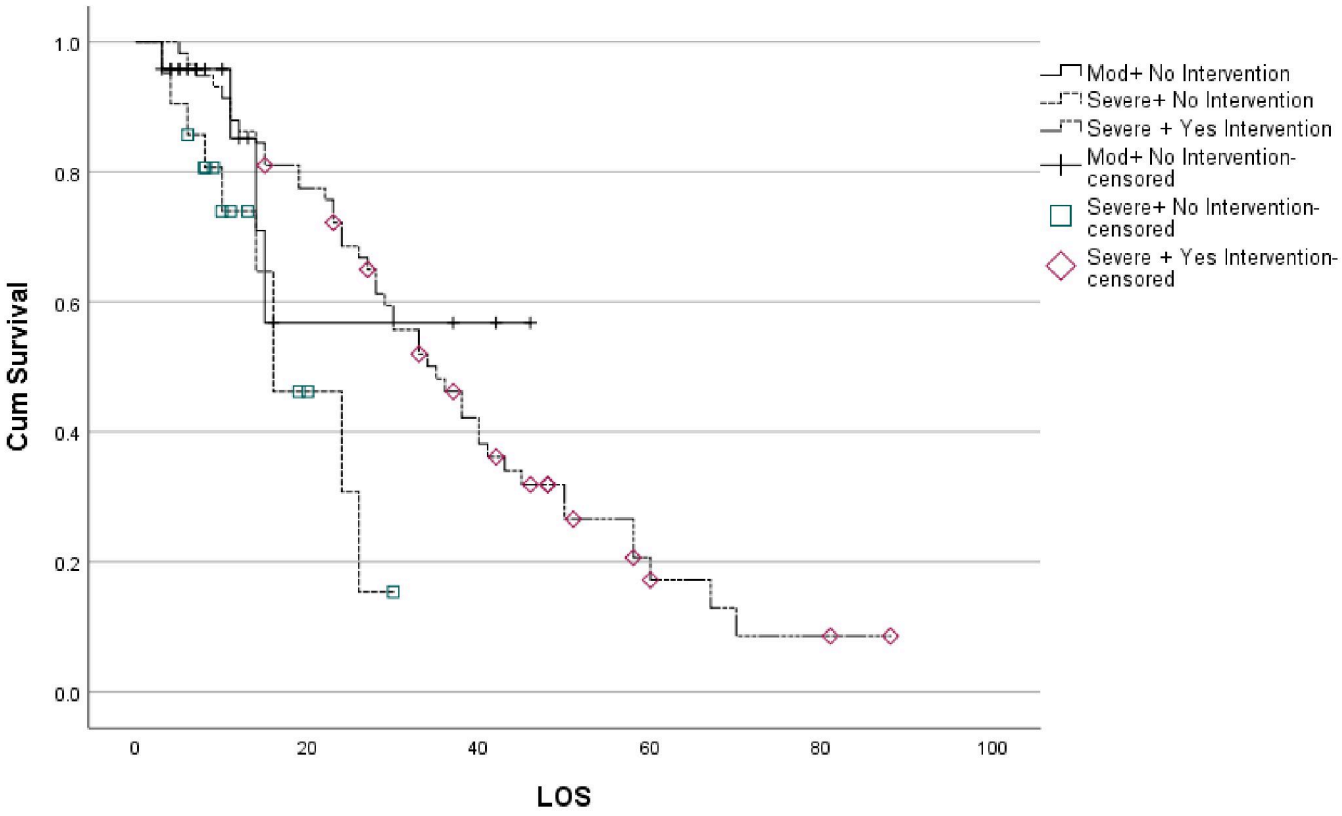


Figure 1

Figure 1

Kaplan-Meier plot depicting survival based on intervention in each group. Mod + No Intervention: group P2 with no intervention; Severe +No Intervention: group P3 with no intervention; Severe + Yes Intervention: Group P3 with intervention; LOS – Length of ICU stay.

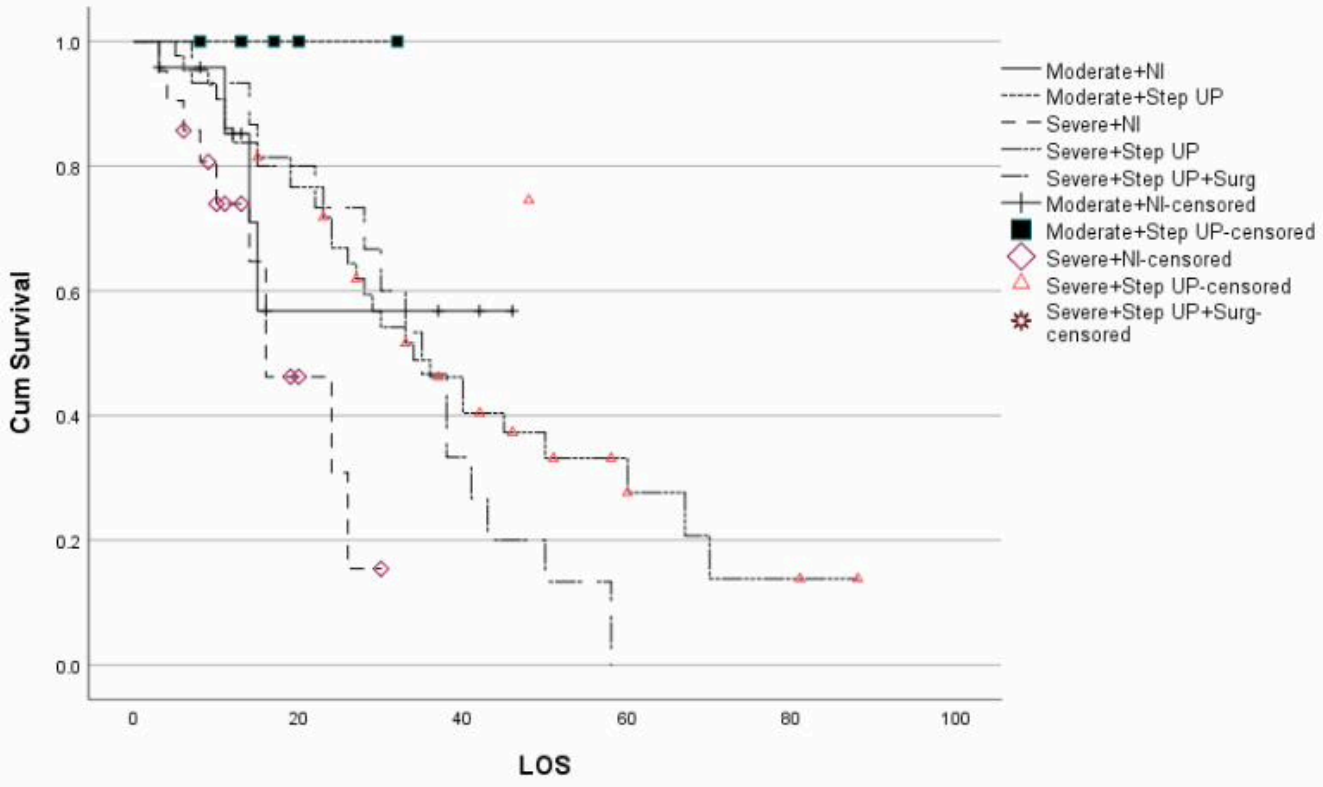


Figure 2

Figure 2

Kaplan-Meier plot depicting survival based on the type of intervention in each group. Moderate + NI: group P2 with no intervention; Moderate+ Step up: Group P2 with Step up procedure; Severe +NI: group P3 with no intervention; Severe + Step up: Group P3 with Step up procedure; Severe+ Step up+ Surg: Group P3 with Step up procedure + Surgery. LOS – Length of ICU stay