Original Article

OPEN ACCESS

Short-Term Mortality and Survival among Patients with Acute-On-Chronic Liver Failure: A Prospective Cohort Study

Rehmatullah Bhatti[1], Adil Hassan[2], Sharjeel Asghar[3], Ubedullah Bughio[4], Abdul Hafeez Soomro[5], Jawaid Iqbal[6]

[1]Assistant Professor, Asian Institute of Medical Sciences, Hyderabad
[2]Assistant Professor, Sindh Medical College, Jinnah Sindh Medical University, Karachi
[3]G I Resident, Asian Institute of Medical Sciences, Hyderabad
[4]Senior Registrar, Asian Institute of Medical Sciences Hyderabad
[5]Assistant Professor Liaquat Institute of Medical Sciences Thatta
[6]Consultant Gastroenterologist, Asian Institute of Medical Sciences Hyderabad

Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, [5,6]Drafting the work or revising it critically for important intellectual content [3,4]Active participation in active methodology, analysis, or interpretation of data for the work

Funding Source: None
Conflict of Interest: None

Received: Aug 28, 2024
Accepted: Dec 24, 2024

Address of Correspondent
Dr. Rehmatullah Bhatti
Assistant Professor, Asian Institute of Medical Sciences
dr_rehmat@hotmail.com

ABSTRACT

Objective: To evaluate the frequency of short-term mortality (30 days) and survival among patients with acute-on-chronic liver failure (ACLF).

Methodology: A descriptive cross-sectional was carried out at gastroenterology department of the Asian Institute of Medical Sciences Sindh, Pakistan. Patients with acute-on-chronic liver failure (ACLF) aged more than 30 years of either gender were included. The ACLF was defined based on the presence of acute decompensation of cirrhosis accompanied by organs failure. The patients were monitored for 30 days and 90 days to assess the mortality and survival. Data were entered and analyzed using SPSS version 26.

Results: Mean age of 117 patients was 50.90 ± 13.93 years, and males were in majority (73.5%). Hepatic failure was the most common organ failure (59.8%), followed by coagulation failure (55.6%), renal failure (43.6%), circulatory failure (41.0%), and CNS failure among (38.5%) of the cases, while the respiratory failure was (17.1%). Overall mortality rate in this cohort was extremely higher across both time points, like at 30 days, 72(61.5%) and at 90 days 102(87.2%), may because most of the patients presented with the most severe form (ACLF Grade=III). Stratification analysis revealed a clear and significant relationship between disease severity and short-term mortality ($p < 0.05$).

Conclusion: Among patients with ACLF, the short-term mortality was observed to highly frequent and significantly associated to patients with multiple organ failures. The findings underscore the importance of organ failure stratification as a key predictor of outcomes in ACLF, suggesting early identification and management of organ dysfunction may be critical in improving survival rates.

Key words: Cirrhosis, ACLF, mortality.

Cite this article as: Bhatti R, Hassan A, Asghar S, Bughio U, Soomro AH, Iqbal J. Short-Term Mortality and Survival among Patients with Acute-On-Chronic Liver Failure: A Prospective Cohort Study. Ann Pak Inst Med Sci. 2025; 21(1):327-332. doi. 10.48036/apims.v21i1.1259.

Introduction

Acute-on-chronic liver failure (ACLF) refers to acute deterioration of liver functions among chronic liver disease patients, resulting in organ failure.[1] A rapid clinical worsening of liver damage in this condition typically occurs following precipitating events such as infections or alcohol consumption.[2] This complex condition has gained as a considerable global concern due to its increasing incidence, poor prognosis, and high rates of short-term mortality.[3] Systemic inflammation, immune dysregulation, and hepatocellular injury are considered as the major pathophysiological mechanisms that contribute to the multi-organ failure onset in ACLF.[4] The severity grade and number of organ failures are significant determining factors of patient outcomes in Acute-on-Chronic Liver Failure (ACLF).

Depending on disease severity, 28 to 30 days (short-term) mortality rates are significantly high, ranging from 30% to 50% and even reaching up to 77% among patients with multiple organ failures.[5,6] Therefore, early mortality in ACLF remains a key challenge regardless of advancements in supportive care.[6]

Pakistan faces a considerable burden of ACLF due to the high prevalence of chronic liver disease, with 2.8 to 3.83

million hepatitis B infected individuals and nearly 9.8 million are infected with hepatitis C, and collectively these infections contribute to nearly 37,000 deaths each year.[7,8] These infections are the major contributor to hepatocellular carcinoma and liver cirrhosis associated deaths.[9] Regional factors may also significantly influence disease progression and patient outcomes. A local research study from Karachi reported viral hepatitis as the major cause of ACLF and identified infections and gastrointestinal bleeding as the most common precipitating factors for acute deterioration of liver damage.[10] Similar, a more recent local study reported substantially high rate of 30-day mortality among ACLF patients, up to 61.5%, with hepatic, renal, and central nervous system failures reported as major predictors of poor outcomes.[11] These findings not only reflect severity of the ACLF but also highlight high short-terms mortality rates in Pakistan. Additionally, ACLF management and patient outcomes are further complicated by regional variations in healthcare access, late presentation, and limited availability of liver transplantation.[10-12] However, the ACLF carries alarmingly high short-term mortality and remains challenging for diagnosis and prognosis. The current scoring systems show variable accuracy across different populations, and most evidence comes from East and Western cohorts od Asia, leaving South Asian and resource-limited settings inadequately represented, hence this prospective was conducted to evaluate the short-term mortality and survival among patients with acute-on-chronic liver failure to generate relevant, applicable evidence. Additionally, the findings may also support the better risk stratification, more informed clinical decision-making, and appropriate transplant referral ultimately contributing to improved outcomes in a critically ill group of the patients.

Methodology

A descriptive cross-sectional cohort study was carried out at gastroenterology department of the Asian Institute of Medical Sciences Sindh, Pakistan. Study was done after taking Ethical approval from Asian Institute of Medical Sciences from December 2017 to November 2018. All the patients aged >30 years old, admitted to the hepatology or gastroenterology department with a confirmed diagnosis of with acute-on-chronic liver failure (ACLF) of either gender were included. However, patients with hepatocellular carcinoma, liver transplantation, HIV co-infection, patients with incomplete clinical records and those who refused to take a part of a study were excluded. Demographic and clinical assessments were done at the time of admission including; age, gender, body mass index (BMI), etiology of chronic liver disease, precipitating event of acute decompensation, and comorbidities. Additionally, laboratory parameters obtained within 24 hours of admission including, serum bilirubin, serum sodium, serum creatinine, (INR), (ALT), (AST), serum albumin, (WBC) count, platelet count, and C-reactive protein (CRP). Diagnosis of chronic liver disease was proven through prior clinical records, imaging, histology, or clinical and biochemical evidence of cirrhosis. Furthermore, the ACLF was defined based on the presence of acute decompensation of cirrhosis accompanied by organ failure as assessed by the CLIF-C Organ Failure (CLIF-C OF) score and further was graded as; (**g**rade-I = only renal failure, or single non-renal organ failure with renal dysfunction and/or mild-to-moderate hepatic encephalopathy), (**g**rade-II = two organ failures) and (**g**rade-III = more than two organ failures). all the patients were followed up through hospital visits, telephonic contact, or medical records review, to assess the mortality rate at 28 days and 90-day from the date of admission. All the data were entered and analyzed using SPSS version 26.

Results

Overall 117 patients with Acute-On-Chronic Liver Failure were enrolled, with an overall mean age of 50.90 ± 13.93 years, and male predominance (73.5%), reflecting a predominantly middle-aged and male population of the patients. However, the Hepatitis C Virus (HCV) infection was the leading cause (35.9%), followed by HBV/HDV co-infection (20.5%) and HBV infection (19.7%), highlighting the overwhelming dominance of viral hepatitis in this cohort. According to the clinical complications at presentation, ascites was the most prevalent among (82.1%) of patients, followed by AKI (65.8%), (57.3%) hepatic encephalopathy, SBP was among 35.0% of patients, while upper gastrointestinal bleeding and respiratory infections were less frequent, among (8.6%) and (15.4%) of the patients, respectively. Moreover, the hepatic failure was the most common organ failure, affecting (59.8%) of study population, followed by coagulation failure (55.6%), renal failure (43.6%), circulatory failure (41.0%), and CNS failure among (38.5%) of the cases, while the respiratory failure was least prevalent, among (17.1%) of patients. Table I

Table I: Demographic and clinical characteristics. (n=117)		
Variables	**N**	**%**
Sex		
Male	86	73.5%
Female	31	26.5%
Cause of CLD		
HCV	42	35.9%
HBV	23	19.7%
ALCOHOLIC	6	5.1%
NASH	3	2.6%
HBV+HDV	24	20.5%
HBV+HCV	8	6.8%
HCV+ALCOHOLIC	3	2.6%
UNKNOWN	6	5.1%
AIH	2	1.7%
Ascites		
Yes	96	82.1%
No	21	17.9%
SBP		
Yes	41	35.0%
No	76	65.0%
AKI		
Yes	77	65.8%
No	40	34.2%
Encephalopathy		
Yes	67	57.3%
No	50	42.7%
Upper gastrointestinal bleeding		
Yes	10	8.5%
No	101	91.5%
Respiratory infection		
Yes	18	15.4%
No	99	84.6%
LIVER FAILURE bilirubin >12 mg/dl		
Yes	70	59.8%
No	47	40.2%
KIDNEY FAILURE Creatinine>2mg/dl		
Yes	51	43.6%
No	66	56.4%
CNS FAILURE Encephalopathy iii-iv		
Yes	45	38.5%
No	72	61.5%
Circulatory Failure		
Yes	48	41.0%
No	69	59.0%
Coagulation failure		
Yes	65	55.6%
No	52	44.4%
Respiratory Failure		
Yes	20	17.1%
No	97	82.9%

Overall mortality rate in this cohort was extremely higher across both time points, like at 30 days, 72(61.5%) mortality rate was noted, with survival rate of 45(38.5%). However, the mortality course worsened considerably over the extended follow-up time, with 90-day mortality reaching 102(87.2%), leaving just 15(12.8%) of the patients alive at three months, which significantly demonstrates the relentlessly progressive and often fatal natural history of ACLF when managed conservatively without transplantation of liver. Table II

Table II: Mortality and survival rate among patients with Acute-On-Chronic Liver Failure. (n=117)		
VARIABLES	**EXPIRED**	**SURVIVED**
30 Days Mortality	72 (61.5%)	45 (38.5%)
90 Days Mortality	102 (87.2%)	15 (12.8%)

In this study around half the cohort, 57(48.7%) patients presented with the most severe form (ACLF Grade=III), reflecting a critically ill population with three or more concurrent organ failures at the time of admission. However, the (ACLF grade=II) was among 31(26.5%) of the patients, while (ACLF Grade=I) and (Grade=0, acute decompensation without organ failure) were identified among 9.4% and 15.4% of the cases, respectively. Figure 1

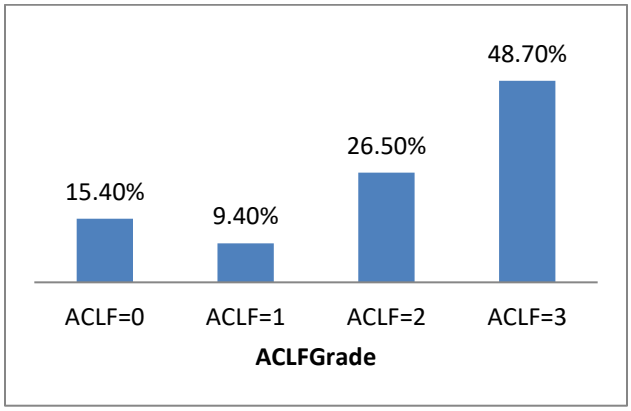

Figure 1. Patients distribution according to ACLF grades. (n=117)

According to the stratification of mortality outcomes by ACLF grade revealed a clear and statistically significant dose-response relationship between disease severity and short-term mortality. According to 30 days, mortality escalated sharply with increasing ACLF grade: only 4 of 18 patients (3.4%) with ACLF Grade 0 expired, compared to 5 (4.3%) in Grade 1, 18 (15.4%) in Grade 2, and a staggering 45 patients (38.5%) in Grade 3. Overall the survival at 30 days was highest among Grade 0 patients (12.0%) and significantly declined precipitously with advancing grade (p=0.001). However, the mortality and advanced grade relationship increased dramatically by 90 days, where Grade 3 patients suffered near-total attrition, with only 1 (0.9%) survivor remaining, while overall cohort mortality reached 87.2% (p=0.002), as sown in table III.

Table III: Mortality and survival rate according to ACLF grades. (n=117)

Mortality rate		ACLF GRADE					p-value
		ACLF=0	ACLF=1	ACLF=2	ACLF=3	Total	
30 days mortality	Expired	4	5	18	45	72	0.001
		3.4%	4.3%	15.4%	38.5%	61.5%	
	Survived	14	6	13	12	45	
		12.0%	5.1%	11.1%	10.3%	38.5%	
90 days mortality	Expired	12	8	26	56	102	0.002
		10.3%	6.8%	22.2%	47.9%	87.2%	
	Survived	6	3	5	1	15	
		5.1%	2.6%	4.3%	0.9%	12.8%	

Discussion

Among patients with underlying cirrhosis of liver, the development of ACLF marks a life-threatening turning point, where the risk of death within days to weeks becomes dramatically real, and where distinguishing early predictors of short-term survival can mean the difference between timely intervention and irreversible loss. This study enrolled overall 117 patients with an overall mean age of 50.9 ± 13.9 years, and male predominance (73.5%), reflecting a predominantly middle-aged and male population of the patients. Consisting demographic profile was noted in the study conducted by Lankarani KB et al[13] who reported middle aged ACLF patients, with slightly higher average age (56.6±16.2 years) and predominance of male gender (66.2%). Likewise, in the study of Qin G et al[14] mean age of ACLF patients was 48 years (49.2±11.7), with clear male majority (75%).

In this study, the HCV infection was the leading cause (35.9%), followed by HBV/HDV co-infection (20.5%) and HBV infection (19.7%), highlighting the overwhelming dominance of viral hepatitis in this cohort. Aligning with these findings, Lankarani KB et al[13] reported viral hepatitis (34.6%) as the leading predisposing factors of acute decompensation and ACLF, followed by variceal bleeding in 19.9%, and alcoholic hepatitis in 4.5% of cases. Consistently, in the study of Qin G et al[14] reported chronic HBV (91%) was the most common contributor to chronic liver disease among ACLF patients, followed by AILDs in 3%, ALDs in 2.74%, chronic HCV in 1.19%, cryptogenic factor in 1.65%, while HBV combined with ALD (0.26%) and HBV combined with HCV (0.16%) were least frequent. The discrepancy in the type of viral infection may be attributed to regional epidemiological differences, with higher chronic HCV burden in your population.

In present study, according to the clinical complications at presentation, ascites was the most prevalent among (82.1%) of patients, followed by AKI (65.8%), hepatic encephalopathy (HE) in 57.3%, and SBP was among 35.0% of patients, while upper gastrointestinal bleeding and respiratory infections were less frequent, among (8.6%) and (15.4%) of the patients, respectively. In agreement, the study published by Zhu CX et al.[15] documented that ascites (78.8%) was the most common complication, followed by HE in 57.1%of ACLF patients. Similarly, in the study of Lankarani KB et al.[13] ascites (84.5%) and Hepatic encephalopathy (95.8%) were the most common complications followed by variceal bleeding in 40.8% of ACLF patients.

In this series, the hepatic failure was the most common organ failure, affecting 59.8% of study population, followed by coagulation failure (55.6%), renal failure (43.6%), circulatory failure (41.0%), and CNS failure among (38.5%), while the respiratory failure was least prevalent, among (17.1%) of patients. Aligning with these findings, the study carried out by El Sayed ML et al.[16] found that in renal failure (83.8% in ward and 60% in ICU) as the commonest organ failure among ACLF patients, followed by cerebral failure (26.7% in ward and 76.7% in ICU). Cerebral and circulatory failures are more common in ICU patients (76.7% and 33.3% respectively) while coagulopathy is more common in ward patients (43.3%). In accordance, Dominguez C et al.[17] reported higher rate of renal failure, cerebral failure, and coagulation failure compared to our findings. They found that renal failure was more common in ACLF grade 1 (70%) and grade 3 (71%), while cerebral failure (85%) in grade 3, and coagulation failure (60%) in ACLF grade 2, while circulatory and respiratory failures were reported in 100% of patients in advanced ACLF grade (ACLF-3).

Moreover, in this cohort, mortality rate was extremely higher across both the 30-day and 90-day time points, with 61.5% at 30 days and worsening considerably over the extended follow-up time reaching 87.2% at 90-day. This demonstrates the relentlessly progressive and often fatal natural history of ACLF when managed conservatively without transplantation of liver. In line

with these findings, in the study of Wang N et al.[18] reported that in the training cohort, 30-day mortality was 37.99% and 90-day mortality was 53.36%, while in validation cohort, mortality rates were 40.41% at 30-day and 55.16% at 90-day. Comparably, in the study of Hafsa F et al.[19] reported lower 28-day mortality (43.75%) than our findings, while reflected a well-recognized high early mortality of ACLF. Consistently, the study conducted by Saini V et al.[20] also reported lower mortality rates at 28-day (48%) and 90-day (60%) compared to our findings.

However, in this study around half the cohort, 48.7% of patients presented with the most severe form of ACLF (Grade=III), reflecting a critically ill population with three or more concurrent organ failures at the time of admission. However, ACLF grade=II was among 26.5% of the patients, while Grade=I and Grade=0 (acute decompensation without organ failure) were identified among 9.4% and 15.4% of the cases, respectively.

Aligning with these findings, in the study of El Sayed ML et al.[16] severity grading showed significant increase in mortality from 20% in ACLF-1 to 100% in ACLF-3 at 30-day and from 50% in ACLF-1 to 100% in ACLF-3 at 90-day in ICU settings, suggesting that high proportion of Grade III patients reflects severely ill and high-mortality cohort. Contrasting to our findings, in the study of Abdallah MA et al.[22] ACLF grade distribution was skewed toward less advanced stages, with 47% in grad-I, 30% in grade-II, 12% in grade 3a, and 11% in grade 3b.

Additionally in this series stratification of mortality outcomes by ACLF grade revealed a clear and statistically significant dose-response relationship between disease severity and short-term mortality ($p<0.05$). Mortality escalated gradually and significantly with increasing ACLF grade, from 3.4% in Grade 0 to 38.5% in Grade 3 at 30 days ($p=0.001$), which were consisting with the study by El Sayed ML et al.[16] where, mortality significant increased with severity grading at 30-day ($p=0.001$) and at 90-day ($p=0.04$). On the other hand, the study of Engelmann C et al[23] also showed significantly high 28-day mortality of 72% in ACLF Grade III. suggesting significantly poor short-term outcomes in advanced ACLF. Furthermore, severity stratification showed that mortality increased from 80% in patients with CLIF-C ACLF scores ≥55 to 100% in those with scores ≥70, suggesting severity-dependent mortality escalation ($p < 0.0001$). According to our findings, relationship between mortality and advanced grade increased dramatically by day 90, where Grade 3 patients suffered near-total attrition, with overall cohort mortality reached 87.2% ($p=0.002$). These findings are consistent with the study published by Xiao L et al[24] who reported 90-day survival of only 48.8%, suggesting mortality rate of 51.2% at 90-day. They further demonstrated that higher ACLF grades (Grade II–III) were significantly associated with mortality ($p<0.001$). in aligns to these findings Abudeif A et al[25] reported that 37.61% of patients were classified as ACLF Grade III and 28-day mortality of 66.97%. They demonstrated that the presence of ≥3 organ failures increased mortality risk significantly (HR = 9.34, $p<0.0001$). Although their follow-up was limited to 28 days, high mortality at early stage may lead to near-complete attrition by 90 days in severe cases.

Conclusion

ACLF was observed to carry a significantly higher short-term mortality, with the majority of patients failing to survive beyond 30 days and by 90 days, with viral hepatitis, as the predominant underlying etiology. There was clear and consistent pattern observed whereby patients with advanced grades of ACLF grades at admission managed significantly worse, with Grade=III patients showing virtually decreased survival rate by 90 days. Collectively, the findings indicated that the ACLF in this population is a rapidly progressive and often serious condition, mostly caused by viral hepatitis, late presentation, and leading to multi-organ failure, though the ACLF grade at admission proved to be a decisive and reliable predictor of survival, with higher grades translating into near-certain mortality.

References

1. Allhoff B, Neumann-Haefelin C, Kasper P. Acute-on-chronic liver failure—current management and future perspectives. *Biomedicines*.2025;13(9):2193. https://doi.org/10.3390/biomedicines13092193
2. Kulkarni AV, Sarin SK. Acute-on-chronic liver failure—steps towards harmonization of the definition! *J Hepatol*. 2024;81(2):360–6. https://doi.org/10.1016/j.jhep.2024.03.036
3. Jiang H, Zhao Z, Cui S, Kong X, Jiang X. Prognostic factors for mortality in patients with acute-on-chronic liver failure. *Eur J Gastroenterol Hepatol*. 2025;37(7):833–43. https://doi.org/10.1097/MEG.0000000000002958
4. Li S, Liu J, Wu J, Zheng X. Immunological mechanisms and effects of bacterial infections in acute-on-chronic liver failure. *Cells*. 2025;14(10):718. https://doi.org/10.3390/cells14100718
5. Zaccherini G, Weiss E, Moreau R. Acute-on-chronic liver failure: definitions, pathophysiology and principles of treatment. *JHEP Rep*.2021;3(1):100176. https://doi.org/10.1016/j.jhepr.2020.100176

6. Karvellas CJ, Bajaj JS, Kamath PS, Napolitano L, O'Leary JG, Solà E, et al. AASLD practice guidance on acute-on-chronic liver failure and the management of critically ill patients with cirrhosis. *Hepatology*.2024;79(6):1463–502. https://doi.org/10.1097/HEP.0000000000000671
7. Salim A, Farooq MO, Saleem S, Malik K. Financial burden and social implications of chronic liver disease in a patient population group in Pakistan. *Pak J Med Sci*. 2024;40(7):1503. https://doi.org/10.12669/pjms.40.7.7976
8. Huma Q, Saeed A, Hassan M, Saeed H, Ammara N, Aamir GK, et al. Overview of hepatitis C elimination efforts in Pakistan and the launch of Prime Minister's programme. *J Pak Med Assoc*. 2024;74(12):2188–90. https://doi.org/10.47391/JPMA.24-97
9. Resham S, Khan M, Rahman E, Adnan F, Manzoor S. Frequency distribution of hepatocellular carcinoma and evaluation of viral persistence in Pakistani patients. *J Pak Med Assoc*. 2025;75(9):1409–16. https://doi.org/10.47391/JPMA.22562
10. Tasneem AA, Luck NH. Acute-on-chronic liver failure: causes, clinical characteristics and predictors of mortality. *J Coll Physicians Surg Pak*. 2017;27(1):8–12.
11. Bhatti R, Bughio U, Hassan A, Soomro AH, Iqbal J, Ali M. Assessment of predictors and mortality in patients with acute-on-chronic liver failure: a prospective study. *Ann PIMS*. 2022;18(3):222–7. https://doi.org/10.48036/apims.v18i3.663
12. Bajaj JS, Choudhury A, Kumaran V, Wong F, Seto WK, Alvares-da-Silva MR, et al. Geographic disparities in access to liver transplant for advanced cirrhosis. *Am J Transplant*. 2024;24(5):733–42. https://doi.org/10.1016/j.ajt.2024.02.018
13. Lankarani KB, Ghanbarinasab Z, Niknam R. Acute-on-chronic liver failure: prevalence, causes, predisposing factors, and outcome. *Gastroenterol Hepatol Bed Bench*. 2024;17(2):161.
14. Qin G, Shao JG, Zhu YC, Xu AD, Yao JH, Wang XL, et al. Population-representative incidence of acute-on-chronic liver failure. *J Clin Gastroenterol*. 2016;50(8):670–5. https://doi.org/10.1097/MCG.0000000000000538
15. Zhu CX, Yang L, Zhao H, Zhang Y, Tu S, Guo J, et al. Impact of cirrhosis-related complications on posttransplant survival in ACLF. *Hepatobiliary Pancreat Dis Int*. 2023;22(1):64–71. https://doi.org/10.1016/j.hbpd.2022.09.004
16. El Sayed ML, Gouda TE, Khalil ES, Al Arman MM, Mohamed IE. Clinical profile and outcome among ICU patients with ACLF. *Egypt J Intern Med*. 2021;33(1):31. https://doi.org/10.1186/s43162-021-00061-0
17. Dominguez C, Romero E, Graciano J, Fernandez JL, Viola L. Prevalence and risk factors of ACLF in Argentina. *World J Hepatol*.2016;8(34):1529. https://doi.org/10.4254/wjh.v8.i34.1529
18. Wang N, Tao S, Chen L. Machine learning model for HBV-ACLF bacterial infection diagnosis. *BMC Infect Dis*. 2025;25(1):847. https://doi.org/10.1186/s12879-025-11199-5
19. Hafsa F, Chaudary ZI, Tariq O, Riaz Z, Shehzad A, Jamil MI, et al. Acute-on-chronic liver failure: causes and predictors of mortality. *Cureus*. 2024;16(1). https://doi.org/10.7759/cureus.52690
20. Saini V, Dadhich P, Swami R, Dadhich SK, Yadav A, Bhati R, et al. Forecasting medium-term mortality in alcohol-related ACLF. *J Clin Exp Hepatol*. 2025;103121. https://doi.org/10.1016/j.jceh.2025.103121
21. Luo J, Hu M, Feng T, Zhang L, Huang Y, Huang Y, et al. Performance of the China-CLIF framework in ACLF. *Gut*. 2026;75(1):131–46. https://doi.org/10.1136/gutjnl-2025-335651
22. Abdallah MA, Kuo YF, Asrani S, Wong RJ, Ahmed A, Kwo P, et al. Novel score predicting waitlist mortality in ACLF. *J Hepatol*. 2021;74(6):1355–61. https://doi.org/10.1016/j.jhep.2020.12.003
23. Engelmann C, Thomsen KL, Zakeri N, Sheikh M, Agarwal B, Jalan R, et al. Validation of CLIF-C ACLF score for ICU futility threshold. *Crit Care*. 2018;22(1):254. https://doi.org/10.1186/s13054-018-2156-0
24. Xiao L, Chen J, Zhao S, Zhoudi W, He K, Qian X, et al. 90-day survival threshold in HBV-ACLF patients. *Adv Sci*. 2024;11(16):2304381. https://doi.org/10.1002/advs.202304381
25. Abudeif A, Al Sayed E, Galal G. Predictors of short-term mortality in decompensated cirrhosis with ACLF. *Clin Exp Hepatol*. 2022;8(4):300–8. https://doi.org/10.5114/ceh.2022.122332