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Original Research Article

SPECTRUM OF INFECTIONS IN CHRONIC DECOMPENSATED LIVER DISEASE: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Patients with chronic decompensated liver disease (CLD) are highly susceptible to infections because of immune dysfunction, bacterial translocation, and gut microbiota alterations. Infections significantly increase morbidity and mortality in cirrhotic patients. The aim is to assess the spectrum of infections in chronic decompensated liver disease and evaluate clinical outcomes at day 9 and day 28 following the primary infective event.

Materials and Methods: This prospective observational study was conducted in the Department of Medicine, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, over one year. A total of 183 patients aged 18–60 years with chronic liver disease and proven infections were enrolled.

Results: SBP was the most common infection (71.6%), followed by pneumonia (6.6%) and urosepsis (6.0%). Culture positivity was observed in 17.5% of patients, with Escherichia coli being the most common organism. Mortality at 3 months was 50.3%.

Conclusion: Infections are associated with significant mortality in chronic decompensated liver disease. Early diagnosis and prompt treatment are essential to improve outcomes.

Keywords: Cirrhosis; Chronic liver disease; Spontaneous bacterial peritonitis; Infection; Mortality

INTRODUCTION

Chronic liver disease is a leading cause of death worldwide. Patients with cirrhosis have several biological and immunological alterations that predispose to the development of infections. These changes involve both a lack of producing an effective immune response and an increase in the exposure of the immune system to gut derived pathogens.[1,2] In cirrhosis, portal hypertension causes an alteration of gut tight junctions, with an increased intestinal permeability, which favors translocation of bacteria from the gut to the systemic circulation.[3] In addition, changes in quality and quantity of bacteria (intestinal bacterial overgrowth and proliferation of pathogenic bacteria such as Enterobacteriaceae and Enterococcaceae) further favor this pathological bacterial translocation, predisposing patients with cirrhosis to the development of infections.[4] Cirrhosis of the liver is also associated with immune dysfunction that involves both the innate and adaptive immune system, resulting in an ineffective immune response. In particular, recent studies identified CD8+ T cell functional and transcriptional alterations in patients with cirrhosis, as well as a reduced count of memory lymphocytes, CD8+ T cells, and natural killer cells, which can contribute to immunosuppression.[5,6]

Community acquired bacterial infections account for about 30% of all infections followed by healthcare acquired in approximately 30% and nosocomial infections in 35-40%.[7]

Among hospitalized patients with cirrhosis, infections account for 25–35% of all admissions and this is 4–5-fold higher rate of infections than in those without cirrhosis.[8]

Bacteria remain the most common pathogens with a prevalence of about 25–46% in patients hospitalized for acute decompensated cirrhosis which then increases the probability of death by approximately 4-fold, reaching 30% at 1 month and 63% at 1 year. Enterobacteriaceae and non-enterococcal streptococci are the major causes of spontaneous infection in cirrhosis.[9]

Indeed, they represent the primary cause of admission to the emergency department among patients with Chronic liver disease. About 20–30% of hospital admissions for acute decompensation are related to an infection, or complicated with an infection during the in hospital stay. In those cases, 10% of patients have more than one episode within the same hospitalization.[10]

Infection-related mortality is high in patients with ESLD, approaching 30% within 30 days and 66% within 1 year from the hospital admission. For this reason, infection is considered an important prognostic marker in patients with ESLD.[11]

Liver dysfunction leads to several abnormalities of the defense mechanisms, as both humoral and cell-mediated immunity are depressed and bacterial translocation from the intestine increases susceptibility to infection, particularly for spontaneous bacterial peritonitis (SBP). With infection, a systemic inflammatory response syndrome may occur resulting in sepsis, renal failure, encephalopathy, and death.[12]

Cirrhosis is classified into compensated and decompensated stages. Compensated cirrhosis is asymptomatic and maintains relatively preserved liver function. However, as the disease progresses, it leads to decompensated cirrhosis, marked by life-threatening complications such as ascites, spontaneous bacterial peritonitis (SBP), variceal bleeding, hepatic encephalopathy (HE), and jaundice. The development of infections in decompensated cirrhosis significantly worsens prognosis, increases hospitalization rates, and contributes to multi-organ failure.

Pathophysiology of Infections in Cirrhosis

The pathogenesis of infections in cirrhotic patients is driven by multiple factors:

1. Impaired Immunity: Cirrhosis results in immune system dysfunction, reducing the ability to fight infections effectively.
2. Bacterial Translocation: Increased intestinal permeability allows pathogenic bacteria and endotoxins to enter the bloodstream, triggering systemic inflammation. 3. Gut Microbiota Dysbiosis: Alterations in gut microbiota led to increased pathogenic bacterial colonization, contributing to infections.
3. Systemic Inflammatory Response Syndrome (SIRS): Many infections lead to an exaggerated inflammatory response, worsening organ dysfunction and increasing mortality risk.

Antibiotic resistance is an emerging concern in the management of cirrhosis-related infections. MDR bacterial strains, including extended-spectrum beta-lactamase (ESBL)- producing Enterobacteriaceae, carbapenem-resistant Enterobacteriaceae (CRE), and vancomycin-resistant enterococci (VRE), are increasingly reported in cirrhotic patients.

Studies suggest that 30-50% of infections in cirrhosis are caused by MDR pathogens. Infections in decompensated cirrhosis are a major contributor to disease progression, hospitalizations, and mortality. This study will provide critical insights into infection epidemiology, microbial trends, and resistance patterns, which will ultimately inform better clinical management and improve patient outcomes.

Aim and Objectives

AIM: To assess various infections in chronic decompensated liver disease

Objective:

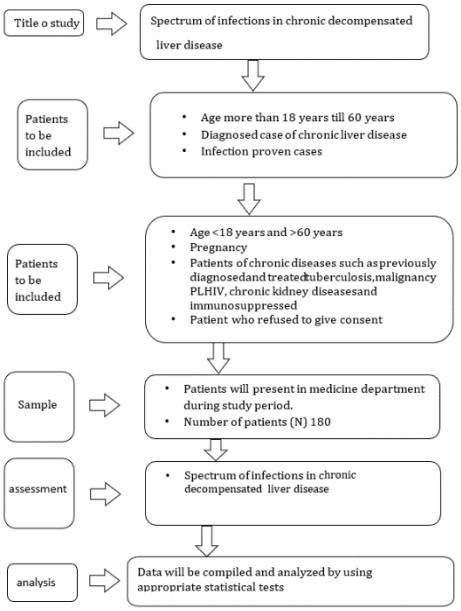
Primary objectives: Clinical spectrum of infections in chronic decompensated liver disease.

Secondary objectives: To determine the clinical outcome at 9 and 28 days of primary event.

MATERIALS AND METHODS

Study design: The present study was a prospective, observational open clinical study. The study was conducted in the OPD, IPD, and Hepatology clinic of Department of Medicine, Pt. B.D. Sharma PGIMS, Rohtak (Haryana). The study was conducted in accordance with the principles of Good Clinical Practice (GCP) and Declaration of Helsinki 1964 with the most recent amendments. Prior ethical clearance was obtained from the Institutional Ethics Committee (IEC) for the study. All the participants in the study were given complete information regarding the study and informed consent was obtained.

Study Design



Study Duration: It was over a period of 1 year. Enrollment was done for the first six months. All patients were followed up to 3 months after enrollment.

Study population: Patients of liver cirrhosis aged between 18-60 years with infection proven cases. Diagnosis of infection was done as per history given by patients, clinical presentation and blood investigation, urine examination and respective investigations as per patients. Diagnosis of cirrhosis was based upon detailed clinical examination including (presence of palmar erythema, spider naevi, Dupuytren's contracture, caput medusae), biochemical investigation and USG abdomen showing (nodular surface, altered echotexture of liver, left lobe hypertrophy, widened interlobar fissure, splenomegaly, presence of evidence of portal hypertension).

Sample size:

Sample size calculation:

$$\text{Sample size}(n) = \frac{(z_{1-\alpha/2})^{2*}(p)(q)}{(d)^2}$$

n = Desired sample size

Z1−α/2=Critical value and a standard value for the corresponding level of confidence. (At 95% CI or 5% level of significance (type-I error) it is 1.96)

P = prevalence of 5% [prevalence rates occur in Asian populations (5-20%)

25% (according to previous study, infection prevalence in hospitalized patients is 25% to 35 % in cirrhosis patients) 13.

q = 1-p (p=25) = 75 d = Absolute error taken as 6.6%. (25% of relative error of p (25) =6.25% n = (1.96)2 x 25 x 75/ (6.3)2 =181 so patients are selected 180.

Selection criteria

Inclusion criteria

- Age more than 18 years till 60 years
- Diagnosed case of chronic liver disease.
- Infection proven cases.

Exclusion criteria

- Age <18 years and >60 years
- Pregnancy
- Patients of chronic diseases such as previously diagnosed and treated tuberculosis, malignancy, PLHIV, chronic kidney diseases and immunosuppressed
- Patient who refused to give consent

Method:

- Detailed clinical interview and physical examination was done at the time of admission. Clinical events (infection, AKI, bleeding, ascites, and encephalopathy) were carefully evaluated, then these patients are subjected to appropriate investigations.
- During hospitalization complete hemogram, serum Total bilirubin, unconjugated bilirubin and conjugated bilirubin, serum total protein serum albumin, serum globulin, PT (Prothrombin time)/INR, alkaline phosphatase, Blood urea (BU), serum creatinine (sCr) at admission and daily till patient improve or discharge & baseline report noted if available, serum electrolytes and ABG (arterial blood gas analysis) will be done at admission and done. viral markers (HBsAg & Anti HCV, HIV) will be investigated.

Culture of ascitic fluid, blood, urine, and sputum was performed when an infection is suspected. Urine routine microscopy, urine electrolytes whenever relevant, ascitic fluid microscopy done when patients have ascites, Ultrasonography of Whole abdomen, chest x ray, and the other lab investigation which was required for evaluation and treatment of patients.

- The diagnosis of cirrhosis was based on clinical evaluation using laboratory values, liver imaging and endoscopy.
- Cirrhosis staged clinically by Child-Pugh classification (CPC) with scoring system of 5-15 score of 5 to 6 being CPC-A,7 to 9 CPC-B and 10 to 15 being CPC – C. (annexure 1)

Statistical Analysis: All the measurements and data were analyzed using standard statistical tools. The measurements were entered in Microsoft excel spreadsheet. Normally distributed variables were mentioned as means and standard deviation. Categorical variables will be expressed as frequencies and percentages. For normally distributed data t test was employed for analysis.

RESULTS

183 patients of chronic decompensated cirrhosis presented in emergency, OPD and hepatology clinic with infections was admitted and baseline investigations were sent and cultures were also sent. Spectrum of infections were seen in the patients on admission, day 9, day 28 and on 3rd month. Out of 183 patients, 3 patients were lost to follow up.

The mean age of patients was 47.53 ± 10.55 years. Males constituted 94.5% of the study population. Alcohol-associated liver disease was the most common etiology (75.4%). Ascites was present in 92.9%, jaundice in 82%, hepatic encephalopathy in 53.6%, and upper gastrointestinal bleeding in 36.1% of patients.

SBP was the most common infection observed in 71.6% of patients, followed by pneumonia (6.6%), urosepsis (6.0%), cellulitis (2.3%), and septicemia (2.3%). Culture positivity was noted in 17.5% of patients. Escherichia coli was the predominant organism (62.6%), followed by Klebsiella species (18.8%).

Mortality at day 9 was 38.3%, while mortality at day 28 reached 49.1%. Overall, 3-month mortality was 50.3%.

Table 1: Baseline characteristics in the patients

	Mean	Std. Deviation
AGE	47.53	10.552
DURATION of alcohol intake (YRS)	12.514	7.6265
LAST ALCOHOL INTAKE (MONTH)	3.156	6.4386
CTP	11.44	2.190
MELD	26.95	8.530
MELD NA	27.77	8.367
HOSPITAL DAYS	6.77	5.594

MEAN age of the patients was 47.53± 10.5. ALD Cirrhosis is the most common type of decompensated cirrhosis. Average duration of alcohol intake in the patients in yrs was 12.5±7.6. CHILD PUGH SCORE in average was 11 which belong to the class c. average hospital stay were 6.7±5.

Table 2: Gender distribution

	Frequency	Percent
FEMALE	10	5.5
MALE	173	94.5
Total	183	100.0

Most of the patients were male with 94.5% and female were 5.5 %

Table 3: Diagnosis

	Frequency	Percent
ALD CIRRHOSIS	138	75.4
T2DM, NASH CIRRHOSIS	9	4.9
T2DM, ALD CIRRHOSIS	7	3.8
HCV CIRRHOSIS	4	2.2
AIH CIRRHOSIS	3	1.6
ALD, HCV CIRRHOSIS	3	1.6
T2DM, ALD, NASH CIRRHOSIS	2	1.1
T2DM, HCV, NASH CIRRHOSIS	2	1.1
T2DM, ALD, HBV CIRRHOSIS	2	1.1
ALD.AIH CIRRHOSIS	1	.5
CHC CIRRHOSIS	1	.5
COPD, ALD CIRRHOSIS	1	.5
COPD, HCV, ALD CIRRHOSIS	1	.5
CRYPTOGENIC CIRRHOSIS	1	.5
HBV CIRRHOSIS	1	.5
HCV, HBV CIRRHOSIS	1	.5
T2DM, ALD, HCV CIRRHOSIS	1	.5
T2DM, HCV CIRRHOSIS	1	.5
T2DM, NASH CIRRHOSIS	1	.5
T2DM, ALD, HCV CIRRHOSIS	1	.5
T2DM, COPD, NASH CIRRHOSIS	1	.5
T2DM, IHD, HCV, NASH CIRRHOSIS	1	.5
Total	183	100.0

(ALD-Alcoholic Liver Disease: T2DM-Type 2 Diabetes Mellitus
NASH – Non-Alcoholic Steatohepatits, HCV-Hepatits C Virus, COPD- Chronic Obstrctive Pulmonry Disease, HBV-Hepatits B Virus, IHD- Ischemic Heart Disease, AIH- Autoimmune Hepatits)
Most common form of cirrhosis is ALD cirrhosis with 75.4 percentage.

Table 4: COMORBIDITY

	Frequency	Percent
NIL	154	84.2
COPD	1	.5
HTN	1	.5
T2DM	24	13.1
T2DM, COPD	1	.5
T2DM, HTN	1	.5
T2DM, IHD	1	.5
Total	183	100.0

Most common co-comorbidity is T2DM,13.1%, FOLLOWED BY 1 % COPD. AND 1% HTN AND 0.5 % IHD.

Table 5: number of patients with UGI bleed UGI bleed

	Frequency	Percent
NO	117	63.9
YES	66	36.1
Total	183	100.0

(UGI-UPPER GASTROINTESTINAL BLEED)

[Table 5] Demonstrates number of patients presents with upper GI bleed 36% patients present with UPPER GI BLEED

Table 6: Number of Patients In Hepatic Encephalopathyhepatic Encephalopathy

	Frequency	Percent
NO	85	46.4
YES	98	53.6
Total	183	100.0

[Table 6] Demonstrates number of patients presents with hepatic encephalopathy. 53.6 % patients present with hepatic encephalopathy

Table 7: number of patients with jaundice

	Frequency	Percent
NO	33	18.0
YES	150	82.0
Total	183	100.0

82% Patients Presents with Jaundice

Table 8: Ascites

	Frequency	Percent
NO	13	7.1
YES	170	92.9
Total	183	100.0

92.9% patients with ascites

Primary outcome:

Table 9: Pattern of Infection

	Frequency	Percent
SBP	131	71.6
PNEUMONIA	12	6.6
UROSEPSIS	11	6.0
SBP+PNEUMONIA	8	4.6
SBP+UROSPESIS	5	2.7
CELLULITIS	4	2.3
SEPTICEMIA	4	2.3
SBP+CELLULITIS	3	1.6
SBP+PNEUMONIA+UROSEPSIS	2	1
PNEUMONIA+ UROSEPSIS	2	1
DISSIMINATED TB	1	.5
Total	183	100.0

Figure 1: different combinations of SBP with other infections

Single SBP IS 87.9 % Most common in SBP infection, 5.3 % SBP+PNEUMONIA, 3.3 % SBP+UROSEPSIS, 2% SBP+CELLULITS, 1.3% SBP+PNEUMONIA+UROSEPSIS

[Table 9] Demonstrate the pattern of infections in chronic decompensated liver disease. most common type of infection is SBP with 71.6%, 6.6% pneumonia, 6.0% urosepsis and 2.3% cellulitis.

Table 10: Culture

	Frequency	Percent
NEGATIVE	151	82.5
POSITIVE	32	17.5
Total	183	100.0

[Table 10] Demonstrate culture outcome in the infection, only 17.5 % patients had culture positive

Table 11: Organism

	Frequency	Percent
ACINETOBACTER	1	3.1
ASPERGILLUS	1	3.1
CANDIDA	1	3.1
E. COLI	20	62.6

ENTEROCOCCUS	1	3.1
KLEBSEILLA	6	18.8
MTB	1	3.1
PESUDOMONAS	1	3.1
Total	32	100.0

(NG- NEGATIVE, MTB- MYCOBACTERIA TUBERCULOSIS, E. COLI- ESCHERIACHIA COLI
Most common organism is E. COLI 62.6 %, followed by KLEBSEILLA 18.8%.

Table 12: Outcome Overall

	Frequency	Percent
DEAD	92	50.3
ALIVE	88	48.2
LAMA	3	1.5
Total	183	100.0

[Table 12] Demonstrate overall outcome that is patients' outcome till 3months of follow up 48.2 % patients are survived 3 months of follow up and 50.3% patients declared dead in 3months of follow up

Table 13: - outcome at 9 day

	Frequency	Percent
ALIVE	110	60.1
DEAD	70	38.3
LOST TO F/U	3	1.6
Total	183	100.0

[Table 13] Demonstrate outcome of patient on day 9 shows mortality 38.3 %. and alive 60.1 % patients

Table 14: Infection at day 9

	Frequency	Percent
NO	77	70
YES	33	30
ALIVE	110	100.0

[Table 14] Demonstrate Infection at day 9 out of 110 patients alive 30% patients had infection at day 9

Table 15: type of infection on day 9

	Frequency	Percent
SBP	14	42.6
PNEUMONIA	6	18.2
SBP+ UROSEPSIS	4	12.2
CELLULITS	3	9.0
SBP+CELLULITS	2	6.0
SBP+PNEUMONIA	2	6.0
UROSEPSIS	2	6.0
TOTAL	33	100

[Table 15] Demonstrate type of infections on day 9, 42.6 % infection is SBP

Table 16: OUTCOME AT 28

	Frequency	Percent
ALIVE	90	49.1
DEAD	90	49.1
LOST TO F/U	3	1.8
Total	183	100.0

[Table 16] Demonstrate outcome at 28 49.1 % were dead, 49.1% patient were alive

Table 17: INFECTION AT DAY 28

	Frequency	Percent
NO	81	94.1
YES	4	5.9
ALIVE	86	100.0

[Table 17] Demonstrate 5.9% patient who was alive on day 28 had infection. and 100% patient who had infection on day 28 type of infection was SBP

Table 18: outcome at 3 months

	Frequency	Percent
ALIVE	88	48.2
DEAD	92	50.3
LOST TO FOLLOW UP	3	1.5
Total	183	100.0

[Table18] Demonstrate at 3 month follow up 48.2% patients are alive

Table 19: Infection related mortality rates

Infection	Total Patients	Survived (%)	Died (%)
Spontaneous Bacterial Peritonitis (SBP)	131	71 (54.2%)	58 (44.3%)
Pneumonia	12	1 (8.3%)	11 (91.7%)
Urosepsis	11	3 (27.3%)	8 (72.7%)
Cellulitis	4	4 (100%)	0 (0%)

[Table 19] Demonstrate infection related mortality rates, SBP had 44.3% mortality, highest mortality was seen in pneumonia with 91.7 % mortality, and least mortality was seen in cellulitis with nil mortality.

DISCUSSION

The present study was conducted to assess the pattern of infections in patients with chronic decompensated liver disease, with follow-up evaluations on day 9, day 28, and at 3 months.[13,14]

In a study Mukherjee PS et at.2017, Analyzing chronic liver diseases in India reported a mean age at diagnosis of 42.8 years.46 Global data indicate that the prevalence of cirrhosis increases with age, with a significant number of cases occurring in individuals aged 50 and above.47. A significant male predominance was observed, with 94.5% male and 5.5% female patients. In the Indian context, males constituted 73% of chronic liver disease cases. Globally, cirrhosis and chronic liver diseases were the tenth leading cause of death for men and the twelfth for women in the United States in 2001, indicating a higher prevalence in males.[15-22]

Age: The mean age of patients in our study was 47.5 years. The mean age in our study aligns closely with national data from India, suggesting that cirrhosis affects individuals in their late 40s to early 50s. This is slightly younger than global averages, which may be attributed to regional factors such as the prevalence of specific aetiologias like alcohol-related liver disease.[23-26]

Gender: While both our study and existing literature report a male predominance in cirrhosis cases, your study shows a higher percentage of male patients (94.5%) compared to the national average of 73%. This discrepancy could be due to regional variations, referral patterns, or a higher prevalence of risk factors such as alcohol consumption among males in your study population.[27-31]

In Sarin et al. (2019), over 60% of cirrhosis cases in India were alcohol-related. In our study, ALD was the most common etiology (75.4%). ALD is the predominant cause in both our study and global studies. In our study ALD percentage (75.4%) is higher than most studies (which report 40-70%), suggesting a stronger association between alcohol consumption and liver disease in our population. our study reports a much lower percentage of NASH-related cirrhosis (4.9%) compared to global reports (20-30%). This difference is likely due to regional variations in obesity prevalence, with India historically having lower obesity rates than Western populations. HCV-related cirrhosis (2.2%) and HBV-related cirrhosis (3.8%) were much lower than global estimates. In our study lower prevalence of viral hepatitis-related cirrhosis compared to global studies suggests: Regional differences in viral hepatitis prevalence, Possible higher vaccination rates against HBV in your population, Limited HCV screening or underdiagnosis.[32-40]

In patients with decompensated cirrhosis there are higher chances of SBP (71.6%) likely reflects more severe disease, stricter diagnostic criteria. Differences in surveillance methods, healthcare settings, and antibiotic use can also influence reported infection rates.[41]

In our study, among 183 patients with decompensated cirrhosis, 71.6% experienced spontaneous bacterial peritonitis (SBP), 6.6% had pneumonia, 6.0% had urosepsis, and 2.3% had cellulitis.[42]

In a study Singal et al. (2014) Analyzed data from 742,391 hospitalizations of cirrhotic patients in the United States between 1998 and 2007. They found that 23% had infections, with urinary tract infections (9–12%) being the most common, followed by skin and soft tissue infections (5–6%), and spontaneous bacterial peritonitis (2–3%).[43]

Higher infection burden in our study (71.6% vs. 23%) suggests that decompensated cirrhosis patients are at a significantly greater risk of infections. SBP is much more common in our study (71.6% vs. 2-3%), likely due to different study populations and more aggressive diagnostic approaches (routine paracentesis). UTIs and skin infections are more common in Singal et al., possibly because they included a broader range of hospitalized cirrhotic, including those without ascites (where SBP is less common but UTIs and skin infections may still occur).[44-46]

Our study reported a culture positivity rate of 17.5% among patients with chronic decompensated

cirrhosis, with Escherichia coli (62.6%) and Klebsiella species (18.8%) as the predominant organisms. This culture positivity rate is lower than the 50–70% reported in other studies.[47,48]

However, the predominance of Gram-negative bacteria, particularly E. coli and Klebsiella, aligns with existing literature.

Lameirão et al. (2019) study, both studies confirm high infection rates in cirrhotic patients. The prevalence of infections increased over time in the literature study, similar to our study where infections were recorded at admission, day 9, day 28, and 3 months. In our study, Spontaneous Bacterial Peritonitis (SBP) was the most common (71.6%), followed by pneumonia (6.6%) and urosepsis (6.0%). In this study, Classified infections into community-acquired (CA) and nosocomial infections, showing a shift over time towards more community-acquired infections. our study focuses on specific infections, whereas the literature study categorizes infections based on their source (community vs. hospital-acquired). Both studies identify Gram-negative bacteria as the predominant pathogens. E. coli and Klebsiella were the most common organisms in both studies. Our study had 17.5% culture positivity. In Literature study No direct comparison, but other studies typically report higher rates (~50-70%). our study's lower culture positivity may be due to prior antibiotic exposure or differences in sample collection methods.

Our study, which reports a 50.3% three-month mortality rate among patients with chronic decompensated cirrhosis and infections, aligns with existing literature emphasizing the severe impact of infections on mortality in cirrhotic patients.

Comparison with Existing Studies:

- **Short-Term Mortality:** A study highlighted that infections in cirrhotic patients increase mortality fourfold, with approximately 30% of patients dying within one-month post-infection.49
- **Long-Term Mortality:** The same study indicated that an additional 30% of these patients died within one year, culminating in a cumulative mortality rate of about 60% at 12 months. 49
- **Three-Month Mortality:** Research published in Medicine reported an overall three- month mortality rate of nearly 60% in advanced cirrhosis patients with infections, which is higher than the rate observed in our study.

50.3% three-month mortality rate observed in our study is consistent with the elevated mortality rates reported in the literature for cirrhotic patients with infections. Variations in mortality percentages across studies may result from differences in patient populations, infection types, healthcare settings, and management protocols.

In a study Arvaniti V et at (2010), Overall median mortality of infected patients was 38%, 30.3% at 1 month and 63% at 12 months. our study reported a 50.3% three-month mortality rate among patients with chronic decompensated cirrhosis and infections. Both studies confirm a high mortality rate in cirrhotic patients with infections. The three-month mortality rate in your study (50.3%) is comparable to the pooled 12-month mortality rate of 63% in the meta-analysis, suggesting that infections significantly impact long-term survival. our study's one-month mortality rate (~38.3%) is close to the 30.3% mortality at one month reported in the meta-analysis. The 12-month mortality rate in the literature study (63%) is higher than your reported three-month mortality (50.3%). This suggests that mortality continues to increase over time in infected cirrhotic patients.

Our study does not provide detailed long-term follow-up data (beyond three months), making it difficult to compare 12-month survival trends. SBP was the most common infection in our study (71.6%) and was also the primary infection analyzed in the literature. Our study's three-month mortality of 50.3% is comparable to the SBP-specific 12-month mortality (66.2%) in the literature, considering the time difference. Both studies acknowledge changing mortality rates over time. our study aligns with the literature in showing a high early mortality rate among infected cirrhotic patients. The literature study found that mortality before 2000 was 47.7%, whereas after 2000, it was 32.3% (P = .023), reflecting improvements in management. Our study does not analyze historical trends in mortality over different time periods. High MELD & Child-Pugh class C are the strongest predictors of death. Literature identifies systemic inflammation, cardiac dysfunction, and adrenal failure as additional mortality risk factors, which were not explicitly analyzed in your study.

Infection -specific mortality rates

In a study, Niu B et.al (2019), In-hospital mortality rates for SBP have been reported at 17.6% in a study analyzing data from 2006 to 2014. Another study indicated a 16.3% mortality rate among cirrhotic patients with SBP. Mortality rates of SBP in our study is 44.3% (58 deaths among 131 patients). The higher mortality rate in your study may be attributed to factors such as delayed diagnosis, advanced liver disease stages, or the presence of multidrug-resistant organisms. Implementing early diagnostic paracentesis and prompt empirical antibiotic therapy could potentially improve outcomes.[50]

In a study Saleem S et. al(2019), Pneumonia in cirrhotic patients has been associated with a 51.0% 90-day mortality rate. (f) Mortality rate of pneumonia in our study is 91.7% (11 deaths among 12 patients). The exceptionally high mortality rate observed in your study suggests severe disease progression, possibly due to late presentation, inadequate initial management, or complications such as sepsis. This underscores the necessity for heightened vigilance, early detection, and aggressive treatment strategies in managing pneumonia among cirrhotic patients. Soft tissue infections, including cellulitis, occur in approximately 11% of cirrhotic patients. In our study no reported deaths among 4 patients. The absence of mortality in our study aligns with existing literature, suggesting that with prompt and appropriate

treatment, cellulitis in cirrhotic patients can have favorable outcomes.[51]

The present study demonstrates the substantial burden of infections in chronic decompensated liver disease. Alcohol-associated liver disease was identified as the predominant etiology. SBP emerged as the most common infection, while pneumonia showed the highest mortality. Gram-negative organisms, particularly E. coli and Klebsiella, were the predominant pathogens

CONCLUSION

Infections are a major driver of morbidity and mortality in patients with chronic decompensated cirrhosis, significantly worsening outcomes and accelerating disease progression. This study highlights the high prevalence of infections, particularly spontaneous bacterial peritonitis (SBP), pneumonia, and urosepsis, and their substantial impact on survival. The findings reinforce the urgent need for early diagnosis, targeted antimicrobial therapy, and preventive measures to improve patient prognosis. This study underscores the critical impact of infections on cirrhosis outcomes and the pressing need for early detection, aggressive management, and preventive strategies. Strengthening infection control measures can significantly reduce mortality and improve the quality of care in patients with chronic liver disease.

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