Original Article

Infections in patients admitted with decompensated chronic liver disease in a tertiary level hospital

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Keywords: *Infection, decompensated chronic liver disease, MELD-Na, CTP, SOFA*

Abstract

Introduction: Infection is one of the major complications leading to hospital admission and mortality in patients with decompensated chronic liver disease (CLD). This study aims to determine the clinical profile and outcome of these patients which is very limited in our part of the world.

Methods: In this prospective observational study; we included all 184 patients from January 2025 to April 2025 with decompensated CLD admitted in Gastroenterology and Hepatology ward of B.P. Koirala Institute of Health Sciences. The clinical profile and outcomes of these patients were evaluated and analyzed. Common scores used in patients with cirrhosis including CTP (Child-Turcotte Pugh), MELD-Na (Model for end-stage liver disease) and SOFA (Sequential organ failure assessment) score were evaluated for their role in predicting mortality.

Results: The prevalence of infection in CLD was found to be 37.5% with male predominance of 53.8%; mean age was 51.42 years (SD: 11.85). Alcohol related cirrhosis was the commonest etiology and other etiology included autoimmune hepatitis, chronic HCV, chronic HBV, Wilson's disease, metabolic syndrome associated steatotic liver disease (MASLD), PSC related and cryptogenic. Spontaneous bacterial peritonitis was the most common infection with 26 (37.7%) followed by urinary tract infection, pneumonia and skin and soft tissue infection. Infection was significantly associated with longer hospital stay, higher MELD-Na, CTP and SOFA scores of patients. Area under the curve for MELD-Na had the highest discriminative ability to predict mortality with cut-off values of 22.5 with sensitivity of 93.75% and specificity of 62.26%. The in hospital mortality in patients with decompensated CLD with infection was 23.2%.

Conclusion: Infection in decompensated CLD patients is a major predictor of adverse outcomes including mortality. Early identification and aggressive management of infection in this group of patients is needed to prevent adverse outcomes.

Introduction

Chronic liver disease (CLD) progresses from an asymptomatic compensated phase to decompensated stage as the disease progresses. Decompensation is marked by development of ascites, gastrointestinal (GI) bleeding, hepatic encephalopathy (HE) and jaundice.[1] Liver cirrhosis is 13th cause of death worldwide responsible for almost 200,000 deaths. Compensated phase which is asymptomatic and prognosis is very good with median survival of around 12 years while decompensated phase is associated with poor prognosis with median survival of two years.[2] Infections increases mortality by four fold with 30% patients dying within 1 month after infection and another 30% within one year.[3]

In patients with cirrhosis bacterial infections are one of the most important cause of progression of liver failure, development of liver related complications and mortality.[4] One of the major precipitating factor for acute on chronic liver failure is bacterial infection accounting for 30 to 57%.[1]

Patients with cirrhosis are susceptible to infections due to associated immune dysfunction (CAID), reduction in bile flow, and changes

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in gut microbial composition and function. Immune dysfunction affects innate and adaptive immunity along with impairment of gut immunity and barrier function that confers predisposition to infection from gut, skin, urine and respiratory tract.[5] CAID refers to wide spectrum of altered immune system in patients with cirrhosis and consists of two components- systemic inflammation and immune deficiency. They are shown in variable intensity depending on the stage of cirrhosis and presence of incidental events, such as bacterial infections.[6]

Compared to general population patients with cirrhosis have twice the risk of developing different infection. Various infections may affect liver including bacterial, parasitic, and fungal infections. These infections may lead to liver failure in patients with underlying CLD.[7] Most common infections in these patients were spontaneous bacterial peritonitis (SBP), urinary tract infections (UTI), pneumonia, skin and soft tissue infections, and spontaneous bacteremia.[2,8] Bacterial infections are one of the most common precipitating event causing decompensation after portal hypertension which is considered as a driver of decompensation.[9] Mortality increases by four folds in these patients.[3] Most patients with decompensated CLD are unable to mount a febrile response to infection; in contrast in cases of alcohol associated hepatitis fever, tachypnea and leukocytosis may be present which may lead to dilemma in differentiating the cause of this response. Evaluation for infection should be initiated once we notice the new onset of acute kidney injury, altered mental status, or signs of organ failure as well as fever and leukocytosis.[5]

The burden of infections in patients with chronic liver disease has not been evaluated in our context. This study will help us to know the extent of problem and plan evaluation and management accordingly.

In patients with advanced chronic liver disease, the natural history is profoundly affected by different infections. A high index of suspicion, early diagnosis, rapid administration of effective antibiotics and prevention of multi-organ failure are required for improving survival in such patients.

Materials and methods

Study design and participants

In this prospective observational study, all patients with decompensated CLD admitted in Gastroenterology and Hepatology ward of B.P. Koirala Institute of health sciences (BPKIHS), Dharan were included from January to April of 2025. Total of 184 patients were included in this study fulfilling the following inclusion and exclusion criteria:

Inclusion criteria

- All patients admitted to ward with decompensated chronic liver disease
- Age more than 18 years
- Patients giving informed consent for study

Exclusion criteria

- Patients less than 18 years of age
- Patients unwilling to provide informed consent

Sample size calculation

The prevalence of bacterial infections in patients with decompensated chronic liver disease as reported in prior studies ranges from 32% to 41%.[10–12]. Sample size was calculated using this prevalence range, the minimum sample size was calculated with the formula for cross-sectional studies:

$$\text{Sample size (n)} = \frac{Z^2.p.q}{d^2}$$

Where,

n= sample size

Z= standard deviation; 1.96 corresponding to 95% confidence interval

p= estimated proportion of population of bacterial infections based on highest reported prevalence= 0.41

q=1-p (proportion of target population not having a particular disease)=1-0.41

d=maximum error allowed, with 95% confidence interval and allowing 10% maximum error will be taken

n= Z2pq/d2=92

Substituting these values:

$$n = \frac{(1.96)2.\ 0.41.\ 0.59}{(0.1)2} = 92$$

The calculated minimum sample size was 92 participants. All consecutive samples fulfilling the inclusion criteria were taken from January 2025 to April 2025 and all 184 consecutive samples fulfilling the inclusion criteria were taken to increase the power of the study.

Data collection

All the participants underwent comprehensive clinical evaluation, including detailed medical history, physical examination and relevant diagnostic investigations were sent. Demographic variables (age and gender) were recorded. Blood was sent for analysis for complete blood count, liver function test, renal function test, prothrombin time (PT), international normalized ratio (INR), random blood sugar, ultrasonography of abdomen and pelvis, Chest X-ray, ascitic fluid analysis including cultures and sensitivity, blood cultures, urine cultures. Data were systematically collected using structured proforma and entered into department database for analysis.

Ethical approval and patient consent

The study was conducted after ethical approval from the Institutional review committee of B.P. Koirala Institute of health sciences with reference no: IRC/182/081/82. The study was conducted in accordance with the ethical principles of the declaration of Helsinki. Written informed consent was obtained from all the participants before collection of data.

Statistical analysis

All the data were analyzed using IBM Statistical Packages for Social Sciences (SPSS) software, version 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0). Baseline characteristics were reported using mean and standard deviation for normal distribution and median and interquartile ranges for skewed distributions for continuous variables and as counts and percentages for categorical variables. Chi-square test was used for comparison across groups and was tabulated.

Results

A total of 184 patients with decompensated CLD were enrolled in the study fulfilling the inclusion and exclusion criteria. The prevalence of infection was found to be 69 (37.5%). Most of the patients were male with 99 (53.8%) and 85 (46.2%) of them were female. The mean age

of the patient was 51.42 years with standard deviation of 11.85 years. The most common etiology of chronic liver disease (Figure 1) was ethanol related with 144 (78.8%).

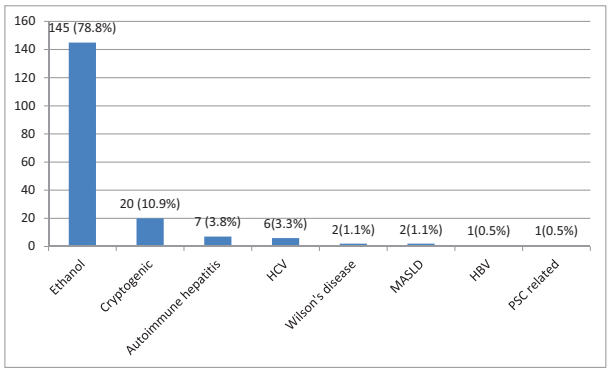

Figure 1: Etiology of chronic liver disease

Spontaneous bacterial peritonitis was the commonest infection with 26 (37.7%) out of which 25 were culture negative neutrophilic ascites and one was monobacterial bacterascites. Most of the infections were present during the admission in 68 (98.6%) patients and only one patient developed infection during the hospital stay. There were 5 cases of infections categorized as others which included two cases of tuberculous ascites and one case each of spontaneous bacterial empyema, leptospirosis and cholangitis.

Table 1: Infections in Chronic liver disease

Infection	Number	Percent (%)
SBP	26	37.7
UTI	20	29.0
Pneumonia	12	17.4
Skin and soft tissue infection	6	8.7
Others	5	7.2

The commonest presenting complaint was abdominal distention 65 (94.2%) followed by abdominal pain 49 (71%) and fever in 37 (53.2%) patients with infection. On examination ascites was present in 65 (94.2%) followed by icterus in 57 (82.6%) and organomegaly in 31 (44.9%).

The common clinical features in patients with infections are listed in Table 2.

Table 2

Clinical features	Number	Percent (%)
Symptoms		
Fever	37	53.6
Abdominal distention	65	94.2
Abdominal pain	49	71.0
Diarrhea	20	29.0
GI Bleeding	18	26.0
Vomiting	12	17.4
Cough	17	24.6
Chest pain	12	17.4
Altered sensorium	14	20.3
Dysuria	16	23.2
Decreased urine output	19	27.5
Signs		
Icterus	57	82.6
Organomegaly	31	44.9
Asterexis	11	15.9
Hepatic encephalopathy	12	17.3
Ascites	65	94.2

The baseline characteristics of patients with infections are shown in Table 3.

Table 3

Variables	Mean	Standard deviation	Min.	Max.
CTP Score	10.0	1.9	5.0	14.0
MELD-Na Score	21.0	7.6	6.0	39.0
SOFA Score	3.9	1.9	0.0	10.0
Hospital Stay (days)	6.4	3.0	2.0	16.0
Hb (gm/dL)	8.9	2.4	3.0	13.8
Platelets ($x10^3$) per cmm	129.0	71.4	10.0	404.0
Total protein	6.4	1.0	3.1	8.2
Albumin	2.5	0.5	1.6	3.7
Na	132.5	5.6	117.7	148.8
	Q1 (25th quartile)	Median	Q3 (75th quartile)	Range
White blood count (per cmm)	6280.0	10600.0	15015.0	3000-49820
PT (second)	17.5	22.0	27.0	15-44
INR	1.2	1.6	1.9	1-3.1
Total Bilirubin (mg/dL)	2.5	5.1	11.2	0.6-39.7
Direct Bilirubin (mg/dL)	1.1	2.3	5.3	0.2-19.6
SGOT (IU)	62.5	96.4	152.0	1-1232
SGPT (IU)	28.0	36.0	53.0	5-333
ALP (IU)	93.0	119.0	163.5	14-503
Urea (mg/dL)	19.0	29.0	55.0	3-176
Creatinine (mg/dL)	0.6	0.8	1.2	0.3-6

According to the timing of acquirement of different infection the most prevalent was community acquired infection which was present in 61 (88%) cases (Figure 2).

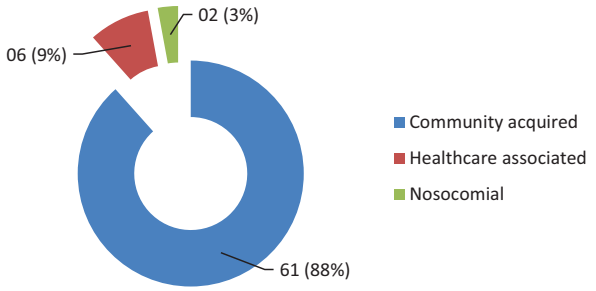

Figure 2: Timing of infection

There were 11 cases with culture was positive with 10 cases isolating bacteria in urine culture and one case of ascitic fluid culture. The most common organism isolated was Escherechia coli in four cases, Acinetobacter species in two cases; one cases each of Klebsiella pneumonia, Psudomonas aeruginosa, Enterococcus faecalis and Staphylococcus aureus. There was one ascitic fluid culture culture with isolation of Acinetobacter species.

On comparing age, duration of hospital stay and scores (MELD-Na, CTP and SOFA) in patients with and without infections duration of hospital stay, MELD-Na, CTP score, and SOFA were statistically significant however age was not statistically significant (Table 4).

Table 4: Comparing variables with infections

	Infection	N	Mean	Std. Deviation	p value
Age (years)	Absent	115	50.65	11.856	0.313
	Present	69	52.48	11.879	
Hospital stay (days)	Absent	115	5.77	2.646	0.001
	Present	69	7.38	3.308	
MELD-Na	Absent	115	19.83	7.567	0.005
	Present	69	23.07	7.265	
CTP score	Absent	115	9.6	1.839	0.001
	Present	69	10.59	1.834	
SOFA	Absent	114	3.68	1.828	0.05
	Present	69	4.25	1.988	

Out of 69 patients with infection, in-hospital mortality was seen in 16 (23.2%) of the patients and remaining 53 (76.8%) improved and were discharged. All the deaths were of Child Turcotte Pugh class C cirrhosis which was statistically significant. Similarly, in-hospital mortality in patients without infection was 17 (14.8%) which was lower than patients with infections. Similarly in-hospital outcome was compared between the patients with and without infections and was not statistically significant (p=0.158) (Table 5).

Table 5: Relation of CTP class and infection on outcomes

Variable		Mortality	Improved	Total	p value
CTP class	B	0	17	17	0.007
	C	16	36	52	
Infection	Present	16	53	69	0.158
	Absent	17	98	115	

The area under the receiver operant curve was plotted and diagnostic accuracy of CTP score, MELD-Na, and SOFA was determined for predicting the in hospital mortality in patients with infection.

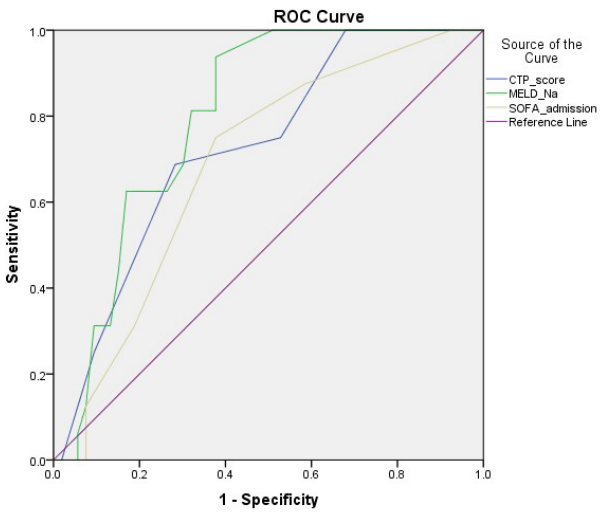

Figure 3: AUROC for predicting mortality in patients with infection

The area under the curve (AUC) analysis revealed MELD-NA had highest discriminative ability, with an AUC of 0.797 (95% CI 0.694-0.9), followed by CTP score (AUC 0.727; 95% CI 0.596-0.858) and SOFA score (AUC 0.688, 95% CI 0.552-0.823). The optimal cut-off points for these were determined by Youden's J Statistics with following values identified as most predictive.

Table 6: Diagnostic performance of different scores

	Cut-off	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Accuracy (%)
CTP Score	11.5	68.75	71.69	42.3	88.37	71.01
MELD-Na	22.5	93.75	62.26	42.85	97.05	69.56
SOFA	4.5	75	62.26	37.5	89.18	65.21

Discussion

Decompensation in chronic liver disease is characterized by onset of ascites, gastrointestinal (GI) bleeding, hepatic encephalopathy and jaundice in a patient with stable chronic liver disease.[13] Cirrhosis is associated with an increased susceptibility to infections due to cirrhosis-associated immune dysfunction (CAID) and other alterations in both innate and adaptive immune system. This predisposes patients to infections originating from the gut, skin, urinary tract, and respiratory system.[5]

In our study, the prevalence of infection among hospitalized patients with decompensated chronic liver disease was 37.5% (n=69) which was similar to study done by Fernandez et al and Fasolato et al in Europe which showed the prevalence of infection in 39.7% and 44.6% respectively.(11,12,14) Similarly, Baijal et al in India reported an overall infection rate of 25%, with infections rates of 37.5% in inpatients and 8% in outpatients.[15]

The mean age of the patient was 51.82±85 years, comparable to finding from similar studies from India and Nepal.[15,16] In our group of patients 53.6% patients were male and 46.4% were female. This gender distribution contrasts with Baijal et al. where only 24.1% patients were female.[15] This differences may reflect regional variation in alcohol consumption patterns and etiologies of chronic liver disease. However, our gender distribution aligns with the findings of Bickram et al. who reported high levels of hazardous alcohol consumption in same geographic region of Nepal.[17]

Alcohol related chronic liver disease was the commonest cause of cirrhosis in our study, accounting for 78.8% (n=145) followed by cryptogenic cirrhosis in 10.9% (n=20). These findings are consistent with studies by Mishra et al. and Bhattarai et al. who reported alcohol as the etiology of cirrhosis 60.8% and 92% of the cases.[16,18]

Abdominal distention (94.2%) was the most common presenting symptom, followed by abdominal pain (71%) and fever (53.2%). Pieri et al. have noted that infection in cirrhotic patients may be initially asymptomatic, warranting a comprehensive evaluation upon admission and during clinical deterioration.[19] Bajaj et al. further highlighted that cirrhotic patients may fail to develop a febrile response due to impaired immune response. Additionally, alcohol-associated hepatitis may present with systemic inflammatory features like fever, leukocytosis, tachypnea even in the absence of infection.[5]

Spontaneous bacterial peritonitis was the most frequently diagnosed infection in our study 37.7% (n=26), followed by urinary tract infection in 29% (n=20), pneumonia in 17.4% (n=12) and skin and soft tissue infections in 8.7% (n=6). These findings are similar to previous studies.(14,15,20) We also identified other infections, including two cases of tuberculous ascites and one case each of spontaneous bacterial empyema, leptospirosis and cholangitis. This refutes the high prevalence of tuberculosis in our region and need to search for other etiological workup in cirrhosis patients who are suspected of having infection. Regarding infection acquisition, most common infections were community acquired 88% (n=61) followed by healthcare associated in 9% (n=6) and nosocomial in 3% (n=2).

Bacterial infections in cirrhosis are known to precipitate complications such as gastrointestinal bleeding, hypervolemic hyponatremia, hepatic encephalopathy, kidney failure and development of acute on chronic liver failure.[4] In our study GI bleeding was present in 26% (n=18) of patients with hematemesis as presentation in three patients, melena in six patients and both hematemesis and melena in nine cases. Hepatic encephalopathy was present in 17.3% (n=12) cases with nine cases in Grade I-II and three cases in Grade III-IV encephalopathy. Acute renal impairment was present in 49 (71%) cases during admission and 11 patients with acute renal impairment had in-hospital mortality and only five patients without AKI had in-hospital mortality.

The culture positivity was relatively low at 15.94% (n=11), which contrasts with studies by Baijal et al. (51.6%) and Bhattacharya et al. (65.5%).(15,21) The potential reasons for this discrepancy might be due to prior use of antibiotics before cultures are drawn, inadequate blood volume for cultures, lack of molecular diagnostic techniques.[22,23]

We found that longer hospital stay (mean 7.38±3.308 days), higher MELD-Na scores (23.07±7.27), CTP score (10.59±1.83) and SOFA scores (4.25±1.99) were significantly associated with infections. These findings are consistent with those of Baijal et al. who reported mean CTP score of 8.9±1.96 and MELD score of 15.9±6.9 in infected patients.[15]

In our study CTP, MELD-Na and SOFA scores were able to predict mortality in patients with infections. The optimal cut-off values for predicting mortality were 11.5 (CTP), 22.5 (MELD-Na) and 4.5 (SOFA). The sensitivity of MELD-Na was highest with 93.75% followed by SOFA and CTP score of 75% and 68.75 respectively. The specificity of CTP score was highest of 71.69% followed by both MELD-Na and SOFA score being 62.26%. Taking all these cut-off will help in predicting patients with adverse in-hospital outcome and can help in early escalation of antimicrobials and decision for intensive care support for better outcomes of those group of patients.

Conclusion

Infections are a common and serious complication among patients hospitalized with decompensated chronic liver disease with prevalence of 37.5% observed in our study. Spontaneous bacterial peritonitis, urinary tract infection and pneumonia were the most frequently encountered infections with community acquired infections being the most predominant type. Infection was significantly associated with longer hospital stay, higher severity scores (MELD-Na, CTP, and SOFA) and increased in-hospital mortality. Given the immunocompromised state of decompensated cirrhosis patients, classical signs of infection may be absent. Therefore, a high index of suspicion and thorough evaluation are warranted, especially in the presence of unexplained renal impairment, hepatic encephalopathy, leukocytosis, or organ dysfunction. Early recognition of symptoms such as fever, abdominal pain, distention, dysuria and cough can aid in timely diagnosis. Risk stratification using CTP, MELD-Na, and SOFA scores at admission can help identify high-risk patients and guide early, aggressive management to improve outcomes.

Limitation

This study was single center study, the results cannot be generalized. It was conducted over a period of 4 months which may not capture seasonal variation in infection rates or hospital admission. Study included only hospitalized patients which might potentially exclude a large segment of cirrhosis patients with infection being treated as outpatient. The patients were not followed up post-discharge; so long term prognosis and post-hospitalization mortality are unknown.

Conflict of interest

None

Funding

No external funding.

Aknowledgements

We would like to thank all the staffs and colleagues of Gastroenterology and Hepatology ward of B.P. Koirala Institute of Health Sciences for all the help and support provided.

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