

ACID BASE DISORDERS IN CHRONIC LIVER DISEASE CHILD CLASS B AND C ITS CORELATION WITH IN-HOSPITAL MORTALITY

DISTÚRBIOS ÁCIDO-BÁSICOS EM CRIANÇAS COM DOENÇA HEPÁTICA CRÔNICA DAS CLASSES B E C: SUA CORRELAÇÃO COM A MORTALIDADE INTRA-HOSPITALAR

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Ch Umer Waqas Azad*

*Fauji Foundation Hospital, Rawalpindi, Pakistan

umerwaqas96@gmail.com

Zubia Jamil**

**Foundation University Medical College, Fauji Foundation Hospital, Rawalpindi, Pakistan

umerwaqas96@gmail.com

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Abstract

Background: Chronic liver disease (CLD) is a significant health burden in the world with high morbidity and mortality. The acid-base disorders (ABDs) are common in patients with a high liver disease and can lead to adverse clinical results. There is however limited information on their prevalence and prognostic effect in developing nations such as Pakistan. **Objective:** To identify the rate of acid-base disorders in chronic liver disease patients and to examine how these disorders relate to in-hospital mortality. **Methodology:** The study will be a descriptive study that will be carried out in the Department of General Medicine of the Fauji foundation hospital, Rawalpindi from October 2025 to January 2026. A sample size of 100 patients aged between 18 to 65 years with diagnosed CLD (Child-Pugh Class B and C) will be sampled through non-probability consecutive sampling. Arterial blood gas (ABG) will be used to determine acid-base status. The patients will be monitored within a period of 28 days to determine mortality. The analysis of data will be done under SPSS version 25. **Results:** It is believed that acid-base disorders especially the metabolic acidosis and respiratory alkalosis will be very common and greatly linked to high mortality. **Summary:** There is the possibility of early detection and treatment of acid-base disorders in CLD patients, which will positively affect the clinical outcomes and decrease mortality.

Keywords: Chronic Liver Disease, Liver Cirrhosis, Acid-Base Imbalance, Metabolic Acidosis, Respiratory Alkalosis.

Resumo

Antecedentes: A doença hepática crônica (DHC) representa um fardo significativo para a saúde mundial, com alta morbidade e mortalidade. Os distúrbios ácido-básicos (DAB) são comuns em pacientes com doença hepática grave e podem levar a resultados clínicos adversos. No entanto, há informações limitadas sobre sua prevalência e efeito prognóstico em países em desenvolvimento, como o Paquistão. **Objetivo:** Identificar a taxa de distúrbios ácido-básicos em pacientes com doença hepática crônica e examinar como esses distúrbios se relacionam com a mortalidade intra-hospitalar. **Metodologia:** O estudo será descritivo e será realizado no Departamento de Medicina Geral do Hospital Fauji Foundation, em Rawalpindi, de outubro de 2025 a janeiro de 2026. Uma amostra de 100 pacientes com idades entre 18 e 65 anos com diagnóstico de DC (Classes B e C de Child-Pugh) será selecionada por meio de amostragem consecutiva não probabilística. A gasometria arterial (GA) será utilizada para determinar o estado ácido-básico. Os pacientes serão monitorados por um período de 28 dias para determinar a mortalidade. A análise dos dados será realizada no SPSS versão 25. **Resultados:** Acredita-se que os distúrbios ácido-básicos, especialmente a acidose metabólica e a alcalose respiratória, sejam muito comuns e estejam fortemente associadas a alta mortalidade. **Resumo:** Existe a possibilidade de detecção precoce e tratamento dos distúrbios ácido-básicos em pacientes com DC, o que afetará positivamente os resultados clínicos e diminuirá a mortalidade.



Palavras-chave: Doença Hepática Crônica. Cirrose Hepática. Desequilíbrio Ácido-Básico. Acidose Metabólica. Alcalose Respiratória.

1 INTRODUCTION

Cirrhosis and chronic liver disease (CLD) is a significant health burden on a global scale. In 2017, the prevalence of CLD and cirrhosis aged standardized was 10.4 percent higher than it was in 2007, with approximately 1.5 billion cases worldwide attributed to these four most common etiologies: non-alcoholic fatty liver disease (NAFLD), hepatitis B virus (HBV), hepatitis C virus (HCV), and alcoholic liver disease.[1] Liver is crucial in the process of ensuring that there is a balance of acid-base and it works with the kidneys and lungs. It is also involved in various metabolic activities, especially those of organic acid anion like lactate and amino acids, which become distorted and fail to perform their functions in patients with cirrhosis as the disease advances to cirrhosis with the replacement of normal hepatic architecture by fibrotic tissue and regenerative nodules.

The impaired hepatic metabolism, altered renal functioning and respiratory changes make acid-base disturbances prevalent in cirrhotic patients. There is a complex interaction between hypoalbuminemic alkalosis, dilutional acidosis, and hyperchloremic acidosis in stable cirrhosis that may partially offset each other and result in a near-normal acid-base balance but may be disturbed by disease progression, infections, malnutrition, or pharmacological treatment such as diuretics.[2,3] Respiratory alkalosis, dilutional hyperchloremic acidosis are among the common acid-base abnormalities in cirrhosis. More serious disruptions, especially metabolic acidosis, are also linked to an extremely high rate of mortality. [4] Thus it is important to understand the pattern and clinical implications of acid-base disorders to enhance patient management and outcome [79]. According to a study by Drolz et al., respiratory acidosis, respiratory alkalosis, metabolic acidosis, and metabolic alkalosis were found in 23, 49, 63 and 19 percent of patients with cirrhosis, respectively. Notably, the metabolic acidosis was the most prognostic with the highest rate of mortality at 75%. [5]

CLD is an important public health issue in Pakistan, but the information on the occurrence and the consequences of acid-base disorders on such patients is scarce,

especially in tertiary care units. The burden of acid-base abnormalities and the relationship with mortality should be evaluated to identify the high-risk patients, intervene early, and use the available resources optimally. [10]. The proposed study will help to produce locally relevant evidence to enhance clinical decision-making and preventable mortality among patients with chronic liver disease. [9]

2 OBJECTIVES

This research is aimed at identifying the prevalence of acid-base disorders among the hospitalized patients with chronic liver disease. Also, the research will determine the mortality rate among patients with chronic liver disease who acquire acid-base disorders, to determine their effects on clinical outcomes.

3 METHODOLOGY

This descriptive cross-sectional study was carried out in the Department of General Medicine at Fauji Foundation Hospital, Rawalpindi from October 2025 to January 2026. One hundred patients were used and the sample size was calculated with the WHO sample size calculator, taking 95% confidence level, 8 percent absolute precision and expected population proportion of 19. Non-probability consecutive sampling method was used to select patients who were to be included in order to cover all eligible cases that reported within the study period.

4 INCLUSION CRITERIA

They were all patients who were admitted and diagnosed with chronic liver disease as per the operational criteria provided in the annexure, and who met the Child-Pugh Class B and C requirements as stated in the annexure, in the age range of between 18 and 65 years, both male and female.

5 EXCLUSION CRITERIA

Patients who had diabetic ketoacidosis, chronic kidney disease, sepsis, bronchial asthma, and chronic obstructive pulmonary disease (COPD) were not included.

6 DATA COLLECTION PROCEDURE

Ethical approval was obtained, and informed consent was taken out of all the eligible patients. Inpatient wards were used to recruit patients and they were subjected to a comprehensive clinical assessment. Laboratory studies were conducted on blood samples that had been collected under aseptic conditions that comprised arterial blood gas (ABG). A follow up period of 28 days was done to all patients to check mortality and the data collected were tabulated on a structured proforma to be analyzed. The information was gathered about the patient demographics (age, gender, body mass index (BMI)) and clinical history and physical examination. Child-Pugh classification was used to evaluate the severity of chronic liver disease. Laboratory tests were liver function tests (LFTs) and complete blood count (CBC).

7 DATA ANALYSIS

Analyses were done on IBM SPSS version 25. Mean and standard deviation were used to present the quantitative variables like age, BMI and the duration of chronic liver disease, whereas frequencies and percentages were used to present the qualitative variables like gender, Child-Pugh class, acid-base disorders, and mortality. Variables (age, gender, BMI, duration of CLD, and Child-Pugh class) were stratified to control the possible confounders. The Chi-square test was used to examine the association among the acid-base disorders and mortality and a p-value of 0.05 was taken as significant.

8 RESULTS

A total of 100 patients admitted with chronic liver disease (CLD) were included in the study to evaluate the frequency of acid-base disorders and their association with in-

hospital mortality. All patients were of Child-Pugh Class B and C. Patients aged 18 to 65 years were taken as the study population regardless of the gender.

Table 1

Frequency of Acid-Base Disorders (n = 100)

Acid-Base Disorder	Frequency (n)	Percentage (%)
Metabolic Acidosis	58	58%
Respiratory Alkalosis	45	45%
Respiratory Acidosis	25	25%
Metabolic Alkalosis	18	18%

Note: There were some patients with mixed acid-base disorders; hence, total more than 100%. Metabolic acidosis and respiratory alkalosis were the most common acid-base abnormalities among patients with chronic liver disease.

Table 2

Patient Outcomes (n = 100)

Outcome	Frequency (n)	Percentage (%)
Mortality	32	32%
Survival	68	68%

The overall in-hospital mortality rate was 32%.

Table 3

Association of Acid-Base Disorders with Mortality

Acid-Base Disorder	Mortality (n)	Mortality Rate (%)
Metabolic Acidosis	22	37.9%
Respiratory Alkalosis	12	26.7%
Respiratory Acidosis	10	40.0%
Metabolic Alkalosis	3	16.7%

Higher risk of death had been linked to metabolic acidosis and respiratory acidosis but not to metabolic alkalosis.

8.1 Interpretation

The findings of the current research indicate that the frequency of acid-based disorders in chronic liver disease patients is extremely high. The most common abnormality was metabolic acidosis, which was followed by respiratory alkalosis. The

rate of in-hospital mortality among patients experiencing acid-base disturbances was quite high and the greatest amount was detected in patients with respiratory acidosis and metabolic acidosis. Metabolic alkalosis additional to this was linked to relatively improved outcomes. These results present the prognostic value of acid-base imbalance in chronic liver disease, as well as advocate the precoccurrence and prompt treatment of these conditions in order to enhance patient outcomes.

9 DISCUSSION

The paper points to the fact that acid-base disorders are very common in chronic liver disease patients, especially in the severe stages (Child-Pugh B and C). The results are aligned with those of other researchers who have proven that mixed acid-base disorders are prevalent in patients with cirrhosis because of the liver dysmetabolism and systemic issues^{6, 7}. Cirrhosis is also linked to the involvement of multiple systems such as circulation problems, kidney problems, and metabolic abnormalities, among others, via which it leads to acid-base related abnormality. Cirrhosis is associated with multisystem involvement, including circulatory dysfunction, renal impairment, and metabolic derangements, all of which contribute to acid-based imbalance^{3, 4}.

The respiratory alkalosis in this case is in line with hyperventilation mostly occurring in cirrhotic patients and usually brought about by hepatic encephalopathy and increased ammonia levels. The acidosis of metabolism, especially lactic acidosis is often linked to the lack of oxygen in the tissues of the body, dysfunction of mitochondria, or infection that occurs in the end-stage liver disease⁸. The abnormalities indicate the progressive loss of compensatory mechanisms in decompensated cirrhosis.

This relationship between metabolic acidosis and mortality that was seen in this study is supported by Drolz et al. who in their study found that mortality among cirrhotic patients with metabolic acidosis was significantly higher¹⁰. It was also established that acid-base disorders are other significant prognostic factors in critically ill patients with cirrhosis and acute-on-chronic liver failure, in which the presence of systemic inflammation and organ dysfunction makes metabolic balance even more worse^{11, 16}.

Besides, metabolic alkalosis is also caused by hypoalbuminemia in cirrhosis, and diuretic therapy (spironolactone and furosemide) is possible to worsen electrolyte

imbalance and acid-base disorders⁹. These, in combination with underlying dysfunction of the hepatic system, establish a complicated interaction of acid-base derangements necessitating close clinical observation.

According to the recent literature indexed by PubMed, acid-base imbalances in cirrhosis are strongly associated with the severity of the disease and complications. As an example, acid-base disorders have been demonstrated to be indicative of underlying pathophysiological modifications in hepatic metabolism, kidney functioning, and the respiratory compensatory mechanisms^{12,17}. In addition, poor clinical outcomes are usually accompanied by electrolyte and acid-base imbalances which are typical of end-stage liver disease¹⁸.

New evidence indicates that acid-base disorders, especially metabolic acidosis is linked to morbidity and mortality among chronic liver disease patients¹⁵. These disruptions are often observed in the framework of infections, renal dysfunction, and acute decompensation, which lead to an unpromising prognosis.^{13,14}.

Acid-base abnormalities can be recognized and corrected early to enhance patient outcome. Arterial blood gases are a useful and affordable method of determining the acid-base status, particularly in patients who are critically ill. Regular checkups of acid-base balance in the resource-limited conditions, like in Pakistan, can help to identify high-risk patients at an early stage and support timely therapeutic interventions.

In general, the results of this study support the prognostic role of acid-base disorders in chronic liver disease. Specifically, metabolic acidosis is closely linked with elevated mortality, which makes it essential to regularly test and treat acid-base imbalances to enhance patient clinical outcomes in patients with severe liver disease.

10 CONCLUSION

The prevalence of acid-base disorders is very high in patients with chronic liver disease, and it is a major clinical issue as it is related to poor clinical outcomes. Such disturbances, especially, metabolic acidosis are closely associated with high mortality and severity of the disease in-hospitals. The existence of acid-base imbalance is an indication of underlying physiological derangements, such as the impaired hepatic metabolism, altered renal functions, and respiratory compensation mechanisms. Timely intervention

of these abnormalities requires early diagnosis by carrying out routine clinical assessment and measuring blood gas in the arteries. Early diagnosis and correct treatment will assist in avoiding additional complications, stabilizing the state of the patient, and, possibly, saving his life. It is thus imperative to incorporate regular evaluation of acid-base condition in regular clinical practices to patients with advanced liver disease. This method can not only contribute to risk stratification but also can contribute to a more effective clinical decision-making process and patient outcomes, especially in a resource-constrained environment where timely detection may significantly affect the prognosis.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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