

Assessment of Pulmonary Manifestations in Cirrhotic Patients at a Tertiary Care Hospital in Odisha: A Correlation Study with Liver Disease Severity

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ABSTRACT

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Background and Aims: Cirrhosis of the liver, a complex and progressive condition, can manifest beyond hepatic dysfunction, potentially affecting pulmonary function. This study aimed to investigate the association between liver cirrhosis severity, as assessed by Child-Pugh scores, and pulmonary manifestations. Clinical parameters were also examined for potential correlations.

Materials and Methods: A cross-sectional study included 100 patients with cirrhosis aged 48.80 ± 13.91 years. Symptom prevalence, varices grades, viral markers, arterial blood gas, pulmonary function, and Child-Pugh classes were assessed. Statistical analysis, including correlation coefficients, regression models, and p-values, was performed using SPSS.

Results: Splenomegaly (98%), Ascites (95%), and abdominal distension (75%) were common symptoms. Varices were observed in 69% of patients. 41% were in Child-Pugh class B, 32% in class C, and 27% in class A. Arterial blood gas abnormalities were noted in 8% of patients. Obstructive pulmonary function was present in 2%, while 25% exhibited restrictive patterns. Severity of liver disease was significantly associated with pulmonary function, with FEV1/FVC ratio reflecting this association ($P < 0.05$).

Conclusion: This study demonstrates a significant link between liver cirrhosis severity and pulmonary manifestations, highlighting potential systemic connections. Arterial blood gas findings may suggest preserved pulmonary gas exchange despite advanced cirrhosis. The FEV1/FVC ratio's correlation with liver disease severity suggests a potential interplay between hepatic dysfunction and altered pulmonary mechanics. Further investigations are warranted to comprehend the complex interactions between liver and pulmonary systems in patients with cirrhosis.

Keywords: Pulmonary Manifestations, Cirrhosis, liver, Child-Pugh scores.

INTRODUCTION

Cirrhosis of the liver, a chronic and progressive condition resulting from various etiologies such as viral hepatitis, alcohol abuse, and non-alcoholic fatty liver disease, is associated with multifaceted systemic effects (1). While the liver's pivotal role in detoxification and metabolic regulation is well-known, recent research has illuminated its influence on other organ systems, including the respiratory system (2). Emerging evidence suggests that cirrhosis may not be confined solely to hepatic dysfunction but might also engender significant pulmonary alterations (3). Understanding these

pulmonary manifestations is crucial, as they can contribute to the overall clinical picture and prognosis of patients with cirrhosis.

This original research article aims to comprehensively investigate the presence of pulmonary manifestations in patients with cirrhosis of the liver and elucidate potential correlations between these manifestations and the Child-Pugh scoring system. The Child-Pugh score, a widely used clinical tool for assessing the severity of liver disease, takes into account parameters such as bilirubin levels, serum albumin concentration, prothrombin time, Ascites, and hepatic encephalopathy (4). While the

Child-Pugh score serves as a valuable prognostic indicator for liver-related complications, its potential relationship with pulmonary dysfunction remains relatively unexplored.

To achieve the study's objectives, a cohort of patients with cirrhosis will undergo comprehensive assessments of pulmonary function. Arterial blood gas (ABG) analysis and spirometry will be utilized to evaluate various aspects of lung function, including oxygen and carbon dioxide levels, as well as the mechanics of respiration. By investigating the relationship between pulmonary parameters and Child-Pugh scores, this study aims to shed light on the intricate interplay between hepatic and respiratory systems in patients with cirrhosis.

In conclusion, this original article endeavors to enhance our understanding of the multifaceted impact of cirrhosis of the liver by examining its potential influence on pulmonary functions. The study's findings could pave the way for improved clinical management strategies, offering holistic care to patients with cirrhosis and highlighting the need for integrated assessments encompassing both hepatic and respiratory domains.

MATERIALS AND METHODS

This study utilized a cross-sectional approach to investigate the pulmonary functions in patients with cirrhosis of the liver and their correlation with Child-Pugh scoring. The study was conducted at IMS & SUM Hospital, Bhubaneswar, and included both outpatient (OPD) and inpatient (IPD) patients with cirrhosis.

Inclusion Criteria:

The inclusion criteria encompassed proven cases of liver cirrhosis, aged above 18 years, comprising both males and females.

Exclusion Criteria:

Patients who met any of the following criteria were excluded from participation in the study:

- Those presenting with life-threatening complications of cirrhosis, such as active upper gastrointestinal hemorrhage or hepatic encephalopathy, were not included.

- Individuals below 18 years of age were ineligible for participation.
- Patients with a previously diagnosed case of chronic obstructive pulmonary disease (COPD), bronchial asthma, interstitial lung disease (ILD), or similar respiratory conditions were excluded.
- Smokers, regardless of the extent or frequency of tobacco use, were not considered for the study.
- Patients experiencing gross Ascites accompanied by severe respiratory distress were not included in the study cohort.
- Individuals who had suffered a recent myocardial infarction (MI) within the past month were ineligible for participation.
- Those that had undergone recent upper abdominal surgery were excluded from the study to ensure consistency and prevent potential confounding factors.

A simple random sampling technique was employed to select 100 eligible participants from the pool of patients with cirrhosis visiting the Department of Medicine, Gastroenterology & Pulmonary Medicine at IMS & SUM Hospital during the study period. The sample size of 100 participants was determined using an appropriate formula for sampling, ensuring statistical validity and representation. Ethical clearance [Ref.no/IEC/IMS.SH/SOA/2021/268] was obtained from the institutional review board of IMS & SUM Hospital, Bhubaneswar, prior to the commencement of the study. Informed consent was obtained from all participants before their inclusion in the study.

Eligible participants underwent a comprehensive assessment, including a battery of laboratory investigations and diagnostic procedures. These assessments comprised complete blood count, liver function tests, renal function tests, chest X-ray, electrocardiogram, abdominal ultrasound, upper gastrointestinal endoscopy, viral marker screening, arterial blood gas analysis, pulmonary function tests, and 2D echocardiography.

Data were collected using a pretested proforma that was designed to meet the specific objectives of the study. The selected participants were enrolled based on the inclusion and exclusion criteria. Data collection was carried out by trained personnel to ensure consistency and accuracy.

Statistical analysis

The collected data were subjected to rigorous statistical analysis using appropriate methods. Correlation coefficients and regression analyses were employed to investigate the relationship between pulmonary parameters and Child-Pugh scores. Statistical significance was determined by p-values. Analysis was

conducted using the SPSS software, ensuring rigorous and comprehensive exploration of liver cirrhosis severity's impact on pulmonary manifestations.

RESULTS

In this study, a total of 100 patients diagnosed with liver cirrhosis were included, with a mean age of 48.80 ± 13.91 years. Age distribution of the study population is shown in Table 1. The patient distribution by age revealed 23% were above 60 years, while only 7% fell within the 18-30 years range. Males predominated females, constituting 73% of the study population with a ratio of 2.70:1.

Table 1: Age Distribution of the Study Population.

Age	Frequency (n=100)	Percentage (%)
≤30	7	7%
31-40	29	29%
41-50	22	22%
51-60	19	19%
>60	23	23%
Mean Age (Years)	48.80±13.91	

The most prevalent symptoms were Splenomegaly (98%), followed by Ascites (95%) and abdominal distension (75%). Pleural effusion was reported in 19% of patients based on chest X-ray findings. Varices were observed in the esophagus, with 51% of patients showing Grade II varices and 18% demonstrating Grade III varices. HBsAg positivity was found in 18% of patients, while anti-HCV positivity was observed in 3%. Regarding disease severity, 41% of patients were categorized as Child-Pugh class B, 32% as class C, and 27% as class A. Arterial blood gas examination indicated abnormalities in 8% of patients. Pulmonary function examination revealed obstructive patterns in 2% of patients and restrictive pulmonary function in 25% of patients. Hepato-renal syndrome was present in 5% of cases.

Notably, all patients with obstructive pulmonary function were classified as Child-Pugh class C, whereas approximately 70% of patients with restrictive pulmonary function were in the same class. An important observation was the significant association between the severity of liver disease and pulmonary function. The study findings also indicated that arterial blood gas examination results were independent of the severity of liver disease (P>0.05). However, FEV1/FVC showed a significant association with the severity of liver disease (P<0.05), suggesting a potential relationship between hepatic dysfunction and altered pulmonary function.

Association of severity of liver disease (child-Pugh score) with different other parameters in the study population is shown in Table 2.

Table 2: Association of Severity of Liver Disease (Child-Pugh Score) With Different Other Parameters in the Study Population.

PARAMETER		Class A (n=27)	Class B (n=41)	Class C (n=32)	P-value
Arterial blood gas analysis	PaCO2	26.43±3.41	25.95±4.3	25.25±5.5	0.832
	PaO2	78.3±9.8	77.1±15.4	74.5±13.8	0.818
	SaO2	95.4±1.9	93.8±6.3	94.2±3.8	0.911
Spirometry	FVC%	98±11.16	93.5±21.4	84.1±19.2	0.514
	FEV1 %	93.3±12.7	85.1±22.2	86±14.2	0.497
	FEV1/FVC	81.3±9.3	73.7±9.6	83.1±9.3	0.041
	FEF25-75%	75.2±29.7	57.3±26.5	76.1±30.54	0.372
Pulmonary Function Test	Obstructive	0	0	2	<0.0001
	Restrictive	2	6	17	
	Normal	25	35	13	

DISCUSSION

Cirrhosis of the liver is a complex and multifaceted condition that can have far-reaching effects on various organ systems beyond its primary impact on hepatic function. This study aimed to investigate the relationship between liver cirrhosis severity, as assessed by Child-Pugh scores, and pulmonary manifestations, as well as to explore potential correlations with various clinical parameters. Summary of association of liver disease with pulmonary function in different studies done globally is shown in Table 3.

The predominance of males over females in this study's cirrhotic patient population (73% male, ratio 2.70:1) aligns with previous research, reflecting the well-documented gender bias in cirrhosis prevalence (5). This observation underscores the importance of gender-based studies to better understand these disparities and their implications for clinical management.

The most common symptoms reported by the patients in this study were Splenomegaly, Ascites, and abdominal distension, which is consistent with the expected clinical presentation of advanced liver cirrhosis (6). Additionally, the high prevalence of varices (Grade II in

51% and Grade III in 18%) highlights the risk of gastrointestinal bleeding in these patients, emphasizing the need for vigilant monitoring and preventive strategies (7).

Interestingly, the study found that a significant proportion of patients had abnormal pulmonary function test results. Notably, while only 2% exhibited obstructive patterns, 25% demonstrated restrictive pulmonary function. This highlights the potential impact of cirrhosis on lung mechanics, with implications for respiratory efficiency and overall quality of life (8).

The correlation between liver disease severity, as indicated by Child-Pugh class and pulmonary function is a noteworthy finding. Previous research has demonstrated the intricate interplay between the liver and the lungs through mechanisms such as inflammation, oxidative stress, and alterations in blood flow (9). The present study contributes to this understanding by emphasizing the potential connection between hepatic dysfunction and impaired pulmonary mechanics.

Arterial blood gas analysis is a valuable tool for assessing acid-base balance and respiratory function.

Table 3: Summary of Association of Liver Disease with Pulmonary Function in Different Studies done globally.

Study	Sample Size	Parameters Assessed	Key Findings
Garg et al. (2014) ^[2]	N = 300	Lung function Mortality risk	- Impaired lung function in patients with acute-on-chronic liver failure. - Lung dysfunction associated with increased mortality risk.
López-Martínez et al. (2016) ^[3]	N = 220	Pulmonary alterations Disease severity	- Cirrhosis may lead to pulmonary alterations and complications. - Impaired lung function correlated with disease severity.
Zeng et al. (2016) ^[8]	N = 1200	FEV1, FVC	- Significant reduction in FEV1 and FVC in patients with cirrhosis. - Cirrhosis associated with impaired lung function, more pronounced in advanced stages
Agustí & Soriano (2011) ^[9]	N = 465	Perioperative complications, lung function	- Increased risk of pulmonary complications post non-hepatic abdominal surgery in patients with cirrhosis. - Impaired lung function linked to higher perioperative complications.
Agarwal et al. (2012) ^[10]	N = 205	Altitude-associated respiratory disorders	- Pulmonary complications in patients with cirrhosis ascending to high altitudes. - Increased susceptibility to altitude-associated respiratory disorders
Tedeschi et al. (2019) ^[11]	N = 150	Lung function, gas exchange Spleen size	- Cirrhosis impacts lung function and gas exchange. - Spleen enlargement has incremental effect on impaired pulmonary mechanics.
Current Study	N = 100	Pulmonary function Arterial blood gas	- Significant correlation between liver disease severity (Child-Pugh scores) and pulmonary function. - Obstructive and restrictive patterns observed in a subset of patients with cirrhosis.

The lack of a significant association between arterial blood gas parameters and liver disease severity in this study suggests that pulmonary gas exchange might remain relatively preserved even in the context of advanced cirrhosis (10). This finding could have

implications for patient management, underscoring the importance of comprehensive assessments beyond hepatic function alone.

The significant association between FEV1/FVC ratio and liver disease severity suggests a potential link

between hepatic dysfunction and alterations in lung compliance or airway resistance. These observations could be attributed to the systemic inflammatory milieu characteristic of cirrhosis, which may extend its effects to the pulmonary system (11).

LIMITATIONS OF THE STUDY

It is important to acknowledge the study's limitations, such as the relatively small sample size and the single-center nature of the study. Additionally, the absence of certain correlations may be due to the complexities of interactions between liver and pulmonary systems that may not be fully captured in this study's scope.

CONCLUSION

This study provides valuable insights into the relationship between liver cirrhosis severity and pulmonary manifestations. The observed associations between Child-Pugh scores, pulmonary function, and arterial blood gas parameters suggest a potential interplay between hepatic and respiratory systems. These findings warrant further investigation and underscore the need for holistic patient assessments in cirrhotic individuals.

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