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Cardiovascular Changes in Decompensated Liver Cirrhosis

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Abstract: Liver cirrhosis is a significant health concern due to its systemic impacts, particularly on cardiovascular health. This study investigates the cardiovascular changes in patients with decompensated liver cirrhosis. Despite existing knowledge on liver cirrhosis, the precise mechanisms linking it to cardiovascular dysfunction remain inadequately understood. We conducted a cross-sectional analysis of 100 patients, divided equally into compensated and decompensated cirrhosis groups. Cardiovascular parameters, including mean arterial pressure, heart rate, and echocardiographic measures, were assessed alongside systemic inflammation markers such as CRP and bilirubin levels. Findings revealed that patients with decompensated cirrhosis had significantly higher mean arterial pressures (92 ± 10 mmHg), heart rates (85 ± 7 bpm), and left ventricular end-diastolic dimensions (50 ± 6 mm) compared to the compensated group. Additionally, ejection fractions were lower, and systemic inflammation markers were elevated in the decompensated group. These results indicate a clear association between liver dysfunction and cardiovascular impairment. The study underscores the importance of integrating cardiovascular management into the treatment protocol for liver cirrhosis patients. Future research should focus on longitudinal studies to understand the progression of these cardiovascular changes and develop targeted interventions to mitigate the cardiovascular risks associated with liver cirrhosis. These efforts could significantly improve patient outcomes and reduce the morbidity associated with this condition.

Key words: Liver cirrhosis, cardiovascular changes, decompensated cirrhosis, mean arterial pressure, heart rate, echocardiography, systemic inflammation.

Introduction. Liver cirrhosis, marked by extensive liver fibrosis and dysfunction, has significant repercussions for various organ systems, particularly the cardiovascular system. In Uzbekistan, liver cirrhosis is increasingly prevalent due to factors such as hepatitis B and C infections and excessive alcohol consumption. The impact of liver cirrhosis on cardiovascular health within this specific demographic has not been comprehensively studied, highlighting the need for focused research in this area (World Health Organization, 2022; Bichko et al., 2021).The theoretical framework of this study is grounded in the understanding that liver cirrhosis induces systemic hemodynamic changes, including alterations in vascular resistance and cardiac output. These changes are primarily due to portal hypertension and liver-related modifications in blood flow dynamics. The pathophysiological basis of these cardiovascular changes has been explored in other regions, with studies by Luyendyk and Boggaram (2020) and Garcia-Tsao and Lim (2021) providing insights into the broader implications of cirrhosis on cardiovascular function. Despite these insights, existing research often lacks region-specific data, particularly concerning the Uzbek population. Studies conducted in other settings, such as those by Sharma and Baig (2022) and Ali and Jafri (2023), have documented similar cardiovascular complications but do not address the unique demographic and healthcare factors present in Uzbekistan. This gap underscores the need for localized studies to better understand and manage the cardiovascular impacts of liver cirrhosis.

This study aims to fill this gap by examining the cardiovascular changes associated with liver cirrhosis in Uzbekistan. The objectives include assessing variations in blood pressure, heart rate, and echocardiographic markers among patients with liver cirrhosis. By focusing on the Uzbek context, this

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research will provide valuable data that can inform tailored healthcare strategies and improve patient management.The novelty of this research lies in its regional focus and the anticipated findings, which are expected to reveal specific cardiovascular alterations in the Uzbek population with liver cirrhosis. These findings will contribute to a better understanding of the condition's impact and support the development of more effective, localized treatment protocols. By addressing this knowledge gap, the study aims to enhance clinical practices and improve outcomes for patients with liver cirrhosis in Uzbekistan.

Methodology. This research utilized a cross-sectional study design to investigate cardiovascular changes in patients with liver cirrhosis. Conducted in healthcare facilities across Uzbekistan, including the Republican Therapeutic Center in Tashkent and regional hospitals in Samarkand, the study spanned from January to December 2023. This design was chosen to provide a detailed assessment of cardiovascular alterations at a specific point in time, facilitating an in-depth examination of the relationship between liver cirrhosis and cardiovascular health.

The study involved 100 patients with diagnosed liver cirrhosis, selected through random sampling from participating healthcare centers. Criteria for inclusion were adults aged 18-65 years with a confirmed diagnosis of liver cirrhosis, categorized into compensated and decompensated stages. Participants were further stratified by demographic factors such as age, sex, and comorbidities to explore variations in cardiovascular changes across different stages of cirrhosis and patient demographics.

Data collection was comprehensive and included several methodologies. Clinical data were gathered through standardized protocols involving blood pressure measurements, heart rate assessments, and symptom documentation. Echocardiography was employed to evaluate heart structure and function, providing insights into potential cardiovascular impacts of liver cirrhosis. Additionally, blood samples were analyzed for liver function tests, lipid profiles, and markers of systemic inflammation to offer a thorough biochemical assessment of cardiovascular health.The collected data were analyzed using SPSS (Statistical Package for the Social Sciences) and R software. Descriptive statistics summarized participant demographics and clinical characteristics, while inferential statistics, including correlation and regression analyses, examined relationships between liver cirrhosis severity and cardiovascular parameters. Statistical analyses were conducted with a 95% confidence level, allowing for robust and reliable findings.

Ethical considerations were paramount throughout the study. Informed consent was obtained from all participants, and the study received approval from the institutional review boards of the involved healthcare facilities. Confidentiality and privacy of participant data were maintained according to the Declaration of Helsinki principles, ensuring that the research was conducted ethically and with respect for the participants.

Results.

Cardiovascular parameters by liver cirrhosis severity: Table 1

Parameter	Compensated Cirrhosis (n=50)	Decompensated Cirrhosis (n=50)	p-value
Mean Arterial Pressure (mmHg)	85 ± 8	92 ± 10	0.002
Heart Rate (bpm)	78 ± 6	85 ± 7	0.001
Left Ventricular End-Diastolic Dimension (mm)	45 ± 5	50 ± 6	0.004
Ejection Fraction (%)	60 ± 4	55 ± 5	0.005
Serum Bilirubin (µmol/L)	25 ± 10	35 ± 12	0.003
CRP (mg/L)	5 ± 2	12 ± 4	0.001

Values are expressed as mean ± standard deviation. p-values are derived from independent t-tests comparing compensated and decompensated cirrhosis groups.

Correlations between systemic inflammation markers and cardiovascular parameters:

Table 2

Parameter	CRP (mg/L)	Bilirubin (μmol/L)
Mean arterial pressure (mmHg)	0.45 ($p < 0.01$)	0.42 ($p < 0.01$)
Heart Rate (bpm)	0.50 ($p < 0.01$)	0.38 ($p < 0.05$)
Left Ventricular End-Diastolic Dimension (mm)	0.47 ($p < 0.01$)	0.40 ($p < 0.05$)
Ejection Fraction (%)	-0.53 ($p < 0.01$)	-0.39 ($p < 0.05$)

Correlation coefficients (r) and p-values are derived from Pearson correlation analyses.

Discussion.

The results show significant cardiovascular changes associated with liver cirrhosis. Patients with decompensated cirrhosis demonstrated higher mean arterial pressures and heart rates compared to those with compensated cirrhosis. Echocardiographic findings revealed increased left ventricular end-diastolic dimensions and decreased ejection fractions in the decompensated group, indicating impaired cardiac function.

Systemic inflammation, as indicated by elevated CRP levels, correlated with adverse cardiovascular parameters, reinforcing the link between liver cirrhosis-induced inflammation and cardiovascular health. Elevated bilirubin levels also correlated with worsened cardiovascular metrics, suggesting that liver dysfunction exacerbates cardiovascular impairment.

Future studies should focus on longitudinal tracking of cardiovascular changes in liver cirrhosis patients to understand progression and reversibility. Investigations into the specific molecular mechanisms linking liver dysfunction to cardiovascular changes are needed, along with intervention trials to test therapies aimed at reducing systemic inflammation and improving cardiovascular outcomes.

Conclusion. Based on the findings of the study, it is evident that liver cirrhosis significantly impacts cardiovascular health, particularly in patients with decompensated cirrhosis. The study demonstrated that patients with advanced liver disease exhibit higher mean arterial pressures, increased heart rates, and impaired cardiac function, as evidenced by larger left ventricular end-diastolic dimensions and reduced ejection fractions. These cardiovascular changes are closely associated with elevated systemic inflammation markers, such as CRP, and higher serum bilirubin levels, indicating a profound systemic effect of liver dysfunction. The implications of these findings suggest that managing cardiovascular health should be an integral part of treating liver cirrhosis patients. Further research is warranted to explore the longitudinal progression of cardiovascular changes in cirrhosis and to investigate targeted interventions aimed at reducing inflammation and improving cardiovascular outcomes, thereby enhancing the overall management and prognosis of liver cirrhosis.

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