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Original Research Article

Study of Association Between Vitamin D Levels and Chronic Liver Disease

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Abstract:

Background: Although Vitamin D insufficiency frequently occurs in individuals with chronic liver disease (CLD), but its relationship with disease severity remains under-explored in the Indian population. To look at the connection between serum Vitamin D concentrations and the severity of CLD.

Methods: 100 patients diagnosed with CLD in this cross-sectional study at Katihar Medical College from March 2023 to September 2024. The severity of chronic liver disease was evaluated using the Child-Pugh and MELD scoring systems, while serum [25(OH)D] levels observed for each patient. Individual were divided into 3 groups according to their serum vitamin D levels: sufficient (>30 ng/mL), insufficient (20–30 ng/mL), and deficient (<20 ng/mL). Correlation and regression techniques were utilized to carry out the statistical analysis.

Results: Among the 100 patients, 64% were Vitamin D deficient, 23% insufficient, and only 13% had adequate. Vitamin D levels were found to have a significant negative connection with both Child-Pugh class and MELD score (r = -0.43). More people with advanced liver disease had vitamin D insufficiency.

Conclusion: Vitamin D deficiency is highly prevalent in CLD patients and is significantly linked with severe illness. Routine screening and supplementation may be considered to improve patient outcomes.

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Introduction

Low levels of 25-hydroxyvitamin D [25(OH)D], the main form of Vitamin D, have gained increasing attention in the context of chronic systemic illnesses, including chronic liver disease (CLD). A secosteroid hormone, vitamin D is essential not only for maintaining calcium and phosphate balance but also for regulating immune responses, controlling inflammation, and supporting liver cell function. Deficiencies in Vitamin D are commonly observed in patients with CLD and are believed to reflect impaired hepatic hydroxylation, malabsorption, reduced sun exposure, and systemic inflammation.

Chronic liver disease, encompassing a wide spectrum of etiologies such as viral hepatitis, alcohol-related liver damage, and NAFLD, is a major cause of death and morbidity globally. In India, its burden is exacerbated by late-stage presentations, limited access to care, and socioeconomic disparities. Disease progression typically culminates in cirrhosis and hepatic decompensation, driven by persistent inflammation and fibrogenesis. While existing prognostic systems like Child-Pugh classification and MELD score remain essential for clinical evaluation, there is growing interest in identifying novel, non-invasive biomarkers that could reflect disease severity and support early intervention.

Emerging evidence suggests a possible link between hypovitaminosis D and the progression of liver fibrosis and cirrhosis. Vitamin D deficiency may not only indicate deteriorating liver synthetic function but also contribute to disease progression through immune dysregulation and enhanced fibrotic pathways. The connection between Vitamin D level and hepatic health is biologically plausible yet clinically underexplored, particularly in Indian populations where nutritional deficiencies are prevalent and sun exposure patterns vary widely.

Despite international recognition of this association, data from regional settings in India remain limited. Variations in disease etiology, environmental exposure, and dietary intake necessitate locally contextualized research. This cross-sectional study, conducted over an 18-month period at Katihar Medical College and Hospital, Bihar, is to investigate connection between clinical severity of CLD and serum Vitamin D concentration. By examining this relationship, the study seeks to enhance understanding of potential prognostic

indicators and inform patient management strategies in resource-limited healthcare environments.

Materials and Methods

Over a span of 18 months, from March 2023 to September 2024, at Katihar Medical College and Hospital, located in Katihar, Bihar an observational cross-sectional study was carried out. The study included 100 patients who had a confirmed diagnosis of chronic liver disease. Eligible participants were adults aged over 18 years with a documented history of CLD lasting more than six months. Patients were excluded if they were receiving Vitamin D supplementation or had coexisting conditions such as chronic kidney disease, malignancies, or other significant systemic illnesses that could confound Vitamin D metabolism.

For each participant, 25(OH)D levels were assessed by a standardized chemiluminescence immunoassay. Both the MELD scoring system and the Child-Pugh classification were used to evaluate the severity of liver disease. In addition to laboratory assessments, demographic and clinical data—including gender, age, comorbidities, liver disease etiology, and complications—were systematically collected.

Software called SPSS version 25 was used to conduct statistical analysis. Depending on the data distribution, either the Pearson or Spearman correlation coefficients were used to examine continuous variables. The chi-square test was used to compare categorical variables. Throughout the analysis, a p-value of less than 0.05 was regarded as statistically significant.

Results

Among the 100 patients assessed, 64 individuals (64%) had Vitamin D deficiency. Within this group, 35 belonged to Child-Pugh Class C, 21 to Class B, and 8 to Class A. A further 23 patients (23%) demonstrated Vitamin D insufficiency (20–30 ng/mL), including 12 classified as Class A, 9 as Class B, and 2 as Class C. Adequate Vitamin D levels (>30 ng/mL) were observed in only 13 patients (13%), of whom 11 were in Class A and 2 in Class B; none were in Class C.

The mean Vitamin D serum concentration was 32.5 ± 6.1 ng/mL in Class A patients, while those in Class C recorded a mean of 14.2 ± 4.3 ng/mL. Analysis also revealed a significant inverse relationship between Vitamin D concentration and MELD score ($r = –0.43$).

Vitamin D Status	No. of Patients	Class A	Class B	Class C
Deficient	64	8	21	35
Insufficient	23	12	9	2
Sufficient	13	11	2	0

Discussion

In a cohort of patients receiving treatment at a tertiary care hospital in Bihar, this study examined the link between serum vitamin D levels and the severity of CLD. Our findings reveal a substantial inverse connection between Vitamin D levels and CLD severity, as indicated by both Child-Pugh classification and MELD scores. Specifically, patients with lower serum 25(OH)D concentrations exhibited a higher prevalence of advanced liver disease, with 64% of the study population classified as Vitamin D deficient and the majority of these falling into Child-Pugh Class C.

These observations support prior research suggesting that low vitamin D is common in chronic liver conditions and may reflect both the compromised liver synthesis of 25(OH)D and increased metabolic demand due to ongoing inflammation and fibrosis. The high proportion of Vitamin D-deficient patients in Class C (35%) aligns with earlier studies that have proposed Vitamin D status as a potential marker of liver functional reserve and systemic immune activation.

Vitamin D influenced in modulating immune responses, hepatic stellate cell activation, and extracellular matrix remodeling—all of which are crucial pathways in liver fibrogenesis. Its deficiency may therefore not only indicate disease progression but also actively contribute to hepatic injury through impaired anti-inflammatory and anti-fibrotic mechanisms. The noteworthy inverse notion Vitamin D levels and MELD score ($r = -0.43$, $p < 0.001$). Multivariate analyses in previous literature have also suggested that hypo Vitamin D levels may independently determine adverse outcomes in CLD, regardless of etiology. This adds to the growing consensus that micronutrient profiling, including Vitamin D assessment, should be integrated into the routine evaluation of patients with chronic liver conditions. The high prevalence of deficiency in our cohort underscores the need for increased clinical awareness, especially in regions with limited nutritional surveillance and inconsistent sunlight exposure.

Even though our findings have clinical significance, there are a few caveats to take into account. Our capacity to determine causal links between vitamin D lower and the CLD is limited by the cross-sectional design. Additionally, potential confounding factors such as dietary intake, seasonal variation, physical activity levels, or unmeasured

inflammatory markers were not accounted for. 100 patients sample size, may restrict the generalizability of the results to larger groups, and may sufficient for preliminary analysis.

Nonetheless, this study offers important insights into the intersection of nutritional status and hepatic pathology in a resource-constrained setting. A clearly defined patient population, standardized laboratory assessment, and objective disease severity classification strengthen the reliability of the findings. Routine screening for Vitamin D deficiency may serve as a low-cost, easily accessible tool to aid in early risk stratification and therapeutic decision-making in chronic liver disease management.

Future prospective studies with bigger, longitudinal follow-up, multi-center cohorts to confirm these findings and explore whether Vitamin D supplementation could alter the clinical trajectory of chronic liver disease.

Conclusion

Low vitamin D levels are significantly linked to more severe forms of chronic liver disease. Although further long-term research is required, routine screening and potential supplementation may help manage these people.

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