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# EVALUATION OF ANEMIA ACROSS THE SPECTRUM OF CHRONIC LIVER DISEASE: A DESCRIPTIVE OBSERVATIONAL STUDY

**Dr. Vikash. M[1*], Dr. Suresh. M.K[2]**
[1*]Junior Resident, Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.
[2]Professor and HOD, Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.
**Corresponding Author:** Dr. Vikash. M
Junior Resident, Department Of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.

## ABSTRACT

**Background:** Chronic Liver Disease is associated with various hematological abnormalities, among which anemia is one of the most common complications. The etiology of anemia in chronic liver disease is multifactorial and includes nutritional deficiencies, gastrointestinal blood loss, hypersplenism, and bone marrow suppression. Identification of the type and severity of anemia is important for appropriate clinical management and prognostic assessment.

**Methodology:** This hospital-based observational descriptive study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences from December 2024 to December 2025. A total of 100 chronic liver disease patients with hemoglobin levels less than 10 g/dL were included in the study. Detailed socio-demographic, clinical, and laboratory data were collected using a structured proforma. Hematological and biochemical investigations were performed to evaluate the type, severity, and associated factors of anemia. Statistical analysis was performed using SPSS version 26.0.

**Results:** The majority of patients were males (81%) with a mean age of 46.7 years. Alcohol-related liver disease was the most common etiology. Iron deficiency anemia was the predominant type of anemia observed, while folic acid deficiency anemia was common among alcohol-related liver disease patients. Moderate anemia was present in 63% of patients, followed by mild anemia (23%) and severe anemia (14%).

Conclusion: Anemia is highly prevalent among chronic liver disease patients and is commonly associated with nutritional deficiencies and hepatic dysfunction. Early diagnosis and appropriate management may improve patient outcomes and quality of life.

**Keywords:** Chronic Liver Disease, Anemia, Iron Deficiency Anemia, Alcoholic Liver Disease, Hypersplenism, Liver Cirrhosis.

## INTRODUCTION

Chronic Liver Disease is a major global health problem associated with significant morbidity and mortality. Chronic liver disease (CLD) encompasses a spectrum of hepatic disorders characterized by progressive destruction and regeneration of liver parenchyma leading to fibrosis, cirrhosis, portal hypertension, and hepatic failure.[1] The common causes of CLD include chronic alcohol consumption, viral hepatitis, non-alcoholic fatty liver disease, autoimmune liver disorders, and metabolic diseases.

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[2] Patients with chronic liver disease frequently develop multiple systemic complications involving the hematological, renal, cardiovascular, and gastrointestinal systems. Among these, hematological abnormalities are commonly encountered and significantly influence disease severity, prognosis, and quality of life.[3]

Anemia is one of the most frequent hematological manifestations observed in patients with chronic liver disease and occurs in nearly 75% of cases.[4] The etiology of anemia in CLD is multifactorial and may result from acute or chronic gastrointestinal hemorrhage, nutritional deficiencies, bone marrow suppression, hemolysis, hypersplenism secondary to portal hypertension, and chronic inflammation.[5] Gastrointestinal bleeding due to esophageal varices, portal hypertensive gastropathy, peptic ulcer disease, or hemorrhoids may lead to acute blood loss and severe iron deficiency anemia.[6] Recurrent occult gastrointestinal bleeding further contributes to chronic anemia and worsens patient outcomes.

Portal hypertension associated with cirrhosis commonly results in splenomegaly and hypersplenism, leading to increased sequestration and destruction of blood cells, including erythrocytes, leukocytes, and platelets.[7] Consequently, thrombocytopenia is considered the most common hematological abnormality in cirrhotic patients, followed by leukopenia and anemia.[8] Thrombocytopenia in chronic liver disease is also aggravated by reduced hepatic synthesis of thrombopoietin and direct bone marrow suppression caused by alcohol, viral infections, or medications.[9]

Severe hepatocellular dysfunction predisposes patients to bleeding tendencies because the liver is responsible for synthesis of most coagulation factors. Deficiency of clotting factors along with thrombocytopenia significantly increases the risk of hemorrhagic manifestations in patients with advanced liver disease.[10] Additionally, chronic liver disease may impair iron metabolism, folate absorption, and vitamin B12 storage, thereby contributing to various forms of nutritional anemia.[11]

Aplastic anemia, characterized by pancytopenia and hypocellular bone marrow, has also been reported following viral hepatitis and may complicate the clinical course of liver disease.[12] Furthermore, antiviral combination therapies used in chronic hepatitis management may contribute to anemia through bone marrow suppression and hemolysis.[13] Ribavirin-induced hemolytic anemia is a well-recognized complication among patients receiving antiviral therapy for chronic hepatitis C infection.[14]

The presence of anemia in chronic liver disease adversely affects tissue oxygenation, physical performance, hospitalization rates, and overall survival. Identification of the type and severity of anemia is therefore important for appropriate clinical management and prognostic evaluation.[15] Despite the high prevalence of hematological abnormalities in chronic liver disease, anemia often remains underdiagnosed and undertreated in routine clinical practice.

Hence, the present study was undertaken to evaluate the prevalence, pattern, and severity of anemia among patients with chronic liver disease and to analyze its association with the spectrum of liver dysfunction.

**Aim**

To evaluate the prevalence, pattern, and severity of anemia among patients with Chronic Liver Disease in a tertiary care hospital.

**Objectives**

1. To determine the prevalence of anemia among patients with chronic liver disease.
2. To assess the morphological types of anemia in patients with chronic liver disease based on hematological parameters.
3. To evaluate the association between severity of chronic liver disease and severity of anemia.

## METHODOLOGY

This hospital-based observational descriptive study will be conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences during the study period from December 2024 to December 2025. The study population will include patients diagnosed with Chronic Liver Disease admitted to the General Medicine department. Patients aged more than 18 years with chronic liver disease and hemoglobin levels less than 10 g/dL will be included in the study. Patients aged below 18 years, patients with overt bleeding manifestations such as hematemesis or melena within the previous three months, known gastrointestinal malignancy or hepatocellular carcinoma, primary hematological or coagulation disorders, acute decompensation of chronic liver disease, and liver failure secondary to septicemia or endotoxemia unrelated to primary liver causes will be excluded from the study.

After obtaining approval from the Institutional Ethics Committee, informed written consent will be obtained from all eligible participants prior to enrollment. Detailed clinical history and socio-demographic data including age, gender, occupation, socioeconomic status, alcohol intake, comorbidities, and etiological factors of chronic liver disease will be collected using a pretested structured proforma. Clinical examination and laboratory investigations will be performed to evaluate the type, grading, severity, and causative factors of anemia in patients with chronic liver disease. Hematological investigations including complete blood count, peripheral smear examination, red blood cell indices, liver function tests, coagulation profile, and relevant biochemical parameters will be carried out using standard laboratory methods. Associated hematological abnormalities such as thrombocytopenia and leukopenia will also be assessed. The study subjects will be managed according to institutional treatment protocols and followed up until discharge from the hospital.

The collected data will be entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0. Descriptive statistics such as mean, standard deviation, frequency, and percentage will be used to summarize socio-demographic and clinical characteristics. Association between categorical variables will be analyzed using the Chi-square test, while continuous variables will be compared using Student’s t-test or analysis of variance (ANOVA)

wherever appropriate. A p-value of less than 0.05 will be considered statistically significant.

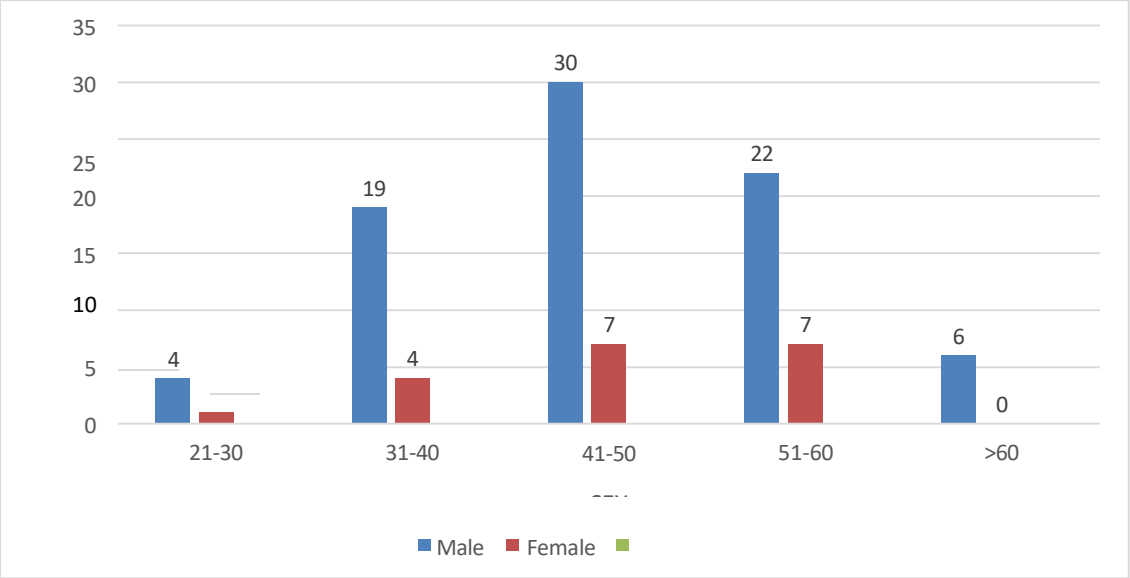
## RESULT

**Table 1:** Age and sex wise distribution of study subjects

| S.No | AGE | SEX | | TOTAL |
|---|---|---|---|---|
| | | Male | Female | |
| 1. | 21-30 | 4 | 1 | 5 |
| 2. | 31-40 | 19 | 4 | 23 |
| 3. | 41-50 | 30 | 7 | 37 |
| 4. | 51-60 | 22 | 7 | 29 |
| 5. | >60 | 4 | 0 | 6 |
| AGE | Total | 81 | 19 | 100 |

Majority of the study subjects were males (81%) when compared to females (19%)

- Mean age of the study subjects was 46.7 years
- Totally it was observed that the majority age group suffering from chronic liver disease was between 41 -60 years



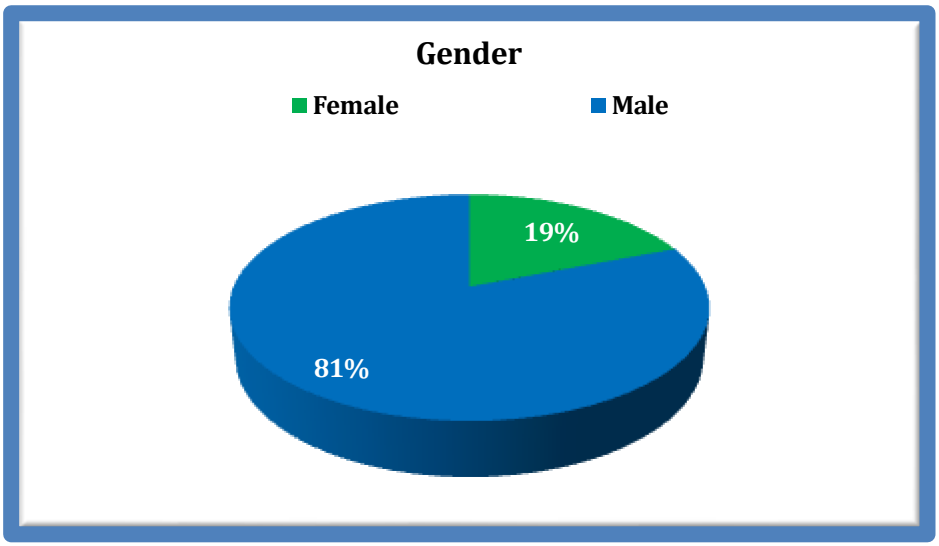




**Table 2 :** Type and distribution of Anaemia in different Chronic Liver disease cases

| TABLE: | ETIOLOGY OF ANEMIA |
|---|---|

| **Etiology of** cause of CLD | BD | | FD | | FD+BD | | IDA | | IDA+BD | | IDA+FD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | Count | % | Count | % | Count | % | Count | % |
| ALC | 6 | 7.7% | 31 | 39.7% | 3 | 3.8% | 29 | 37.2% | 1 | 1.3% | 8 | 10.3% |
| HBV | 0 | 0% | 4 | 36.4% | 0 | 0% | 6 | 54.5% | 0 | 0% | 1 | 9.1% |
| HCV | 0 | 0% | 3 | 42.9% | 0 | 0% | 3 | 42.9% | 0 | 0% | 1 | 14.3% |
| NAFLD | 1 | 25.0% | 1 | 25.0% | 0 | 0% | 1 | 25.0% | 0 | 0% | 1 | 25.0% |

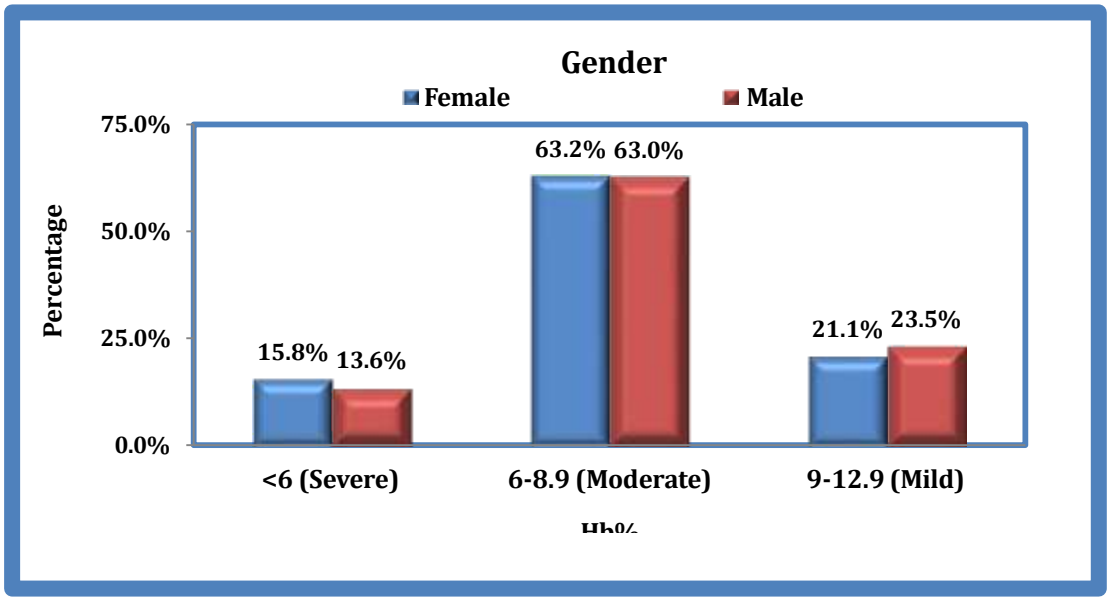
P < 0.05

- It was observed that in ALC the most common anaemia is folic acid deficiency (39.7%) followed by Iron deficiency (37.2%), in HBV most common was Iron deficiency (54.5%) followed by Folic acid deficiency (36.4%), in HCV both Iron & Folic acid deficiency were equally distributed (42.9%) and in NAFLD Iron and B12 deficiency were equally distributed (25%).
- Among all the types of anaemia Iron deficiency anaemia was the commonest one observed.

Table 3: Distribution of Grading and Severity of Anaemia

| Hb | SEX | | | | Total | |
|---|---|---|---|---|---|---|
| | F | | M | | | |
| | Count | % | Count | % | Count | % |
| <6 (Severe) | 3 | 15.8% | 11 | 13.6% | 14 | 14.0% |
| 6-8.9 (Moderate) | 12 | 63.2% | 51 | 63.0% | 63 | 63.0% |
| 9-12.9 (Mild) | 4 | 21.1% | 19 | 23.5% | 23 | 23.0% |
| Total | 19 | 100.0% | 81 | 100.0% | 100 | 100.0% |

P > 0.05




- Regarding severity about 14% were severely anaemic flowed by 63% moderately anaemic and 23% were mild anaemic as noticed.

Table 4: Age wise distribution of different types of Chronic Liver diseases

| Age | ETIOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ALC | | HBV | | HCV | | NAFLDa | |
| | Count | % | Count | % | Count | % | Count | % |
| 21-30 | 3 | 3.8% | 1 | 9.1% | 0 | 0% | 1 | 25.0% |
| 31-40 | 20 | 25.6% | 1 | 9.1% | 2 | 28.6% | 0 | 0% |
| 41-50 | 28 | 35.9% | 4 | 36.4% | 3 | 42.9% | 2 | 50.0% |
| 51-60 | 21 | 26.9% | 5 | 45.5% | 2 | 28.6% | 1 | 25.0% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| >60 | 6 | 7.7% | 0 | 0% | 0 | 0% | 0 | 0% |

- In this study among the ALC cases maximum 35.9% were belong to the age group 41-50 years followed by 45.5% belong to 51-60 among HBV,42.9% belong to 41-50 years among HCV and about 50% of cases belong to 41-50 years among NAFLD .
- Totally it was observed that the majority age group suffering from chronic liver disease was between 41 -60 years
- Regarding distribution of spectrum of chronic liver disease majority of the study subjects were belong to ALC followed by HBV, HCV and NAFLD.

Table 5: Mean values of different factors associated with Chronic liver disease

| Variable | ETIOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ALC | | HBV | | HCV | | NAFLD | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| AGE | 47.32 | 10.05 | 47.27 | 8.80 | 47.43 | 7.16 | 45.00 | 13.34 |
| TB | 4.51 | 6.07 | 2.32 | 2.97 | 2.79 | 3.18 | 1.95 | 1.12 |
| AST | 82.83 | 70.83 | 44.18 | 24.20 | 71.43 | 59.05 | 65.50 | 18.59 |
| ALT | 47.76 | 39.83 | 31.73 | 27.40 | 54.00 | 39.78 | 32.50 | 5.26 |
| ALBUMIN | 4.34 | 12.94 | 3.03 | 0.65 | 2.86 | 0.46 | 2.70 | 0.34 |
| PT INR | 1.94 | 0.53 | 1.79 | 0.39 | 1.86 | 0.26 | 1.88 | 0.39 |
| Hb (gr/dl) | 7.92 | 1.57 | 6.80 | 1.60 | 6.94 | 1.73 | 7.23 | 2.25 |
| MCH (pg) | 26.97 | 4.70 | 26.98 | 4.42 | 26.29 | 3.86 | 23.50 | 5.45 |
| MCV (fl) | 93.28 | 14.59 | 86.27 | 15.35 | 90.14 | 10.24 | 91.25 | 20.97 |
| SERUM FOLIC ACID(ng/ml) | 5.18 | 2.46 | 5.13 | 3.34 | 4.59 | 2.61 | 6.85 | 3.16 |
| SERUM VitB12 (pg/ml) | 431.03 | 221.30 | 536.09 | 232.61 | 494.86 | 174.42 | 400.75 | 224.31 |
| S.iron | 53.74 | 45.33 | 50.91 | 54.53 | 29.29 | 24.56 | 44.75 | 46.64 |
| Ferritin | 178.99 | 196.64 | 214.27 | 267.06 | 77.00 | 83.99 | 147.75 | 209.06 |
| TIBC | 447.18 | 87.86 | 412.64 | 82.91 | 470.57 | 82.14 | 457.50 | 65.13 |
| CTP SCORE | 8.77 | 2.20 | 7.55 | 2.07 | 8.71 | 1.98 | 9.75 | 2.36 |
| MELD –NA | 21.92 | 8.04 | 16.36 | 6.17 | 22.14 | 7.06 | 19.25 | 10.21 |

- Mean age of study subjects was 46.7 years
- And the lowest mean values of serum iron (29.29mcg/dl) and folic acid (4.59ng/ml) was observed among HCV cases and serum vit-B12 (221.3 pg/ml) seen in ALC cases in this study.

## DISCUSSION

The present study evaluated the spectrum of anemia among patients with Chronic Liver Disease and demonstrated that hematological abnormalities are highly prevalent in chronic liver disease patients. In the present study, males constituted 81% of the study population, while females accounted for 19%, with a mean age of 46.7 years. The majority of patients belonged to the age group between 41–60 years. This male predominance may be attributed to the higher prevalence of alcohol consumption and chronic viral hepatitis among males.[16] Similar demographic patterns have been reported in earlier studies evaluating chronic liver disease and anemia.[17]

Among the etiological spectrum of chronic liver disease, alcohol-related liver disease (ALC) was the predominant etiology followed by hepatitis B virus (HBV), hepatitis C virus (HCV), and non-alcoholic fatty liver disease (NAFLD). The majority of ALC patients belonged to the 41–50 years age group, whereas HBV patients were more commonly observed in the 51–60 years age group. HCV and NAFLD cases were predominantly distributed in the 41–50 years age group. These findings suggest that chronic liver disease commonly affects middle-aged individuals during their economically productive years, thereby increasing healthcare and socioeconomic burden.[18]

The present study showed a statistically significant association between the type of chronic liver disease and the pattern of anemia ($p < 0.05$). Among patients with alcohol-related liver disease, folic acid deficiency anemia was the most common type

(39.7%), followed by iron deficiency anemia (37.2%). Chronic alcohol intake is known to impair folate absorption, decrease nutritional intake, and directly suppress bone marrow activity, predisposing patients to folate deficiency anemia.[19] In HBV patients, iron deficiency anemia was the predominant type (54.5%), whereas in HCV patients both iron deficiency anemia and folic acid deficiency anemia were equally distributed (42.9%). Among NAFLD patients, iron deficiency and vitamin B12 deficiency anemia were equally distributed. Overall, iron deficiency anemia was the most common anemia observed across the study population. These findings are consistent with previous reports indicating that nutritional deficiencies, chronic gastrointestinal blood loss, hypersplenism, and chronic inflammation contribute significantly to anemia in chronic liver disease.[20]

Regarding severity of anemia, 63% of patients had moderate anemia, 23% had mild anemia, and 14% had severe anemia. Moderate anemia being the predominant form indicates prolonged disease progression and chronic nutritional compromise in these patients.[21] Severe anemia in chronic liver disease may worsen tissue hypoxia, precipitate hepatic decompensation, and increase morbidity and mortality.[22] However, no statistically significant difference was observed between gender and severity of anemia ($p > 0.05$).

Biochemical evaluation revealed elevated bilirubin, AST, and ALT levels among all etiological groups, particularly in alcohol-related liver disease, indicating significant hepatocellular injury. Mean AST levels were markedly elevated in ALC patients compared to other etiologies, which is a characteristic biochemical pattern associated with alcoholic liver injury.[23] Serum albumin levels were reduced across all groups, reflecting impaired hepatic synthetic function and advanced liver disease. PT-INR values were also elevated, indicating coagulopathy secondary to reduced synthesis of clotting factors by the diseased liver.[24] Mean hemoglobin levels were markedly reduced in all groups, especially among HBV and HCV patients.

The findings of the present study highlight that anemia is a common and clinically significant complication among chronic liver disease patients. Early diagnosis of anemia and identification of its underlying etiology are essential for appropriate management and improvement of clinical outcomes in patients with chronic liver disease.

## CONCLUSION

The present study concludes that anemia is a common and significant hematological complication among patients with Chronic Liver Disease. The majority of patients were middle-aged males, with alcohol-related liver disease being the most common etiology. Iron deficiency anemia was the predominant type of anemia observed, followed by folic acid deficiency anemia. Most patients had moderate anemia, indicating substantial nutritional and hematological compromise associated with chronic liver disease. Abnormal biochemical parameters such as elevated liver enzymes, bilirubin, and prolonged PT-INR reflected advanced hepatic dysfunction. Early identification and appropriate management of anemia and associated nutritional deficiencies may improve quality of life, reduce complications, and enhance overall clinical outcomes in chronic liver disease patients.

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