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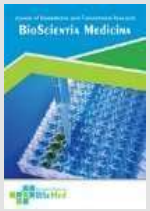

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The Relationship between Albumin Levels with SGOT, SGPT, and de Ritis Ratio in Chronic Hepatitis B Patients: A Single-Center Observational Study at Dr. M. Djamil General Hospital, Padang, Indonesia

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A B S T R A C T

Background: Chronic hepatitis B (CHB) is a persistent hepatitis B virus (HBV) infection and can cause progressive liver damage. This damage can be measured through a decrease in albumin levels and an increase in liver enzymes such as aspartate aminotransferase (AST/SGOT), alanine aminotransferase (ALT/SGPT), and de Ritis ratio (AST/ALT). This study aims to analyze the relationship between albumin levels and SGOT, SGPT, and de Ritis ratio in CHB patients. **Methods:** This cross-sectional retrospective analytical study involved 50 CHB patients diagnosed at Dr. M. Djamil General Hospital Padang between June 2022 to June 2023. Data on albumin levels, SGOT, SGPT, and de Ritis ratio were obtained from medical records. The de Ritis ratio, SGOT, and SGPT were grouped into normal and increased. Statistical analysis used an independent t-test with a significance of $p < 0.05$. **Results:** The research subjects consisted of 26 men (52%) and 24 women (48%) with an average age of 42.46 ± 13.39 years. The mean albumin level in the increased SGOT group (3.69 ± 0.78 g/dL) was significantly lower than the normal SGOT group (4.39 ± 0.61 g/dL) ($p = 0.003$). The mean albumin level in the increased de Ritis ratio group (3.90 ± 0.80 g/dL) was also significantly lower than the normal de Ritis ratio group (4.46 ± 0.70 g/dL) ($p = 0.006$). There was no significant difference between albumin levels in the normal and increased SGPT groups ($p = 0.548$). **Conclusion:** There is a significant negative relationship between albumin levels and SGOT and de Ritis ratio in CHB patients. Decreased albumin levels may be an indicator of more severe liver damage in these patients.

1. Introduction

Hepatitis B virus (HBV) infection represents a significant global health burden, with an estimated 296 million people living with chronic infection in 2019.[1] This global prevalence reflects ongoing challenges in HBV control and elimination, especially in resource-limited areas. The impact of HBV infection is not only limited to morbidity but also mortality, with around 820,000 deaths each year due to complications such as liver cirrhosis and hepatocellular carcinoma (HCC).[2] Indonesia, as a country with an HBsAg prevalence of around 9.4%, is included in the category of countries with a high prevalence of HBV infection.[3] This figure shows that almost one in ten Indonesians are infected with HBV, which puts them at risk of long-term complications such as cirrhosis and HCC. This high prevalence also has significant economic implications, both in terms of direct health care costs and lost productivity due to HBV-related morbidity and mortality.

HBV is a DNA virus that is transmitted through blood and other body fluids, including semen, vaginal fluids, and saliva.[4] Transmission can occur through various means, including unprotected sexual contact, sharing needles, unscreened blood transfusions, and from mother to child during birth. Acute HBV infection is usually asymptomatic or only causes mild symptoms such as fatigue, nausea, and jaundice. However, in a small percentage of cases, acute infection can progress to fulminant hepatitis, which is a life-threatening condition. Chronic infections occur when the immune system fails to completely clear the virus. This causes persistent liver inflammation, which over time can lead to fibrosis, cirrhosis, and ultimately HCC.[5] Fibrosis is the formation of scar tissue in the liver, while cirrhosis is an advanced stage of fibrosis in which the normal structure of the liver is replaced by extensive scar tissue. HCC is the most common type of primary liver cancer and often occurs in patients with cirrhosis due to HBV.

Liver damage in CHB can be assessed through various laboratory parameters, including serum albumin levels and liver enzymes such as aspartate aminotransferase (AST/SGOT) and alanine aminotransferase (ALT/SGPT).[6] Albumin is the main protein synthesized by the liver and has various important functions in body. Albumin functions as a transporter for various molecules, including hormones, fatty acids, bilirubin, and drugs. In addition, albumin also plays a role in maintaining plasma oncotic pressure, which is important for maintaining adequate blood volume. Albumin also has antioxidant properties, which can protect cells from damage caused by free radicals.[7,8] A decrease in serum albumin levels in CHB patients can indicate a disruption in the function of protein synthesis in the liver due to liver cell damage.[9,10] Liver cell damage can be caused by various factors, including chronic inflammation, fibrosis, and cirrhosis. Decreased albumin levels may also be an independent predictor for mortality in CHB patients, indicating that albumin is not only a marker of liver damage, but also plays a role in the pathogenesis of the disease.

SGOT and SGPT are intracellular enzymes that are mainly found in the liver, although they are also present in small amounts in other tissues such as heart muscle and skeletal muscle.[11,12] Increased levels of SGOT and SGPT in serum indicate liver cell damage and the release of these enzymes into the circulation. Elevated SGOT and SGPT levels can occur in various liver diseases, including CHB, alcoholic hepatitis, and non-alcoholic fatty liver disease. The de Ritis ratio, which is the AST/ALT ratio, is also used as an additional indicator to differentiate between different types of liver disease.[13] A high de Ritis ratio (>2) is often associated with alcoholic liver disease, whereas a low de Ritis ratio (<1) is more common in acute viral hepatitis. In CHB patients, the de Ritis ratio can vary depending on the severity of the disease and the presence of complications such as fibrosis and cirrhosis. Understanding the relationship between albumin levels and SGOT, SGPT, and de Ritis ratio in CHB patients is very important to identify patients who are at risk of more severe liver damage. Additionally, this information may also help guide therapeutic decisions, such as selecting appropriate antiviral therapy and monitoring response to therapy. This study aims to analyze the relationship between albumin levels and SGOT, SGPT, and de Ritis ratio in CHB patients at Dr. M. Djamil General Hospital Padang.

2. Methods

This study used a cross-sectional retrospective design (cross-sectional). This design was chosen because it allows researchers to collect data on the relationship between albumin levels and SGOT, SGPT, and de Ritis ratio in chronic hepatitis B (CHB) patients at a certain point in time. The data collected came from medical records of patients who had been diagnosed with CHB at Dr. M. Djamil General Hospital Padang. This retrospective approach makes it possible to analyze existing data, making it more efficient in terms of time and resources compared to prospective designs. This research was conducted at Dr. M. Djamil General Hospital Padang which is the largest referral

hospital in West Sumatera. This hospital has complete laboratory and medical record facilities, making it possible to collect accurate and reliable data. Apart from that, Dr. M. Djamil General Hospital Padang is also a referral center for CHB patients in the West Sumatera region, so the data collected can represent the characteristics of CHB patients in the region. The study population was all patients diagnosed with CHB at Dr. M. Djamil General Hospital Padang. The research sample consisted of 50 patients who met the inclusion and exclusion criteria. This research was approved by the Research Ethics Committee of Dr. M. Djamil General Hospital Padang. All patient data is anonymized to protect their privacy. This study does not involve any intervention on patients, so there are no additional risks for patients participating in this study.

The inclusion criteria are patients aged 18 years or more. These criteria were established to ensure that research subjects were adults who were able to give informed consent and to avoid factors that could influence albumin and liver enzyme levels in children; The diagnosis of CHB must be made by a clinician based on serological examination, such as positive HBsAg for more than six months, and/or liver biopsy. This criterion ensures that the research subjects truly suffer from CHB and not other liver diseases; Complete Data: Complete data is available regarding albumin levels, SGOT, SGPT, and de Ritis ratio in the patient's medical record. These criteria are necessary to ensure that data analysis can be carried out accurately and completely. Meanwhile, the exclusion criteria are that patients with liver diseases other than CHB, such as hepatitis C, autoimmune hepatitis, and alcoholic liver disease, are excluded from this study. This was done to avoid bias in the study results caused by differences in pathophysiology and clinical manifestations between different types of liver disease; Patients with other medical conditions that could affect albumin levels, such as nephrotic syndrome and severe malnutrition, were also excluded. This was done to ensure that the changes in albumin levels observed in research subjects were truly caused by CHB and not by other factors; Antiviral Therapy: Patients undergoing antiviral therapy for CHB were excluded from this study. This is done because antiviral therapy can affect albumin levels and liver enzymes, which can interfere with the interpretation of research results.

Data were collected retrospectively from medical records of patients who met the inclusion and exclusion criteria. Data collected includes: Demographic Data: Patient age and gender; Laboratory Data: Serum albumin levels: Measured in grams per deciliter (g/dL); SGOT (AST): Measured in units per liter (U/L); SGPT (ALT): Measured in units per liter (U/L); De Ritis Ratio: Calculated by dividing the SGOT value by the SGPT value. Laboratory data were collected from the results of laboratory examinations carried out at the time of CHB diagnosis or during routine patient monitoring. All laboratory examinations were carried out at the central laboratory installation of Dr. M. Djamil General Hospital Padang using standard methods and calibrated tools.

After the data is collected, data processing is carried out to prepare the data for statistical analysis. Data is checked to ensure there are no entry errors or missing data. If errors are found, the data will be corrected or deleted if it cannot be corrected. The de Ritis ratio, SGOT, and SGPT are grouped into two categories, namely normal and increased, based on the laboratory reference values used at Dr. M. Djamil General Hospital Padang. If necessary, the data will be transformed to meet the assumptions of the statistical test to be used. Data analysis was carried out using SPSS version 25 statistical software. The independent t-test was used to compare the mean albumin levels between the normal and increased SGOT group, the normal and increased SGPT group, and the normal and increased de Ritis ratio group. The independent t-test was chosen because the data analyzed is numerical data and aims to compare the means between two independent groups. The level of significance was set at $p < 0.05$, which means that the difference between the two groups is considered statistically significant if the probability that the

difference occurred by chance is less than 5%. Apart from the independent t-test, descriptive analysis was also carried out to describe the demographic characteristics of the research subjects and the distribution of albumin levels, SGOT, SGPT, and de Ritis ratio. Descriptive analysis includes calculating the mean, standard deviation, minimum value and maximum value.

3. Results

Table 1 presents an interesting profile of 50 chronic hepatitis B (CHB) patients at Dr. M. Djamil General Hospital Padang. The gender distribution is fairly balanced, with slightly more males (52%). The age of the patients varied, with a mean of 42.46 years, but the Kolmogorov-Smirnov (K-S) test indicated an abnormal age distribution (p=0.021), indicating the possibility of certain age groups being more susceptible to CHB. The laboratory parameter albumin showed a mean of 3.96 g/dL, but the distribution was also not normal (p=0.073). This suggests there is a large variation in the degree of liver damage among patients. As many as 24% of patients had low albumin levels, indicating significant liver function disorders in some patients. The liver enzymes SGOT and SGPT showed a mean of 36.56 U/L and 38.84 U/L respectively, with a nearly normal distribution (p=0.20 and p=0.15). However, the wide range of values (7-122 U/L for SGOT and 3-148 U/L for SGPT) reflects a diverse spectrum of liver damage, ranging from mild to severe. The de Ritis ratio, the ratio between SGOT and SGPT, had a mean of 1.20, with half of the patients having a ratio ≥1. Although the distribution was close to normal (p=0.20), a wide range of values (0.41–6) indicated variation in the type of liver damage, with higher ratios indicating possible alcoholic liver disease or advanced fibrosis. Overall, Table 1 depicts a complex picture of CHB patients, with variations in age, degree of liver damage, and type of damage.

Table 1. Characteristics of respondents.

Variable	Frequency	Percentage	Mean ± SD	Median (min-max)	K-S test*
Gender					
Male	26	52			
Female	24	48			
Age (years)	50	100	42,46 ± 13,39		p = 0,021
Albumin (g/dL)			3,96 ± 10,11		p = 0,073
Normal	38	76			
Low	12	24			
SGOT (U/L)			36,56 ± 24,31	26,5 (7-122)	p = 0,20
Normal	33	66			
Increased	17	34			
SGPT (U/L)			38,84 ± 29,22	30 (3-148)	p = 0,15
Normal	34	68			
Increased	16	32			
de Ritis ratio (SGOT/SGPT)			1,20 ± 0,83	1,03 (0,41-6)	p = 0,20
≥1	26	52			
≤1	24	48			

Table 2 shows the results of the analysis of mean albumin levels in chronic hepatitis B (CHB) patients grouped based on SGOT, SGPT, and de Ritis ratio levels. There was a significant difference between the mean albumin levels in the normal SGOT group (4.39 ± 0.61 g/dL) and the increased SGOT group (3.69 ± 0.78 g/dL) with a p-value = 0.003. This shows that an increase in SGOT is associated with a decrease in albumin levels in CHB patients. The decrease in albumin levels in the increased SGOT group indicates a disruption in the function of protein synthesis in the liver due to more severe liver cell damage. There was no significant difference between the mean albumin levels in the normal SGPT group (4.20 ± 0.76 g/dL) and the increased SGPT group (4.06 ± 0.70 g/dL) with a p-value = 0.548. This shows that an increase in SGPT is not significantly related to a decrease in albumin levels in CHB patients. Although SGPT is an indicator of liver damage, albumin is influenced by various factors other than liver damage, such as nutritional status and kidney function. There was a significant difference between the mean albumin levels in the normal de Ritis ratio group (4.46 ± 0.70 g/dL) and the increased de Ritis ratio group (3.90 ± 0.80 g/dL) with a value of p = 0.006. This shows that an increase in the de Ritis ratio is associated with a decrease in albumin levels in CHB patients. An increase in the de Ritis ratio indicates more severe liver damage, and a decrease in albumin levels in this group may reflect a more severe impairment of protein synthesis function in the liver.

Table 2. Average albumin levels in SGOT, SGPT, and de Ritis ratio groups.

Parameter	Average albumin levels in normal group (g/dL)	Average albumin levels increase (g/dL)	p-value
SGOT	4,39 ± 0,61	3,69 ± 0,78	0,003*
SGPT	4,20 ± 0,76	4,06 ± 0,70	0,548
de Ritis ratio	4,46 ± 0,70	3,90 ± 0,80	0,006*

4. Discussion

The results of this study provide valuable insight into the relationship between albumin levels and liver enzymes SGOT, SGPT, and de Ritis ratio in chronic hepatitis B (CHB) patients. The main findings showed a significant negative relationship between albumin levels with SGOT and de Ritis ratio, indicating that decreased albumin levels may be a marker of more severe liver damage in CHB patients. Albumin, as the main protein synthesized by the liver, has a crucial role in maintaining body homeostasis. Albumin's functions include maintaining plasma oncotic pressure, transporting various important molecules such as hormones, fatty acids, bilirubin, and drugs, and acting as an antioxidant.[14]

Chronic HBV infection causes progressive liver cell damage, including hepatocyte necrosis, fibrosis, and cirrhosis. This damage disrupts the liver's ability to produce albumin, which is one of the main proteins synthesized by this organ.[15] Chronic inflammation that occurs in CHB triggers the release of pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha. (TNF-α). These cytokines can increase albumin catabolism, accelerate its breakdown, and contribute to a decrease in serum albumin levels.[16] In CHB patients with cirrhosis, portal hypertension can cause leakage of albumin into the peritoneal cavity (ascites) or into the digestive tract. In addition, the decline in renal function that often occurs in advanced CHB patients may also contribute to urinary albumin loss.[17] Decreased albumin levels in CHB patients have been associated with various complications, including ascites, spontaneous bacterial peritonitis, hepatic encephalopathy, and an increased risk of death.[18,19] Therefore, routine monitoring of albumin levels is very important in the management of CHB patients. Low albumin levels can be an early alarm to identify patients who are at high risk of complications and require more aggressive therapeutic intervention.

The findings of this study showed that there was a significant negative relationship between albumin levels and SGOT and de Ritis ratio. This shows that the lower the albumin level, the higher the SGOT level and de Ritis ratio. SGOT is an enzyme mainly found in the cytoplasm of hepatocytes. An increase in SGOT indicates liver cell damage. When hepatocytes are damaged, SGOT is released into the bloodstream, causing an increase in serum SGOT levels.[20] A decrease in albumin levels can also occur due to hepatocyte damage which interferes with albumin synthesis.

Fibrosis and cirrhosis of the liver are consequences of chronic liver damage. In this condition, normal liver tissue is replaced by scar tissue, which can disrupt overall liver function. More severe liver damage in fibrosis and cirrhosis can cause decreased albumin synthesis and increased SGOT release from damaged hepatocytes.[21] Chronic inflammation in CHB can trigger increased production of various inflammatory mediators, including pro-inflammatory cytokines. These cytokines can increase the permeability of liver cell membranes, allowing more SGOT to leak into the bloodstream. In addition, pro-inflammatory cytokines can also increase albumin catabolism, thereby contributing to a decrease in serum albumin levels.[22]

The de Ritis ratio, which is the ratio between SGOT and SGPT, is not just a comparison of two liver enzymes. This ratio can provide additional information about the type and severity of liver damage. In general, a higher de Ritis ratio (>2) is often associated with alcoholic liver disease, whereas a lower ratio (<1) is more often found in acute viral hepatitis.[23] However, in the case of CHB, an increased de Ritis ratio may indicate presence of advanced fibrosis or cirrhosis.[24]

HBV can infect and damage mitochondria in hepatocytes. Because SGOT is more abundant in mitochondria than SGPT, mitochondrial damage can cause a higher increase in SGOT compared to SGPT, thereby increasing the de Ritis ratio.[25] Liver fibrosis and cirrhosis can cause structural changes in the liver that can affect the distribution of liver enzymes. In this condition, more SGOT may be released from damaged hepatocytes than SGPT, thereby increasing the de Ritis ratio.[26] Excessive alcohol consumption in CHB patients can worsen liver damage and cause an increase in the de Ritis ratio. Alcohol can damage mitochondria and accelerate liver fibrosis, both of which can contribute to an increased de Ritis ratio.[27]

The findings of this study have important implications in clinical practice. First, this study emphasizes the importance of routinely monitoring albumin and liver enzyme levels (SGOT, SGPT, and de Ritis ratio) in CHB patients. This monitoring can be helpful in Decreased albumin levels and elevated liver enzymes may indicate more severe liver damage; Changes in albumin and liver enzyme levels over time can provide information about disease progression and response to therapy; Patients with low albumin levels and elevated liver enzymes may be at higher risk for complications such as ascites, spontaneous bacterial peritonitis, and hepatic encephalopathy.

In addition to its role as a prognostic marker, albumin has also attracted attention as a potential therapeutic target in CHB patients with low albumin levels. Several studies have shown that albumin supplementation can provide benefits in patients with chronic liver disease, including cirrhosis.[28,29] Albumin plays an important role in maintaining plasma oncotic pressure, which is important for preventing fluid accumulation in tissues (edema) and body cavities (ascites). Albumin supplementation can help increase plasma oncotic pressure and reduce the risk of edema and ascites in CHB patients.[30] Albumin also plays a role in transporting various important substances, such as hormones, fatty acids, bilirubin, and drugs. Albumin supplementation may help improve liver function by increasing the transport of these substances.[31] Albumin has anti-inflammatory and antioxidant properties that may help reduce liver damage due to inflammation and oxidative stress.[32] Although some studies have shown promising results, more research is still needed. further to evaluate the effectiveness and safety of albumin supplementation in CHB patients. Larger randomized controlled clinical studies are needed to determine whether albumin

supplementation can improve clinical outcomes and quality of life in CHB patients with low albumin levels.

SGOT and SGPT, apart from being indicators of liver damage, can also be used as predictors of liver fibrosis in CHB patients. Liver fibrosis is the process of scar tissue formation in the liver due to chronic liver damage. Severe liver fibrosis can progress to cirrhosis, which is an incurable condition and can lead to various complications, including liver failure and hepatocellular carcinoma (HCC).[33] Several studies have shown that the AST/ALT ratio (de Ritis ratio) can be used to predict liver fibrosis in CHB patients. A higher de Ritis ratio (>1) has been associated with a significantly increased risk of liver fibrosis.[34,35] In addition, increased SGOT and SGPT levels can also be a predictor of liver fibrosis in CHB patients.[36]

Regular monitoring of SGOT and SGPT can help identify CHB patients who are at high risk of developing liver fibrosis. Patients with significant increases in SGOT and SGPT may require further evaluation, such as imaging studies or liver biopsy, to assess the degree of liver fibrosis. Early detection of liver fibrosis may allow earlier therapeutic intervention, which can slow or even reverse the progression of fibrosis. Hepatocellular carcinoma (HCC) is the most common type of liver cancer and is one of the leading causes of cancer-related deaths worldwide.[37] CHB is a major risk factor for HCC, and this risk increases with the severity of liver damage. Several studies have shown that increased SGOT and SGPT levels can be a predictor of CHB progression to HCC.[38,39] CHB patients with persistent elevated SGOT and SGPT may require closer monitoring and regular HCC screening.

5. Conclusion

This study shows that albumin levels are negatively related to SGOT and de Ritis ratio in CHB patients. Decreased albumin levels may be an indicator of more severe liver damage in these patients. However, no significant relationship was found between albumin levels and SGPT.

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