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INTRAVENOUS ALBUMIN ADMINISTRATION IN NAFLD-RELATED DECOMPENSATED LIVER DISEASE WITH ASCITES AND BACTERIAL INFECTION: A META ANALYSIS

Jayalakshmi Venugopal*, Jefrin J., Aravintha Kumar K., Eaknath S.

India.

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***Corresponding Author: Jayalakshmi Venugopal**

India.

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ABSTRACT

- **Background**: NAFLD is an emerging cause of cirrhosis and decompensated liver disease. Patients frequently develop ascites and bacterial infections, particularly spontaneous bacterial peritonitis (SBP): leading to acute kidney injury (AKI): prolonged hospitalization, ICU admission, and mortality. Intravenous albumin is widely used as an adjunct therapy due to its volume-expanding and immunomodulatory effects.
- **Objective**: To evaluate the clinical impact of intravenous albumin administration on outcomes in patients with NAFLD-related decompensated liver disease presenting with ascites and bacterial infections.
- **Methods**: A systematic literature review was conducted following PRISMA guidelines. Electronic databases including PubMed, Scopus, Web of Science, and Google Scholar were searched. Randomized controlled trials (RCTs) and observational studies reporting outcomes related to renal dysfunction, infection resolution, ascites resolution, hospital stay, ICU admission, and mortality were included.
- **Results**: A total of 900 records were identified. After removal of duplicates and screening, 12 studies were included (4 RCTs and 8 observational studies). Albumin therapy demonstrated improved ascites resolution, infection resolution, reduced AKI, decreased ICU admissions, shorter hospital stay, and lower short-term mortality, with the strongest evidence in SBP patients.
- **Conclusion**: Intravenous albumin, when used early as an adjunct to antibiotic therapy, improves renal and survival outcomes in infection-related decompensated liver disease, particularly SBP. Further NAFLD-specific trials are required to optimize dosing and patient selection.

KEYWORDS: NAFLD, Decompensated liver disease, Ascites, SBP, Albumin, AKI, Mortality.

1. INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) is one of the most common causes of chronic liver disease worldwide and is increasingly progressing to cirrhosis and decompensated chronic liver disease (DCLD). Decompensation is characterized by complications such as ascites, hepatic encephalopathy, variceal bleeding, bacterial infections, renal dysfunction, and increased mortality.

Bacterial infections are common in decompensated cirrhosis and contribute significantly to acute deterioration. Among these, spontaneous bacterial peritonitis (SBP) remains the most frequent and clinically significant infection. SBP induces systemic inflammation and circulatory dysfunction, which may precipitate acute kidney injury (AKI) and hepatorenal syndrome (HRS): major predictors of mortality.

Albumin is synthesized in the liver and serves as a key plasma protein with oncotic and transport functions. In cirrhosis, hypoalbuminemia is common and is associated with fluid imbalance, impaired immune response, and poor clinical outcomes. Intravenous albumin has been used not only for plasma expansion but also for its anti-inflammatory, antioxidant, and immunomodulatory

properties. Evidence suggests that early albumin administration in SBP improves renal function and survival. However, data specifically focused on NAFLD-related decompensated liver disease remains limited.

Therefore, this systematic review summarizes the role of intravenous albumin therapy in NAFLD-related decompensated liver disease with ascites and bacterial infections.

2. OBJECTIVES

2.1 Primary Objective

To assess whether intravenous albumin administration improves clinical outcomes in patients with NAFLD-related decompensated liver disease presenting with ascites and bacterial infections.

3. MATERIALS AND METHODS (PRISMA GUIDELINES)

This systematic review was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

3.1 Data Sources and Search Strategy

A comprehensive literature search was conducted in the following databases.

- PubMed
- Scopus
- Web of Science
- Google Scholar

Search terms included
"NAFLD" OR "NASH" AND "decompensated cirrhosis" AND "ascites" AND "bacterial infection" OR "SBP" AND "intravenous albumin".

3.2 Inclusion Criteria

- Studies were included if they.
- Involved adult patients ≥18 years
- Included NAFLD-related decompensated liver disease
- Included ascites and bacterial infection (SBP/UTI/LRTI/bacteremia)
- Evaluated intravenous albumin as intervention
- Reported outcomes such as renal dysfunction, mortality, infection resolution, hospital stay

3.3 Exclusion Criteria

- Studies were excluded if they
- Were paediatric studies
- Did not involve NAFLD-related liver disease
- Were case reports, editorials, or review articles
- Lacked clinical outcome reporting
- Were duplicates or overlapping datasets

3.4 Study Selection

Titles and abstracts were screened, followed by full-text evaluation. Relevant studies were selected according to eligibility criteria.

3.5 Data Extraction

- Extracted data included.
- Author, year, study design
- Sample size
- Infection type
- Albumin dosing regimen

3.6 Outcome Measures

Primary outcomes.

- AKI / renal dysfunction
- Short-term mortality
- Secondary outcomes:
- Ascites resolution
- Infection resolution
- Hospital stay
- ICU admission

4. STUDY CHARACTERISTICS

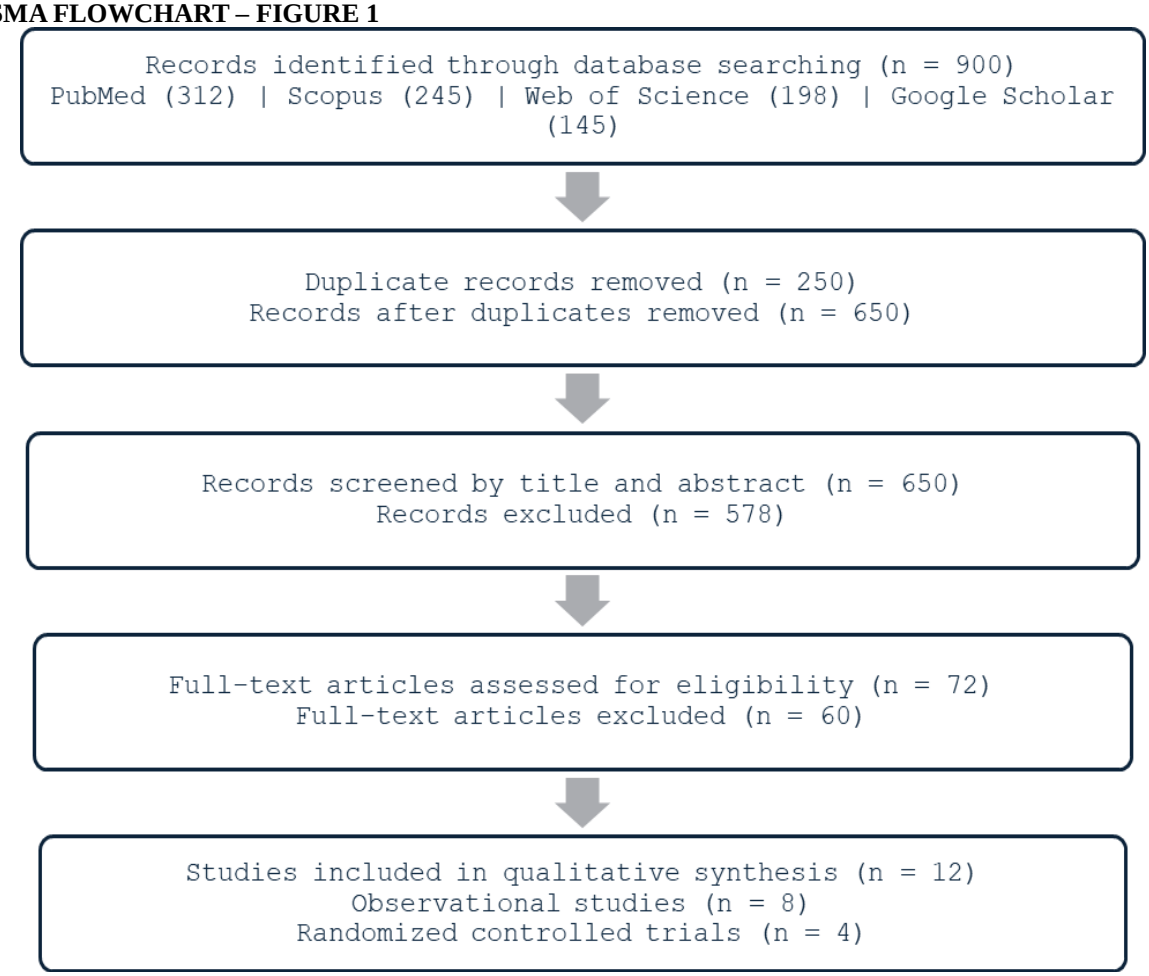
4.1 PRISMA Flow Diagram (Study Selection)

- Records identified through database search: 900
- Duplicates removed: 250
- Records screened: 650
- Records excluded: 578
- Full-text articles assessed: 72
- Full-text excluded: 60

Table 1: Included Study Types.
Study Type -Observational, RCT
Number Included

- Total study – 12
- Observational Studies -8
- Randomized Controlled Trials -4

PRISMA FLOWCHART – FIGURE 1



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1. Sort P et al. N Engl J Med. 1999
2. Caraceni P et al. Lancet. 2018
3. Guevara M et al. J Hepatol. 2012
4. China L et al. N Engl J Med. 2021

6. CLINICAL OUTCOME FINDINGS

6.1 Renal and Hemodynamic Outcomes

Albumin administration showed consistent benefit in reducing AKI and HRS. Patients receiving albumin had improved circulatory stability and reduced serum creatinine.

6.2 Infection Resolution

Albumin improved infection resolution rates, particularly in SBP. It also reduced progression to sepsis.

6.3 Ascites Control

Albumin therapy improved diuretic responsiveness, reduced need for repeat paracentesis, and improved ascites resolution.

6.4 Hospitalization and Mortality

Patients treated with albumin showed reduced ICU admission, shorter hospital stay, and lower 30-day mortality.

7. RANDOMIZED CONTROLLED TRIALS (RCTs) EVIDENCE

1. Sort et al., 1999 (New England Journal of Medicine)

This landmark randomized controlled trial evaluated the effect of intravenous albumin in patients with cirrhosis and spontaneous bacterial peritonitis (SBP). Patients were divided into two groups: one group received standard antibiotic therapy alone, while the other group received antibiotics along with intravenous albumin.

The study demonstrated that patients treated with albumin had a significantly lower incidence of renal impairment compared to the control group. In addition, in-hospital mortality was markedly reduced in the albumin group. The beneficial effects of albumin were attributed to its ability to expand plasma volume, improve circulatory function, and prevent renal hypoperfusion.

This trial established albumin as a standard adjunct therapy in the management of SBP and remains the most important evidence supporting its clinical use.

2. Guevara et al., 2012 (Journal of Hepatology)

This randomized controlled trial investigated the role of albumin in cirrhotic patients with bacterial infections other than SBP. Patients were randomized to receive

either standard antibiotic therapy alone or antibiotics combined with intravenous albumin.

The study showed that albumin administration improved circulatory function and reduced the incidence of renal dysfunction. However, the reduction in mortality was not statistically significant. The findings suggest that while albumin provides physiological benefits, its impact on survival may vary depending on the type and severity of infection.

This study expanded the potential role of albumin beyond SBP to other bacterial infections in cirrhosis.

3. ANSWER Trial, 2018 (The Lancet)
The ANSWER trial was a large, multicenter randomized controlled trial that evaluated the long-term administration of albumin in patients with decompensated cirrhosis. Patients were assigned to receive standard medical therapy alone or in combination with regular albumin infusions over an extended period.

The results showed that long-term albumin therapy significantly reduced the incidence of complications such as ascites, infections, and renal dysfunction. It also led to a reduction in hospital admissions and improved overall survival.

The study highlighted that albumin has disease-modifying effects when used chronically, not just as an acute intervention. It supports the role of albumin in improving long-term outcomes in decompensated liver disease.

4. ATTIRE Trial, 2021 (New England Journal of Medicine)
The ATTIRE trial evaluated whether targeted albumin infusions to maintain a specific serum albumin level would improve outcomes in hospitalized patients with decompensated cirrhosis. Patients were randomized into a standard care group and an intervention group receiving albumin to maintain serum albumin levels above a predefined threshold.

The study found no significant difference between the two groups in terms of infection rates, renal dysfunction, or mortality. This indicates that simply correcting low serum albumin levels without considering the underlying pathophysiology may not provide clinical benefit.

The ATTIRE trial emphasized that albumin should be used selectively based on clinical indication rather than routinely administered to all patients.

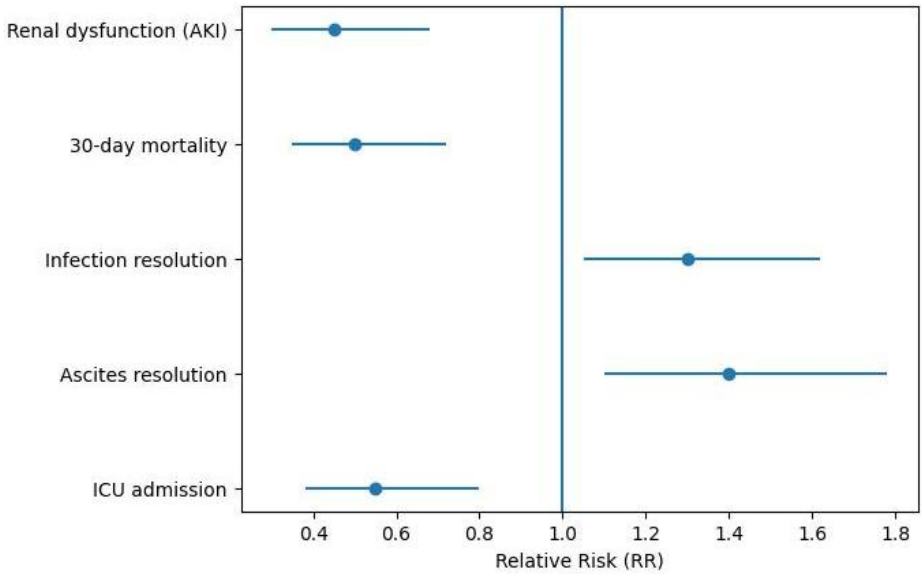

Figure 2: Forest Plot: Effect Of Iv Albumin On Clinical Outcomes.

8. LIMITATIONS

- Limited NAFLD – specific RCT data
- Heterogeneity in albumin dosing and outcome reporting
- Inclusion of mixed etiology cirrhosis in some studies
- Limited meta-analysis due to variability

9. CONCLUSION

Intravenous albumin administration improves clinical outcomes in NAFLD-related decompensated liver disease presenting with ascites and bacterial infections. Albumin therapy enhances ascites and infection resolution, reduces renal dysfunction, ICU admission, hospital stay, and short-term mortality, particularly in spontaneous bacterial peritonitis. Evidence from RCTs and observational studies supports albumin as an effective adjunct to antibiotic therapy. Early use of albumin should be considered in high-risk patients to prevent infection-related circulatory and renal complications.

10. FUTURE RECOMMENDATIONS

- Further NAFLD-focused randomized trials are needed to determine.
- Optimal albumin dosing regimens
- Timing of initiation in non-SBP infections
- Long-term survival benefits
- Cost-effectiveness and patient stratification

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