Outpatient Intravenous Albumin Decreases Hospitalization and Mortality in Patients with Cirrhosis

A Thesis Presented for the
Doctor of Medicine
Degree
Burnett School of Medicine

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December 2022

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Abstract

Main Research Question:

What is the effect of routine outpatient albumin infusion on the incidence of hospitalization and mortality in patients with end stage liver disease within a one year time period?

Background, Significance and Rationale: Administration of intravenous human albumin therapy has an important role in the management of spontaneous bacterial peritonitis, acute kidney injury, and reduction in risk of circulatory dysfunction following paracentesis. We hypothesized that albumin infusions given on an outpatient basis with increasing frequency will improve volume management and outcomes in patients with cirrhosis and refractory ascites or anasarca.

Methods: We examined consecutive patients with cirrhosis and refractory ascites who initiated an outpatient intravenous human albumin treatment protocol. All patients received at least one albumin infusion of 25% human albumin 50g which was given independently from albumin received during paracenteses between the years of 2011 and 2015. Patients with transjugular intrahepatic portosystemic shunts (TIPS) were excluded. Laboratory and clinical data during the three months before and longitudinal follow up over 12 months was assessed, including hospitalizations, transplantation and overall survival.

Results: 97 patients received at least one outpatient infusion of albumin. Patient demographics included median age 62 (range 38-86), 64% male, 86% Caucasian, 43% cryptogenic/nonalcoholic fatty liver disease and 34% chronic hepatitis C. Primary presentation included ascites 74%, hepatic hydrothorax 13%, and anasarca 12%. Median Model for End-Stage Liver Disease (MELD) score was 15 (6-29) with 24% MELD >20 and 51% of patients required hospitalizations within three months prior to initiation of outpatient albumin protocol. 18% of patients received a transplant by 12 months and 69% died during follow up. The median frequency of albumin infusions among patients was one infusion every 3 weeks and 40% received albumin infusions at least once every 2 weeks. Frequency of hospitalizations was decreased at 3 months ($p=0.04$), 6 months ($p=0.04$), and 12 months ($p=0.08$) among patients who had infusions at least every 2 weeks. Competing-risks regression was performed, demonstrating patients who received albumin infusions at least once every 2 weeks during the first 12 months had a lower cumulative incidence of death accounting for liver transplantation as a competing event ($p=0.05$), independent of sustained virologic response with chronic hepatitis C treatment and MELD score ($p = 0.04$).

Conclusions: Outpatient intravenous human albumin infusions every 2 weeks or more is associated with decreased risk of hospitalization and mortality in patients with cirrhosis who were not candidates for TIPS procedure. Albumin therapy may improve outcomes through enhanced volume management and reduced incidence of complications.

Research Questions:

What is the effect of routine outpatient albumin infusion on the incidence of hospitalization and mortality in patients with liver cirrhosis, refractory ascites, and anasarca within a one year time period?

What is the most effective frequency of outpatient albumin infusions (once a week vs once every two weeks vs once a month) to decrease the incidence of hospitalization and mortality in patients with liver cirrhosis, refractory ascites, and anasarca within a one year time period?

Does the efficacy of routine outpatient albumin infusions in patients with end stage liver disease change over a one year time period?

We hypothesize that routine albumin infusions as well as increased frequency of outpatient albumin infusions will decrease incidence and mortality in patients with end stage liver disease. We also hypothesize that the efficacy of outpatient albumin infusions will remain the same over the course of 12 months.

Introduction, Significance, Rationale

Liver cirrhosis is a late stage hepatic disease state characterized by replacement of functional hepatic tissue with non-functional fibrotic tissue.[1] It is a devastating disease with high morbidity and mortality and is the 12th most common cause of death in the world.[2] Though liver cirrhosis can result from a host of etiologies such as alcoholic liver disease, fatty liver disease, or viral hepatitis the end result of liver cirrhosis is markedly similar with varying prognosis based on lab findings. The prognosis of disease can be described using the Model for End Stage Liver Disease (MELD) score which takes objective measurements of International Normalized Ratio (INR), creatinine, and bilirubin to predict survival.[3] Patients with high MELD scores have poor prognosis and high mortality rates along with higher incidence of common, cirrhosis-related complications. The most common complications brought on by the loss of hepatic functionality include ascites and anasarca.

Ascites is the most common complication of cirrhosis, occurring in up to 50% of patients with compensated cirrhosis within ten years of follow up.[4] Refractory ascites, known as diuretic-resistant ascites, is defined by recurrence despite maximal doses of diuretics and a sodium-restricted diet. [5] Complications of refractory ascites include spontaneous bacterial peritonitis (SBP), hepatorenal syndrome (HRS), and hepatic hydrothorax.[6] Additionally, individuals with refractory ascites frequently develop elevated serum creatinine while undergoing diuretic therapy as a consequence of renal hypoperfusion and prerenal azotemia.[5] Treatment of refractory ascites includes frequent large-volume paracenteses, transjugular intrahepatic portosystemic shunt (TIPS), and ultimately liver transplantation.[6] Refractory ascites is associated with a poor prognosis and a six-year survival of 21% compared with 54% in patients with well-controlled

ascites.[7] Refractory ascites is the reason behind 35% of hospitalizations in patients with end stage liver disease requiring hospitalization.[8] This poses a significant financial burden since hospitalizations account for 50% of health care expenditures in patients with end stage liver disease.[2]

Anasarca is a similar complication of cirrhosis and prominent in patients with end-stage organ dysfunction, however fluid accumulation is more generalized in nature. Though epidemiological studies have not been performed for this particular complication, anasarca has high incidence in patients with liver disease and is a common complaint and cause of hospitalization for patients with liver disease.[9]

Albumin is a multifunctional protein involved in protein transport, metabolism, and immunomodulation, among other roles.[10] In cirrhotics, administration of intravenous human albumin can prevent post-paracentesis circulatory dysfunction, improve survival in the setting spontaneous bacterial peritonitis, and may reduce duration of hospitalization in patients presenting with ascites.[11-13] Intravenous albumin given under these circumstances can expand the intravascular circulatory volume, improve renal perfusion, and decrease the risk of acute kidney injury and HRS.[13] An unblinded, randomized trial revealed that weekly albumin infusions begun after a patient's first episode of ascites has been found to significantly increase survival and decrease risk of ascites recurrence.[13] And further studies on patients with uncomplicated ascites receiving albumin infusions have shown increased survival with similarly decreased recurrence of ascites.[13,14] Additional retrospective data on patients with cirrhosis and refractory ascites who were not candidates for undergoing TIPS suggested weekly albumin infusions may be effective in achieving diuresis and reducing body weight associated with fluid overload.[15] Albumin has also been found to make vasopressin analogues such as terlipresson more effective when used as an adjunct.[16]

With this understanding, we implemented a protocol of outpatient intravenous albumin therapy in a cohort of patients with decompensated cirrhosis and refractory ascites or anasarca. We then performed a retrospective analysis to determine whether outpatient albumin may improve volume management in these patients with assessment of endpoints including requirement for paracentesis or thoracentesis, frequency of hospitalization, and survival.

By studying the effects of routine outpatient albumin infusions on patients with end stage liver disease who are not candidates for TIPS and determining the best frequency at which to do infusions, we hope to change the current standard of care so that these patients can stay out of the hospital and live longer lives.

Research Materials and Methods

Patients

All patients were followed within a large tertiary care outpatient hepatology practice affiliated with the Baylor Simmons Transplant Institute at the Baylor Scott & White All Saints Medical Center in Fort Worth and Baylor University Medical Center in Dallas, Texas. Patients with cirrhosis and recurrent ascites, hepatic hydrothorax, or anasarca who were identified by their primary hepatologist as refractory to diuretic therapy were initiated on an intravenous albumin therapy protocol administered within our outpatient clinics. A retrospective review of all patients who initiated the protocol from 2011 to 2015 were included in the analysis. Laboratory and clinical data, including hospitalizations, during the three months before and longitudinal follow up over 12 months was assessed, including hospitalizations, transplantation and overall survival. All demographic, clinical, and laboratory data were obtained through retrospective review of clinic and hospital electronic medical record systems in accordance with a protocol approved by the Institutional Review Board of Baylor Research Institute.

Albumin Therapy

Patients were initiated on a regimen of outpatient intravenous infusions of 25% human albumin at a dose of 50 grams per infusion. Albumin infusions were administered as frequently as once every week or less frequent at the discretion of the primary hepatologist. Albumin was given independent of any albumin received during paracenteses or whether a patient required a paracentesis. As albumin given during a paracentesis was not considered to be part of the outpatient albumin infusion protocol, any volume given in this setting was not included in data analysis. All patients who received at least one outpatient albumin infusion as part of the outpatient albumin therapy protocol were included in this study.

Follow up, hospitalization, and survival

All patients were closely followed within our hepatology clinics during the three months prior to and twelve months after initiation of the outpatient albumin infusion protocol. Key endpoints assessed included number and frequency of albumin infusions, paracenteses, number of hospitalizations, causes of hospitalizations, causes of death and overall survival. Patients who underwent liver transplantation were censored from survival analysis. Due to the close follow up of patients within the Baylor Scott & White outpatient and inpatient hepatology program, all laboratory, clinical, and hospitalization data throughout the follow up period were accounted for within the electronic medical record system.

Calculations

MELD score was calculated by the following formula: MELD(i) = 0.957 x ln(Cr) + 0.378 x ln(bilirubin) +1.120 x ln(INR) + 0.643. If initial MELD is greater than 11, we then used the formula: MELD = MELD(i) + 1.32 x (137 - Na) – [0.033 x MELD(i) x (137 - Na)]^3. MELD-Na score was calculated by the following formula: MELD-Na = MELD Score – Na -0.025 x MELD x (140-Na) +140. [17]

Statistical Analysis

Statistical analysis was performed using STATA (Version 12.1, STATA Corp., College Station, TX). Pairwise comparisons between continuous and categorical variables were assessed using the 2-sided t-test and the chi-square or Fisher's exact tests, respectively. Stepwise multivariate linear regression and logistic regression analyses were performed to assess factors predictive of continuous and categorical outcomes, respectively. Kaplan-Meier analysis with log-rank test of equality was used to examine survival. Cox proportional hazards modeling was performed to assess independent predictors of survival based on Kaplan-Meier analysis. A p-value of 0.05 was considered statistically significant and all comparisons were two-tailed.

Results

3 Months Prior to Infusion

Overall, 97 patients were identified in our clinics with refractory ascites, hydrothorax, or anasarca and were initiated on the outpatient intravenous albumin infusion protocol. Median age was 62 (38-86), median BMI 30.2 (17.2-47.2), median model for end-stage liver disease score (MELD) 15 (6-29), and median MELD-Na 18 (6-31). Over one-half of patients had a MELD score greater than 15 and approximately one-quarter with a MELD score greater than 20. The majority of patients had refractory ascites (89%) and a smaller proportion had refractory hydrothorax (14%).

51% of patients required hospitalizations during the 3 months prior to infusions with a median of 1 hospitalization per patient (range 0-5).

Figure 1. Distribution of MELD Scores

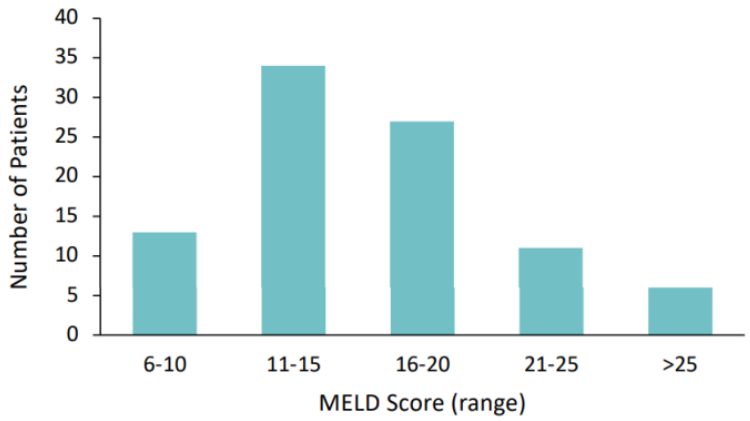
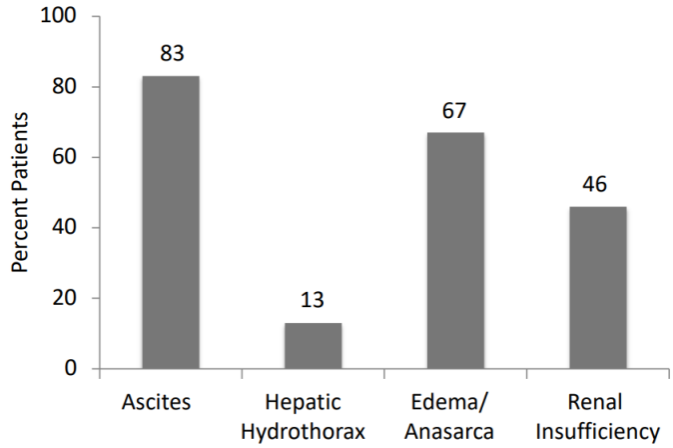


Figure 2. Baseline Complications



3 Months After Initiation of Albumin Infusions

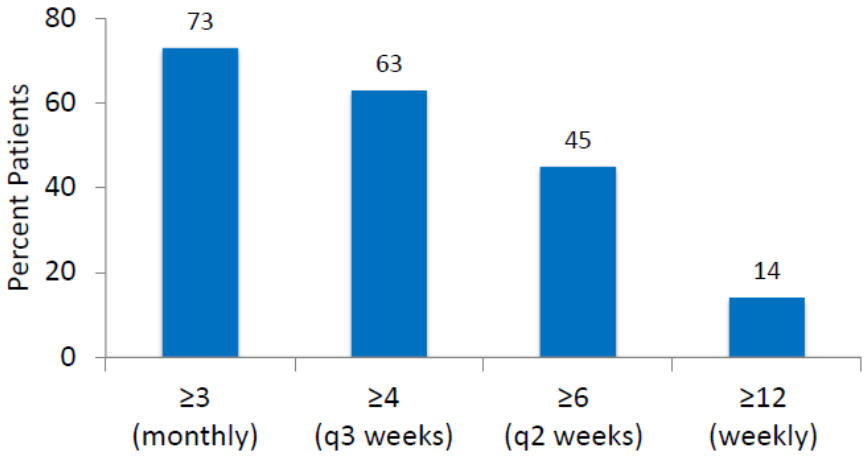
Adherence to regimen

All patients received at least 1 infusion of intravenous albumin with a median of 5 infusions (1-14) over the first 3 month period. 48 patients (49%) required hospitalizations during this time.

Table 1: Patient Characteristics after 3 month follow up

	Overall (n=97)	**≥ 3 Infusions (n=71)**	**< 3 Infusions (n=26)**	**P Value**
Age	62 (38-86)	62 (40-86)	63 (38-81)	0.80
Gender				
Male	62 (64%)	48 (68%)	14 (54%)	0.21
Female	35 (36%)	23 (32%)	12 (46%)	
Race				
Caucasian	83 (86%)	61 (86%)	22 (85%)	0.12
African American	6 (6%)	6 (8%)	0 (0%)	
Hispanic	8 (8%)	4 (6%)	4 (15%)	
Diagnosis				
Cryptogenic	35 (36%)	28 (39%)	7 (27%)	0.11
HCV	33 (34%)	26 (37%)	7 (27%)	
Other	29 (30%)	17 (24%)	12 (46%)	
HCC	15 (15%)	7 (10%)	8 (31%)	0.01
BMI	30 (17-47)	31 (20-47)	28 (17-41)	0.06
MELD	15 (6-29)	15 (6-29)	17 (6-28)	0.39
Fluid Overload				
Ascites	81 (84%)	61 (86%)	20 (77%)	0.29
Hydrothorax	13 (13%)	13 (18%)	0 (0%)	0.02
Anasarca	65 (67%)	51 (72%)	14 (54%)	0.10
Renal insufficiency	45 (46%)	30 (42%)	15 (58%)	0.18
Prior hospitalizations	63 (65%)	43 (61%)	20 (77%)	0.14

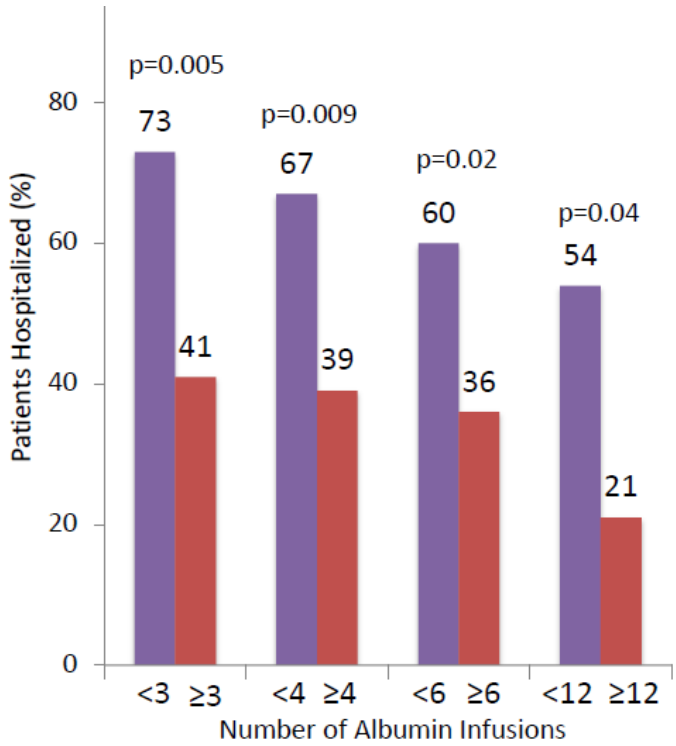
Figure 3: Number of Albumin Infusions Received Over 3 Month Follow-Up



Hospitalizations 3 Months After Initiation

Incidence of hospitalization was lower in patients who received at least 3 infusions during the 3 month period. Progressively lower incidence of hospitalization is seen with increasing frequency of infusions, with the lowest hospitalization rate in patients who received at least 12 infusions ($p<0.05$) during this time period.

Figure 4: Hospitalizations Over 3 Month Follow-Up



Using the Wilcoxon rank-sum test, the number of hospitalizations was lower after initiation of infusions in patients who received at least 3 infusions with median 0 (0-5) vs. 1 (0-3), p=0.02. This was also seen in patients receiving 4 infusions with median 0 (0-5) vs. 1 (0-3), p=0.03; 6 infusions with median of 0 (0-5) vs. 1 (0-3), p=0.05; and 12 infusions with median of 0 (0-5) vs. 1 (0-3), p=0.04.

Receiving at least 3 albumin infusions was associated with a lower risk of hospitalization independent of age, race, history of renal insufficiency, MELD score, and number of hospitalizations prior to initiating albumin therapy.

Table 2: Risk Factors for Hospitalization using Logistic Regression

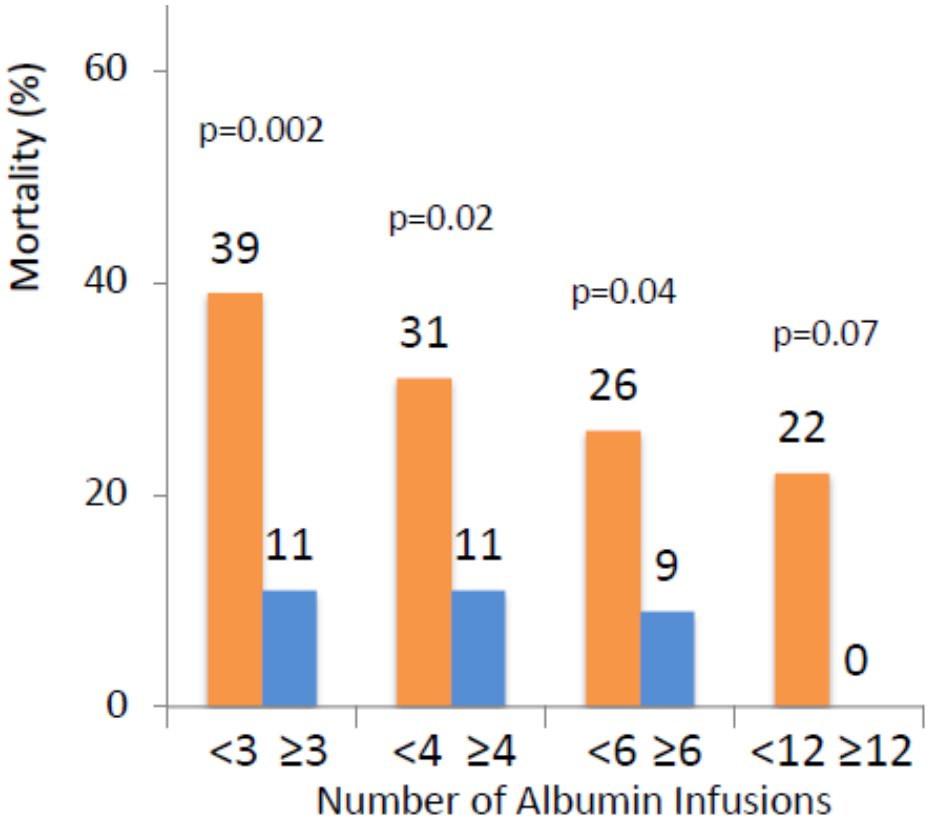
	Odds Ratio (Univariate)	**P value**	**Odds Ratio (Multivariate)**	**P value**
≥3 Infusions	0.25 (0.09-0.68)	0.007	0.24 (0.07-0.76)	0.01
Age	1.04 (0.99-1.09)	0.08	1.07 (1.00-1.13)	0.03
Caucasian race	0.34 (0.10-1.16)	0.09	0.24 (0.06-0.97)	0.05
Renal insufficiency	1.87 (0.83-4.19)	0.13	0.53 (0.17-1.65)	0.27
MELD	1.16 (1.06-1.27)	0.001	1.21 (1.07-1.36)	0.002
HCC	2.32 (0.73-7.37)	0.16	1.24 (0.31-4.94)	0.76
Prior hospitalizations	1.42 (0.93-2.16)	0.10	1.14 (0.70-1.88)	0.61

Survival 3 Months After Initiation

19% (18/97) patients died during the 3 month follow up.

Receiving at least 3 albumin infusions over 3 months was associated with a decreased incidence of death with progressively lower incidence of death with more frequent albumin infusions.

Figure 5: Mortality Over 3 Month Follow-Up



Kaplan Meier analysis (log-rank test) also demonstrated improved survival in patients who underwent 3 infusions (p=0.0004), 4 infusions (p=0.009), 6 infusions (p=0.02) and 12 infusions (p=0.065).

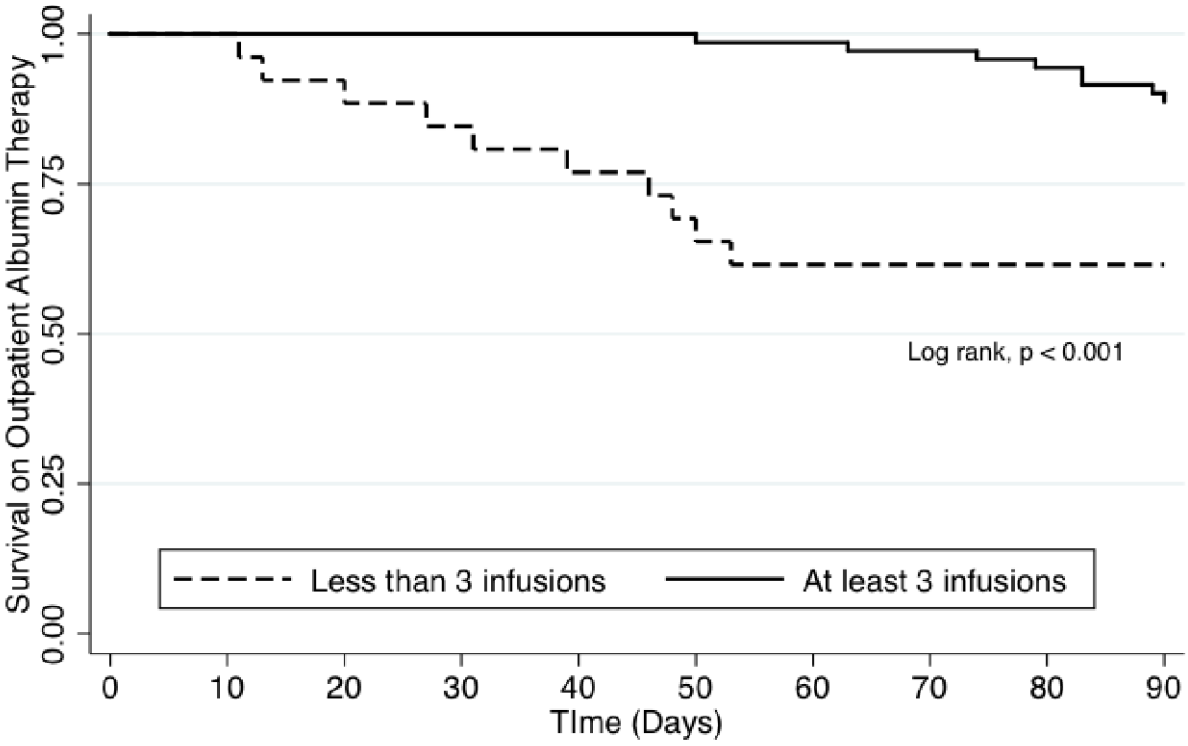
Having at least 3 albumin infusions was independently associated with improved survival with a Hazards Ratio of 0.24 (0.08-0.75) and p value of 0.01. Having 4 or 6 albumin infusions was also associated with improved survival with p values of 0.06 and 0.02 respectively.

Table 3: Risk Factors for Mortality Based on Cox Proportional Hazards Model

	Hazard Ratio (Univariate)	**P value**	**Hazard Ratio (Multivariate)**	**P value**
≥3 Infusions	0.22 (0.09-0.55)	0.001	0.24 (0.08-0.75)	0.01
Age	1.03 (0.98-1.09)	0.24	1.04 (0.98-1.10)	0.23
HCC	2.41 (0.86-6.76)	0.10	1.30 (0.38-4.52)	0.67
Renal insufficiency	1.96 (0.76-5.06)	0.16	0.76 (0.23-2.55)	0.66
BMI	0.90 (0.82-0.99)	0.03	0.95 (0.85-1.05)	0.31
MELD	1.13 (1.03-1.23)	0.01	1.15 (1.02-1.30)	0.03
Prior hospitalizations	1.35 (0.93-1.97)	0.12	1.35 (0.85-2.15)	0.21
Hospitalization after infusions	1.33 (0.94-1.88)	0.11	0.93 (0.54-1.61)	0.80

There was a higher incidence of death in patients who received less than 3 albumin infusions over the 3 month period compared to those that received 3 or more with p <0.001.

Figure 6: Survival Based on Frequency of Outpatient Albumin Over 3 Month Follow-Up



Number at Risk					
< 3 infusions	26	24	20	16	16
≥ 3 infusions	71	71	71	70	67

12 Months After Initiation of Albumin Infusions

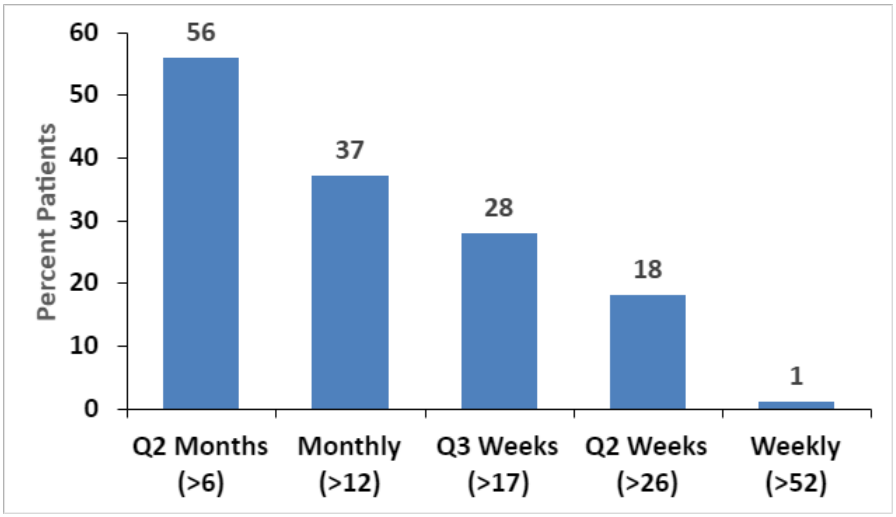
Adherence to regimen

During the 12 month follow up, median frequency of albumin infusions among patients was one infusion every 3 weeks. When corrected for patients who received a transplant or expired during this time, 40% of patients received albumin infusions at least once every 2 weeks.

Table 4: Patient Characteristics After 12 Month Follow Up

Patient Characteristics	**Overall (n=97)**	**≥ 12 Infusions (n=37)**	**< 12 Infusions (n=60)**	**P Value**
Age	62 (38-86)	61 (45-75)	62 (38-86)	0.65
Gender Male Female	 62 (64%) 35 (36%)	 26 (70%) 11 (30%)	 36 (60%) 24 (40%)	 0.31
Race Caucasian African American Hispanic	 83 (86%) 6 (6%) 8 (8%)	 35 (95%) 1 (3%) 1 (3%)	 48 (80%) 5 (8%) 7 (12%)	 0.03
Diagnosis Cryptogenic Hepatitis C Virus Other	 35 (36%) 33 (34%) 29 (30%)	 17 (46%) 11 (30%) 9 (24%)	 18 (30%) 22 (37%) 20 (33%)	 0.17
Hepatocellular Carcinoma BMI MELD	15 (15%) 31 (17-47) 16 (6-29)	4 (11%) 32 (22-43) 16 (7-29)	11 (18%) 28 (17-47) 16 (6-28)	0.30 0.08 0.92
Prior hospitalizations Hospitalizations over 12 Months Mortality	63 (65%) 1.35 39 (40%)	43 (61%) 1.57 (0-9) 6 (16%)	20 (77%) 1.22 (2%) 33 (55%)	0.14 0.38 0.00010

Figure 7: Albumin Infusions Received Over 12 Month Follow-Up



Frequency of hospitalizations was decreased at 3, 6 and 12 months among patients who had infusions at least every 2 weeks.

Figure 8: Hospitalizations Over 12 Month Follow-Up

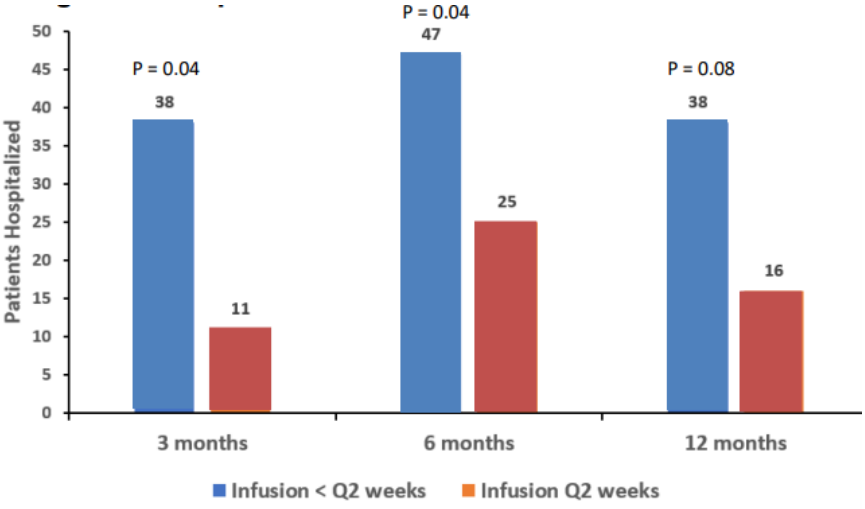


Table 5: Causes of Hospitalizations Over 12 Month Follow-Up

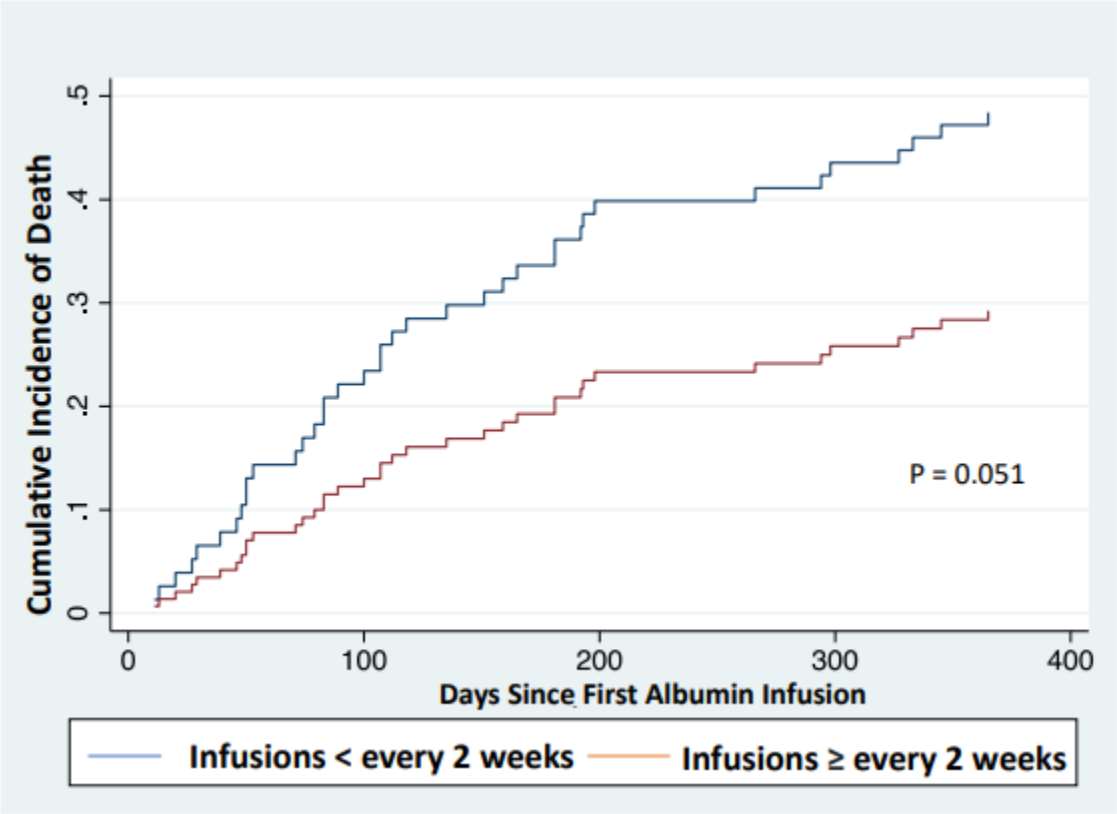
Cause of Hospitalization	Number of Patients	Percentage of total hospitalizations
Hepatic Encephalopathy	45	22.8 (45/197)
Fluid Overload		
Ascites	37	18.8 (37/197)
Anasarca	18	9.1 (18/197)
Hepatic Hydrothorax	2	1 (2/197)
Gastrointestinal Bleed	10	5 (10/197)
Electrolyte Abnormality		
Hyponatremia	10	5 (10/197)
Hypoglycemia	4	2 (4/197)
Hyperkalemia	2	1 (2/197)
Renal Failure		
Hepatorenal Syndrome	7	3.6 (7/197)
Nonspecific Acute Kidney Injury	6	3 (6/197)
Urinary Tract Infection	2	1 (2/197)
Acute Tubular Necrosis	2	1 (2/197)
Infectious		
Sepsis	7	3.6 (7/197)
Gastroenteritis	6	2.5 (6/197)
Pneumonia	5	2.5 (5/197)
Spontaneous Bacterial Peritonitis	3	1.5 (3/197)
Cellulitis	2	1 (2/197)
Cardiogenic		
Congestive Heart Failure	5	2.5 (5/197)
Atrial Fibrillation	1	1 (2/197)
Inflammatory		
Pancreatitis	4	2 (4/197)
Hernia-related complications	2	1 (2/197)
Cholecystitis	1	0.5 (1/197)
Hematologic Abnormality		
Pancytopenia	3	1.5 (3/197)
Anemia	3	1.5 (3/197)
Transfusion Reaction	1	0.5 (1/197)
Fall	3	1.5 (3/197)
Chronic Obstructive Pulmonary Disease Exacerbation	3	1.5 (3/197)
Small Bowel Obstruction	2	1 (2/197)
Narrowing of the Colon	1	0.5 (1/197)

Table 6: Causes of Death Over 12 Month Follow Up

Cause of Death	Number of Patients	Percentage of total patient deaths
Decompensated Liver Failure (Hepatic encephalopathy, fluid overload)	10	25 (10/40)
Insufficient Documentation	7	17.5 (7/40)
Sepsis	4	10 (4/40)
GI Bleed	4	10 (4/40)
Acute Coronary Syndrome	3	7.5 (3/40)
Hepatocellular Carcinoma	2	5 (2/40)
Pneumonia	2	5 (2/40)
Pulmonary embolism	1	2.5 (1/40)
Pancreatitis	1	2.5 (1/40)
Hepatorenal syndrome	1	2.5 (1/40)
Hepatopulmonary syndrome	1	2.5 (1/40)
Ruptured umbilical hernia	1	2.5 (1/40)
Inoperable bowel obstruction	1	2.5 (1/40)
Fall	1	2.5 (1/40)
Liver transplant complication	1	2.5 (1/40)

Patients who received albumin infusions at least every other week, over the 12 months of follow up had lower cumulative incidence of death with p value of 0.051.

Figure 9: Incidence of Death Over 12 Month Follow Up



Discussion

Outpatient IV albumin is associated with decreased risk of hospitalization and mortality in patients with cirrhosis and refractory ascites or anasarca, independent of risk factors including MELD scores and prior hospitalizations. The effects of outpatient albumin infusions are significant when done monthly over the first 3 months and when done at least every other week over 12 months. A similar study was done in 2006 which showed similar findings but initiated albumin infusions for patients who had just experienced their first episode of ascites.[16] Taking their findings in account, outpatient albumin infusions are not just effective for patients with their first episode of ascites, but also for patients with refractory ascites who are not candidates for TIPs placement.

The high rates of morbidity and mortality among liver cirrhotics is clearly seen in our results. In the first 3 months, 51% of patients had been hospitalized and by 12 months that number rose to 85%. As for mortality, 19% of patients had died by 3 months and 69% died after the 12 month follow up. This makes sense considering the median and high end of the initial MELD scores were 15 and 29 and correlate to 6% and 19.6% chance of death within 3 months, respectively. Looking closer at the cause of hospitalizations, 66% over the 12 month follow up were related to cirrhosis. The causes of hospitalization related to cirrhosis included fluid overload, hepatic encephalopathy, spontaneous Bacterial peritonitis, gastrointestinal bleed, and others. 48% of all deaths during follow up were also related to cirrhosis and included hepatocellular carcinoma, hepatorenal/pulmonary syndromes, etc. In future studies it would be interesting to compare these percentages with a similar patient population who are not undergoing any outpatient albumin therapy.

Our research also showed that receiving monthly albumin infusions up to the 3 month mark decreased hospitalization and mortality, but this was not seen at 12 months. Instead, only patients undergoing albumin infusions every other week or more frequently were shown to have decreased hospitalizations and mortality. This could imply that the efficacy of albumin infusions wanes over time.

Having patients undergo routine outpatient albumin infusions would change the current treatment for this patient population. Currently, administration of IV albumin is reserved for patients actively undergoing paracentesis or who suffer from hepatorenal syndrome or spontaneous bacterial peritonitis. [18] This is due to albumin infusions having the typical risks of infused medications such as transfusion reactions and fluid overload. These infusions would also be an additional cost to the patient and would only be available in specialized health care facilities. However, if we can continue to show that these outpatient albumin infusions decrease morbidity and mortality in patients with liver cirrhosis, implementing the infusion regimen has the potential to keep patients out of the hospital and enjoy longer lives.

Limitations

The retrospective design of the study is a limitation since we only have access to data that was gathered in 2015 for these patients. For example, we were unable to calculate the MELD score of a patient due to them not having labs drawn for an INR. Another limitation is that albumin infusion frequency was based on attending discretion which could introduce bias into the study. Patient compliance was also a limiting factor due to the inconvenience of regular clinic visits for the infusions. There is also a potential for selection bias since sicker patients require hospitalization and are unable to undergo outpatient albumin infusions since they are in the hospital.

Future Directions

Moving forward, it would be beneficial to do a prospective study in which patients with liver cirrhosis, refractory ascites and anasarca are randomly assigned to receive albumin infusions at set frequencies (weekly vs twice a week vs at attending's discretion) to definitively prove that outpatient albumin infusions directly decrease morbidity and mortality in patients without any selection bias. It would also be interesting to try to follow patients out further since our results imply that outpatient albumin infusion efficacy may wane over time (monthly albumin infusions were statistically significant in decreasing hospitalizations and mortality at the 3 month mark, whereas only albumin infusions every other week or more frequently by 12 months was significant).

In our patient population there were 7 patients who only had anasarca. We could have excluded them from the trial to focus solely on patients with ascites which could be an avenue for further research in looking at patients with liver cirrhosis and just ascites.

If any of these further research avenues are pursued and continue to show the benefit of intravenous albumin infusions, it could change the current standard of care for patients with liver cirrhosis who are not candidates for TIPs.

Conclusion

Outpatient intravenous albumin infusions decrease incidence of hospitalization and mortality in cirrhotic patients with refractory ascites or anasarca who are not candidates for transjugular intrahepatic portosystemic shunt (TIPS) placement.

Compliance

This research was reviewed and approved by the Baylor Scott and White Research Institute IRB on May 17th 2021.. The IRB reference number is 361293.

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