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Original Article

Talc pleurodesis for hepatic pleural effusions: clinical outcomes following serum albumin optimization

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ABSTRACT

Background: Hepatic hydrothorax is a debilitating complication of advanced liver disease, often unresponsive to medical therapy. In settings where liver transplantation and TIPS are not readily available, talc pleurodesis may offer effective palliation. This study evaluates its outcomes, safety, and predictors of recurrence in such patients.

Materials and Methods: A retrospective observational review study was conducted on 52 patients undergoing talc pleurodesis for hepatic hydrothorax between January 2020 and June 2025. Data included demographics, liver disease etiology, Child–Pugh class, MELD score, serum albumin, chest tube duration, hospital stay, recurrence, and complications. Quantitative variables were expressed as mean ± SD, and correlations were analyzed using Pearson's r.

Results: Mean age was 61.2 ± 7.2 years; 67.3% were male. Hepatitis C was the leading etiology (96.2%), and 82.7% were Child–Pugh class C. Mean MELD score was 15.2 ± 5.4, correlating with both Child–Pugh class (r = 0.67) and recurrence (r = 0.63). Baseline albumin was 2.78 ± 0.44 g/dL, inversely related to recurrence (r = –0.39). After albumin optimization (>3.4 g/dL), the correlation disappeared (r = 0.02). Mean chest tube duration was 12.8 ± 7.3 days, hospital stay 4.6 ± 2.5 days, with a strong correlation between tube duration and recurrence (r = 0.67). Clinical control was achieved in 77%; pain (19.2%) and empyema (11.5%) were the main complications.

Conclusions: Talc pleurodesis offers effective palliation and significant symptomatic relief in refractory hepatic hydrothorax, especially where advanced therapies are inaccessible, improving quality of life for patients with end-stage liver disease.

Keywords: hepatic hydrothorax, talc pleurodesis, cirrhosis, palliative management, recurrence

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Introduction

Hepatic hydrothorax (HH) is defined as the accumulation of pleural fluid in patients with liver cirrhosis in the absence of primary cardiac or pulmonary disease, and it represents a challenging complication of advanced hepatic failure. It is estimated to occur in approximately 5–10% of patients with cirrhosis and is associated with significant morbidity and mortality due to respiratory compromise and recurrent effusions [1,2]. The underlying pathophysiology involves the transdiaphragmatic movement of ascitic fluid through small defects in the diaphragm due to negative intrathoracic pressure and elevated intra-abdominal pressure [3,4].

Conservative management strategies such as sodium restriction, diuretics, and repeated thoracenteses are often insufficient in refractory cases [5]. Transjugular intrahepatic portosystemic shunt (TIPS) or liver transplantation are definitive options but are frequently unavailable or contraindicated due to comorbidities or poor hepatic reserve, especially in resource-limited settings [6,7]. For these patients, pleural interventions such as chemical pleurodesis have been explored as palliative or semi-definitive alternatives to control recurrent effusions [8].

Among sclerosing agents, talc pleurodesis remains the most widely accepted because of its efficacy, cost-effectiveness, and favorable safety profile when sterile, graded talc preparations (such as Steritalc®) are used [9,10]. However, the success rate of talc pleurodesis in hepatic hydrothorax has been variable, ranging from 11% to 72%, largely due to poor hepatic function, malnutrition, and persistent hypoalbuminemia preventing adequate pleural apposition [11,12]. Several studies have identified hypoalbuminemia as a strong predictor of pleurodesis failure, reflecting impaired reparative processes and ongoing transudation of fluid into the pleural cavity [13,14]. Therefore, pre-procedural optimization especially correction of serum albumin levels may play a pivotal role in improving pleurodesis outcomes in these patients [15].

In developing countries, where chronic liver disease is common and advanced therapeutic options remain limited, there is a need for simple, reproducible, and effective techniques for managing hepatic pleural effusions [16]. Our institutional experience has shown that normalization of serum albumin before pleurodesis, followed by complete therapeutic drainage and talc instillation, markedly enhances success rates and minimizes recurrence.

This study presents our five-year single-center experience (January 2020 to June 2025) evaluating outcomes of sterile, graded talc preparations, talc pleurodesis in hepatic pleural effusions. Our standardized protocol emphasizes albumin correction before the procedure, followed by therapeutic pleural tapping and talc pleurodesis. The albumin levels were maintained around 3.5g/dL during this whole procedure till the removal of chest tube post-procedure. The objectives of this study are to determine the overall success rate, identify predictors of failure, and assess the safety and efficacy of our albumin-optimized pleurodesis protocol in patients with hepatic hydrothorax.

Materials and Methods

Study Design and Setting

This was a retrospective observational review study conducted in the Department of Thoracic Surgery, Services Institute of Medical Sciences (SIMS), Services Hospital, Lahore, over a period of five and a half years (January 2020 to June 2025).

Study Population

Inclusion criteria: Patients aged ≥18 years presenting with pleural effusion secondary to hepatic failure (hepatic hydrothorax), confirmed clinically and radiologically, were included. Diagnosis of hepatic hydrothorax was based on: presence of liver cirrhosis and/or portal hypertension, absence of underlying primary pulmonary or cardiac disease, transudative pleural effusion on Light's criteria and complete drainage of pleural effusion before pleurodesis.

Exclusion criteria: Malignant or tuberculous pleural effusions: spontaneous bacterial empyema, spontaneous bacterial peritonitis, uncorrectable coagulopathy (INR > 2.5), patients having albumin of < 3.5 g/dL despite optimization, patients unfit for thoracic procedures and those who declined consent (Figure 1).

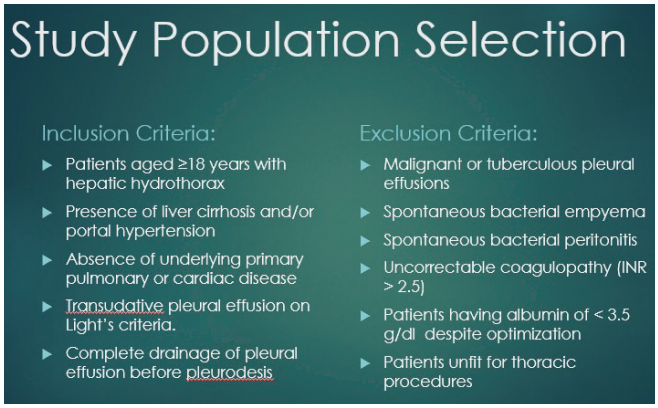

Figure 1. Flowchart demonstrating the selection of the study population based on inclusion and exclusion criteria.

Pre-Procedural Optimization

Serum albumin optimization followed a standardized protocol supervised by the hepatology team. Intravenous 20% human albumin was administered at 1 g/kg divided over 48–72 hours, followed by daily supplementation of 20–40 g/day depending on urine output, hemodynamics, and laboratory monitoring. Optimization continued until albumin was ≥3.5 g/dL on two consecutive days. Nutritional support included high-protein oral diet (1.2–1.5 g/kg/day) or enteral supplementation. Diuretics were titrated to achieve controlled negative fluid balance without worsening renal function.

Importantly, albumin levels were maintained within the optimized range (≥3.5 g/dL) for four weeks following talc pleurodesis to support pleural symphysis and minimize recurrence. Patients who failed to achieve the minimum optimization threshold (≥3.5 g/dL) prior to pleurodesis, or those whose serum albumin dropped below the optimized range during the four-week post-pleurodesis period, were excluded from the study analysis. Twelve patients initially failed to reach ≥3.5 g/dL and pleurodesis was postponed; all subsequently achieved optimization before proceeding with the procedure. No patient underwent pleurodesis without meeting the predefined albumin threshold.

Pleural Fluid Drainage and Talc Pleurodesis Technique

Once albumin levels were optimized, therapeutic pleural drainage was performed to evacuate the effusion completely. A 28–32 Fr intercostal tube was inserted under aseptic conditions and connected to underwater seal drainage.

When full lung re-expansion was confirmed on chest radiograph and daily drainage was <100 mL, talc pleurodesis was performed (3 g in sterile saline slurry). The talc slurry was instilled through the chest tube, which was then clamped for 2 hours.

After unclamping, the tube remained on underwater seal drainage until output was minimal and no radiological evidence of recurrence was seen. The tube was removed once pleural symphysis was confirmed clinically and radiographically.

Post-Procedural Care and Follow-Up

Patients were monitored for pain, fever, and dyspnea post-procedure. Antibiotics and analgesics were administered as required. Follow-up chest radiographs were obtained at 24 hours, one week, and one month post-procedure, and then at three-month intervals for up to six months. Pleurodesis success was defined as the absence of reaccumulation of pleural fluid on imaging and symptom resolution for ≥3 months post-procedure without repeat thoracentesis. Failure was defined as reaccumulation of effusion requiring further drainage or repeat pleurodesis.

This study was conducted as a retrospective review of routinely collected clinical data. The study was approved by the institutional ethics review board of Services Institute of Medical Sciences with reference number IRB/2025/1677/SIMS on 20.10.2025. As per institutional policy for retrospective studies with minimal risk, the requirement for individual informed consent was waived. All patient data were anonymized and handled confidentially in accordance with the Declaration of Helsinki and institutional guidelines to ensure protection of patient privacy.

Statistical Analysis

All data were analyzed using SPSS version 26. Quantitative variables (age, MELD score, serum albumin, chest tube duration, hospital stay) were expressed as mean ± SD with range, while categorical variables (gender, Child–Pugh class, etiology, recurrence, complications) were presented as frequencies and percentages. Pearson's correlation coefficient (r) was used to assess relationships between MELD score, Child–Pugh class, serum albumin, chest tube duration, and recurrence. For patients achieving post-optimization albumin >3.4 g/dL, the correlation with recurrence was recalculated to evaluate the effect of corrected hypoalbuminemia. All correlation coefficients were accompanied by two-tailed p-values, with significance set at $p < 0.05$. A multivariable logistic regression model was constructed to identify independent predictors of pleurodesis failure. Variables with $p < 0.10$ on univariate analysis (MELD score, Child–Pugh class, baseline albumin, chest tube duration) were included in the final model.

Results

A total of 52 patients who underwent talc pleurodesis for hepatic pleural effusion were included in the study. The mean age of the cohort was 61.2 ± 7.2 years (range: 45–73 years). There were 35 males (67.3%) and 17 females (32.7%). The predominant etiology of hepatic hydrothorax was hepatitis C infection (50/52; 96.2%), followed by alcohol-related liver disease (12/52; 23.1%) and hepatitis B infection (5/52; 9.6%). Several patients had dual etiologies, such as hepatitis C with alcohol use

disorder. Therefore, percentages exceed 100%. Etiologies were not mutually exclusive. Most patients were classified as Child–Pugh class C (43/52; 82.7%), indicating advanced hepatic dysfunction.

The mean MELD score was 15.2 ± 5.4 (range: 6–25). A strong positive correlation was observed between MELD score and Child–Pugh class (r = 0.67), suggesting that higher MELD values were associated with more severe hepatic impairment. MELD score also correlated positively with recurrence (r = 0.63), while a moderate correlation was noted between Child–Pugh class and recurrence (r = 0.50).

The mean baseline serum albumin was 2.78 ± 0.44 g/dL (range: 1.8–3.7 g/dL). After nutritional and medical optimization, post-procedure albumin levels were maintained at >3.4 g/dL in all patients. Baseline albumin demonstrated a moderate inverse correlation with recurrence (r = –0.39), indicating that patients with lower pre-procedure albumin levels were more likely to experience recurrent effusion. However, after optimization, this correlation became negligible (r = 0.02), suggesting that once hypoalbuminemia was corrected, recurrence was more closely linked to hepatic reserve rather than albumin level.

The mean chest tube duration was 12.8 ± 7.3 days (range: 3–30 days), and the mean hospital stay was 4.6 ± 2.5 days (range: 3–15 days). A strong positive correlation (r = 0.67) was observed between chest tube duration and recurrence, implying that patients requiring prolonged drainage were more likely to develop recurrence, likely due to persistent fluid production or incomplete pleural apposition.

The mean time to recurrence after a single session of pleurodesis was 5.0 ± 2.4 days (range: 3–8 days). Twenty-two (42.3%) patients achieved complete resolution with a single pleurodesis session, 15 (28.8%) required two sessions, and 3 (5.7%) required three sessions. Twelve (23%) patients experienced pleurodesis failure with persistent effusions. Overall, final clinical control of pleural effusion was achieved in 40 patients (77%), while 12 patients (23%) experienced recurrence or died during follow-up.

On multivariable logistic regression, MELD score (p = 0.01) and chest tube duration (p = 0.03) were independent predictors of recurrence, while post-optimization albumin was not statistically significant.

Complications were noted in several patients, with pain being the most frequent (10 patients; 19.2%), followed by fever (2 patients; 3.8%). Empyema developed in 6 patients (11.5%), all within the subgroup experiencing pleurodesis failure. Five patients (9.6%) died during follow-up. Four deaths occurred within 30 days, primarily due to progressive hepatic failure (n = 3) and sepsis unrelated to empyema (n = 1). One late death (after 30 days) resulted from variceal bleeding.

Table 1. Baseline demographic and clinical characteristics.

Variable	N (%) or Mean ± SD	Range
Total Patients	52	—
Age (Years)	61.2 ± 7.2	45–73
Gender		
Male	35 (67.3%)	—
Female	17 (32.7%)	—
Etiology		
Hepatitis C	50 (96.2%)	—
Hepatitis B	5 (9.6%)	—
Alcoholic liver disease	12 (23.1%)	—
Child–pugh category		
Class A	0 (0%)	—
Class B	9 (17.3%)	—
Class C	43 (82.7%)	—
MELD score	15.2 ± 5.4	6–25
Baseline albumin (g/dL)	2.78 ± 0.44	1.8–3.7
Chest tube duration (days)	12.8 ± 7.3	3–30
Hospital stay (days)	4.6 ± 2.5	3–15

Table 2. Correlation analysis between clinical parameters and recurrence.

Variables Compared	Correlation coefficient (r)	Interpretation	p-value
MELD vs child–pugh class	0.67	Strong positive	< 0.001
MELD vs recurrence	0.63	Moderate–strong positive	< 0.05
Child–pugh vs recurrence	0.50	Moderate positive	< 0.05
Baseline albumin vs recurrence	–0.39	Moderate negative	< 0.05
Post-optimization albumin vs recurrence	0.02	No correlation	0.91
Chest tube duration vs recurrence	0.67	Strong positive	< 0.05

Table 3. Procedural outcomes and complications.	
Variable	n (%)
Outcome	
Complete control after 1 session	22 (42.3%)
Two sessions required	15 (28.8%)
Three sessions required	3 (5.7%)
Pleurodesis failure	12 (23.0%)
Overall clinical control achieved	40 (77.0%)
Complications	
Pain	10 (19.2%)
Fever	2 (3.8%)
Empyema	6 (11.5%)
Mortality	5 (9.6%)

In summary, talc pleurodesis provided effective and sustained control of hepatic pleural effusion in approximately three-quarters of patients, though recurrence and complication rates remained considerable. Neither age nor sex significantly influenced pleurodesis success.

Discussion

In this study of 52 patients with hepatic hydrothorax secondary to advanced cirrhosis, talc pleurodesis provided effective palliation in a majority of cases, with 77% achieving control of pleural effusion and improvement in dyspnea. The mean MELD score was 15.2 ± 5.4, and 82.7% of patients were Child–Pugh class C, representing an advanced hepatic disease cohort. The correlation analysis demonstrated that higher MELD and Child–Pugh scores were associated with recurrence, emphasizing the impact of hepatic reserve on pleurodesis success.

The success rate observed in this series aligns with international experience, where reported control rates range between 70% and 80% following talc pleurodesis for hepatic hydrothorax [17-19]. A success rate of 73% was reported using video-assisted thoracoscopic pleurodesis, while other studies have documented efficacy between 65% and 79% in similar populations [8,20]. These findings indicate that, even in resource-limited centers where TIPS and liver transplantation are not routinely available, comparable outcomes can be achieved with meticulous patient selection and optimization.

The complication rate in the present series was approximately 23%, with pain being the most common adverse effect (19%), followed by fever and empyema (3.8% and 11.5%, respectively). This complication profile is consistent with other published data, where pain and transient fever are frequent but manageable events, and serious infections occur in up to 10–20% of patients [3]. Despite these complications, talc pleurodesis remains considerably safer than repeated large-volume thoracentesis, which carries risks of pneumothorax, infection, and protein loss in patients with poor hepatic synthetic function.

The mean chest tube duration was 12.8 ± 7.3 days, and longer drainage was significantly associated with recurrence ($r = 0.67$). Similar associations have been documented, where early tube removal after successful pleural symphysis reduced recurrence risk [21].

Serum albumin levels also demonstrated prognostic relevance. Patients with lower baseline albumin showed higher recurrence rates ($r = –0.39$), consistent with the role of hypoalbuminemia in maintaining negative oncotic pressure and facilitating effusion reaccumulation [18,22]. After optimization, when albumin was maintained above 3.4 g/dL, this association disappeared, suggesting that correction of nutritional and volume status improves pleurodesis success. Albumin optimization was associated with reduced recurrence, although causality cannot be conclusively established.

Importantly, the study highlights the role of talc pleurodesis in patients with end-stage liver disease, particularly in regions where definitive options are either not readily available or unaffordable. Hepatic hydrothorax severely compromises quality of life due to dyspnea and recurrent fluid accumulation. The present experience demonstrates that pleurodesis provides meaningful symptomatic relief, reduces the need for repeated hospital admissions, and allows earlier discharge (mean stay 4.6 ± 2.5 days). Talc pleurodesis appeared to improve symptoms, thereby improving both physical comfort and psychosocial well-being [17,18,22]. In this context, pleurodesis serves as a humane, cost-effective, and clinically justified option to address refractory symptoms in patients otherwise left without curative options.

While the procedure's long-term survival benefit remains limited by underlying liver failure, its role as a symptom-directed intervention is significant. The re-

sults also suggest that recurrence is more closely related to the degree of hepatic decompensation than to procedural inadequacy. Therefore, talc pleurodesis should be considered part of comprehensive care for cirrhotic patients with hydrothorax, complementing diuretics, albumin therapy, and controlled sodium intake. The study's strengths include its focus on real-world data and the demonstration of achievable outcomes without reliance on high-cost technologies.

Limitations of the Study

This study has certain limitations inherent to its single-center, retrospective observational design. The sample size was relatively small, which may limit the statistical power to generalize the findings to broader populations. Patients were not randomized, and the choice of management relied partly on clinical judgment and patient condition, introducing potential selection bias. Additionally, long-term follow-up was limited in some cases due to poor compliance or mortality related to underlying hepatic dysfunction. Advanced hemodynamic parameters such as portal pressure gradient or detailed nutritional status were not routinely measured, which could have provided more comprehensive insight into predictors of recurrence.

In conclusion, talc pleurodesis is a safe, effective, and cost-efficient palliative option for patients with refractory hepatic hydrothorax, particularly in regions where liver transplantation or transjugular intrahepatic portosystemic shunt (TIPS) is scarce. The procedure successfully controlled recurrent pleural effusion in a majority of patients and significantly improved dyspnea and overall comfort, enhancing quality of life despite advanced liver disease. Although recurrence was observed in some patients with poor liver function, the symptomatic relief achieved was clinically meaningful. In the context of developing healthcare systems, this simple intervention can serve as an important palliative strategy for end-stage liver disease patients unfit for definitive surgical options. Larger multicentric studies with longer follow-up are warranted to better define prognostic indicators and optimize patient selection for talc pleurodesis in hepatic hydrothorax.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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Ethics approval

The study was approved by the institutional ethics review board of Services Institute of Medical Sciences with reference number IRB/2025/1677/SIMS on 20.10.2025.

Authors' contribution

MSN: Conceptualization, Methodology, Writing - original draft. ZS: Data curation, Formal analysis, Writing - review & editing.

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