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Tunneled Pleural Catheter Placement with and without Talc Poudrage for Treatment of Pleural Effusions Due to Congestive Heart Failure

Adnan Majid¹, Fayeze Kheir², Meghan Fashjian¹, Sumit Chatterji³, Sebastian Fernandez-Bussy⁴, Sebastian Ochoa¹, George Cheng¹, and Erik Folch¹

¹Division of Thoracic Surgery and Interventional Pulmonology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts; ²Division of Pulmonary Diseases, Critical Care, and Environmental Medicine, Tulane University Health Sciences Center, New Orleans, Louisiana; ³Department of Respiratory Medicine, Addenbrooke's Hospital, Cambridge University Hospitals National Health Service Trust, Cambridge, United Kingdom; and ⁴Section of Interventional Pulmonology, Clinica Alemana, Universidad Del Desarrollo, Santiago, Chile

ORCID ID: 0000-0002-6203-5343 (A.M.).

Abstract

Rationale: There is a paucity of evidence regarding the role of tunneled pleural catheters in pleural effusions caused by congestive heart failure that is refractory to medical management.

Objectives: The aim of this study was to assess the feasibility of tunneled pleural catheter drainage for treatment of refractory pleural effusions associated with congestive heart failure, either when used alone or with concomitant talc pleurodesis performed during thoracoscopy.

Methods: This was a retrospective cohort study. We identified patients with congestive heart failure and recurrent symptomatic pleural effusions who were treated between 2005 and 2015 by placement of a tunneled pleural catheter. Patients underwent either thoracoscopy followed by talc poudrage and pleural catheter placement (group 1) or catheter insertion alone (group 2).

Measurements and Main Results: Forty-three catheters were inserted in 36 patients, with 15 placed in group 1 and 28 in group 2. Successful pleurodesis was seen in 80% in group 1 and 25% in group 2. The median time of catheter placement was 11.5 days in group 1 and 66 days in group 2. There was a significant decrease in hospital admissions and pleural interventions after catheter placement compared with before insertion ($P < 0.05$).

Conclusions: This single-center, retrospective study demonstrated the feasibility of catheter placement used alone or with talc poudrage for the treatment of refractory pleural effusions associated with congestive heart failure. The addition of talc poudrage might increase the pleurodesis rate and reduce the days to catheter removal in highly selected patients. Prospective studies on a larger number of patients are warranted to verify the safety and efficacy of this intervention.

Keywords: congestive heart failure; New York Heart Association

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Correspondence and requests for reprints should be addressed to Adnan Majid, M.D., Director, Interventional Pulmonology, Beth Israel Deaconess Medical Center, Associate Professor of Medicine, Harvard Medical School, 185 Pilgrim Road, Deaconess-201, Boston, MA 02215. E-mail: amajid@bidmc.harvard.edu

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Congestive heart failure (CHF) remains the most common cause of pleural effusion. Fluid in the pleural space accumulates when increased hydrostatic pressure in the pleural microcirculation exceeds the capacity of lymphatic vessels to reabsorb the excess fluid (1). Although pleural effusion is present

in approximately 70% of patients with CHF (2), treatment of the underlying disease usually results in fluid reabsorption.

In symptomatic patients, therapeutic thoracentesis is often considered while awaiting a pharmacological treatment effect. Occasionally, patients have

recurrent symptomatic pleural effusions despite optimal medical management, or medical therapy is limited due to other complications such as low blood pressure, syncope, or worsening renal function. Available options for such patients include repeated therapeutic

thoracentesis or drainage and pleurodesis (talc poudrage or slurry) (3–6). Alternatively, a tunneled pleural catheter can be considered in such a population (7).

Although tunneled pleural catheters are used routinely in the management of malignant pleural effusion, there are limited data demonstrating the use of these catheters in nonmalignant pleural effusions, specifically those caused by CHF refractory to medical management (8, 9). The aim of this study was to assess the feasibility of tunneled pleural catheter placement when used in this group.

Methods

Study Design

This retrospective cohort study was approved by the institutional review board with waiver of informed consent for data collection and analysis (protocol number 2014-P000258). Each patient underwent standard procedural consent for catheter placement per standard institution practices and guidelines.

Subject Population and Baseline Characteristics

Data on patients who underwent catheter (Pleur-X; CareFusion Corporation, San Diego, CA) insertion were reviewed from June 2005 until January 2015. Patients with pleural effusions due to CHF who had a pleural catheter inserted were included. All patients included had failed to respond to maximal medical therapy and required at least two thoracenteses within 1 month for symptomatic relief. Patients with malignancy or other confounding causes of pleural effusion such as pneumonia, postcardiac injury syndrome, or post coronary artery bypass graft were excluded from the study.

Records were reviewed for patient symptoms, demographics, cardiac history, medications, echocardiogram, serum creatinine, pleural fluid analysis, operative reports, complications after catheter placement, hospital admissions, reintervention, catheter removal date, and/or death.

Catheter infectious complications were defined as the presence of cellulitis, deep tissue infection, or pleural space infection (pus, positive pleural fluid Gram stain/culture, or positive catheter tip Gram stain/culture). Other complications

recorded included: catheter occlusion, rupture, migration or malfunction due to loculations, bleeding, pneumothorax, and death directly related to the procedure. Date of removal was recorded only in patients who underwent therapeutic withdrawal of the catheter. All patients in the study were followed up to 6 month. There was no loss of follow up.

Operative Techniques

Tunneled pleural catheter inserted during medical thoracoscopy and talc poudrage (group 1). Patients underwent medical thoracoscopy (Karl Storz GmbH, Tuttlingen, Germany) with talc poudrage followed by catheter insertion. Under ultrasound guidance, a single port was placed and rigid thoracoscopy was performed under moderate sedation in the operating room with continuous monitoring by an anesthesiologist as per standard protocols, with the patient in a lateral decubitus position. Pleural fluid was removed with a 14F suction catheter and the tunneled pleural catheter was inserted and directed inferoposteriorly followed by 4 to 8 g of talc poudrage (mean, 5 g) (Sclerosol Intrapleural Aerosol; Bryan Corporation, Woburn, MA) under direct visualization. A 24F chest tube was introduced through the thoracoscopy cannula and directed posterosuperiorly.

Both tubes were left on -20 cm H_2O wall suction until combined drainage was less than 250 ml in 24 hours. When this was achieved, the 24F chest tube was

removed and the catheter was capped and drained daily for 2 weeks. If pleural fluid drainage persisted for more than 2 weeks, the catheter was scheduled to be drained three times per week until it was less than 50 ml for three consecutive drainages. When that threshold was reached, a chest ultrasound was performed, and if there was no evidence of significant pleural effusion (>200 ml), the catheter was removed. The fluid volume was calculated by measuring the maximum perpendicular distance between the surface and the chest wall right above the diaphragm with the patient in the supine position, at maximum inspiration. If maximum perpendicular distance was less than 15 mm it corresponded to effusion equivalent volume of less than 200 ml (10).

Tunneled pleural catheter insertion technique and drainage method (Group 2). Alternatively, using ultrasound, with the patient in a lateral decubitus or sitting position, a pleural fluid pocket was identified and marked. Under local anesthesia, the catheter was placed by tunneling the catheter into the subcutaneous tissue posterolaterally, approximately 6 to 8 cm from the marked skin insertion site. The catheter was then introduced into the pleural space using a modified Seldinger technique. Pleural fluid was removed using the catheter with dedicated prevacuumed bottles. Patients were instructed to drain the pleural cavity two to three times per week and no more than 1 L per session. Pleural fluid drainage was done more frequently in

Table 1. Demographics and baseline characteristics

	Overall	Group 1	Group 2
No. of patients	36	13	23
Tunneled pleural catheter inserted	43	15	28
Age, mean (range), yr	82.5 (61–97)	81.5 (61–97)	84.3 (67–91)
Female sex	19 (52.7%)	7 (19.4%)	12 (33.3%)
Cardiac etiology			
Systolic heart failure	13	3	10
Diastolic heart failure	15	6	9
Combined heart failure	1	0	1
Severe pulmonary hypertension	4	1	3
Severe aortic stenosis	3	0	3
Right-sided pleural effusion	28 (78%)	11 (30.6%)	17 (47.2%)
Serum NT-proBNP, median, pg/ml	3,895	2,780	4,764
NYHA dyspnea score, mean	2.49	2.15	2.67

Definition of abbreviations: NT-proBNP = N-terminal pro-brain natriuretic peptide; NYHA = New York Heart Association.

Table 2. Tunneled pleural catheter outcome

	TPC No.	Pleurodesis Achieved (%)	TPC Placement Time (d) Median (Range)	TPC Removal (%)	Postintervention NYHA Score Mean
Group 1	15	80	11.5 (2–22)	80	1.69
Group 2	28	25	66 (31–205)	25	1.90
Overall	43	44.2	20 (2–205)	44.2	1.82

Definition of abbreviations: NYHA = New York Heart Association; TPC = tunneled pleural catheter.

group 1 for the first 2 weeks as compared with group 2.

The decision to insert the tunneled pleural catheter under ultrasound guidance or during thoracoscopy with talc poudrage was based on the patient's New York Heart Association (NYHA) dyspnea score, age, and patient preference (Table 1).

Outcomes

Successful pleurodesis in both groups was defined as no significant radiographic pleural fluid reaccumulation after catheter removal on chest radiography, chest ultrasound, or a chest computed tomography scan until the end of follow up or death that required further pleural intervention on the same side. Other reported outcomes were adverse events, number of pleural interventions, number of admissions, and serum creatinine (6 mo before and up to 6 mo after catheter procedure).

Data Analysis and Statistical Methods

Statistical analysis was performed using SPSS version 21, with a *P* value of less than 0.05 defined as significant. Descriptive statistics, including mean, median, range, and percentage, were used to describe patient demographics and outcomes. Mann-Whitney test was used for continuous variables and Fisher exact test for categorical variables. Survival analysis was conducted with the Kaplan-Meier method with time to event being tunneled pleural catheter removal.

Results

A total of 43 catheters were inserted in 36 patients, including 7 patients who had subsequent contralateral catheter insertion (Table 1). Patients had a mean age of 82.5 years (range, 61–97 yr), with 52.7% being women. The median serum N-terminal pro-brain natriuretic

peptide level was 3,895 pg/ml (range, 668–47,742 pg/ml) before insertion of catheter. Median creatinine was 1.2 mg/dl before and after catheter insertion (*P* = 0.63). Seventy-eight percent (28/36) of patients underwent right-sided catheter insertion. Thirteen patients (36%) had systolic heart failure, 15 (42%) had diastolic heart failure, 1 (3%) had combined (systolic and diastolic) heart failure, 4 (11%) had severe pulmonary hypertension, and 3 (8%) had severe aortic stenosis.

Treatment Outcomes Overall

All patients reported improved dyspnea after pleural intervention. Overall, successful pleurodesis was achieved in 44.2%, and catheters were removed in 44.2%. After the intervention, NYHA mean score decreased from 2.49 (group 1 = 2.15; group 2 = 2.67) to 1.82 (group 1 = 1.69, group 2 = 1.90) (Table 2). Pleurodesis was achieved more frequently in group 1 (Table 2). The median time to catheter removal of all catheters (both groups) was 20 days (range, 2–205 d).

Treatment Outcomes by Group

Group 1. Fifteen catheters were inserted during thoracoscopy and talc poudrage. Median time from catheter placement to removal was 11.5 days (range, 2–22 d). Eleven successful pleurodeses were achieved initially after intervention leading to 11 catheter removals. There was one additional successful pleurodesis achieved when talc slurry was given via catheter, leading to catheter removal. This resulted in a total of 12 successful pleurodeses (80%) and 12 catheters removed (80%).

Group 2. Twenty-eight catheters were inserted alone under ultrasound guidance. Median time from catheter placement to removal was 66 days (range, 31–205). Seven

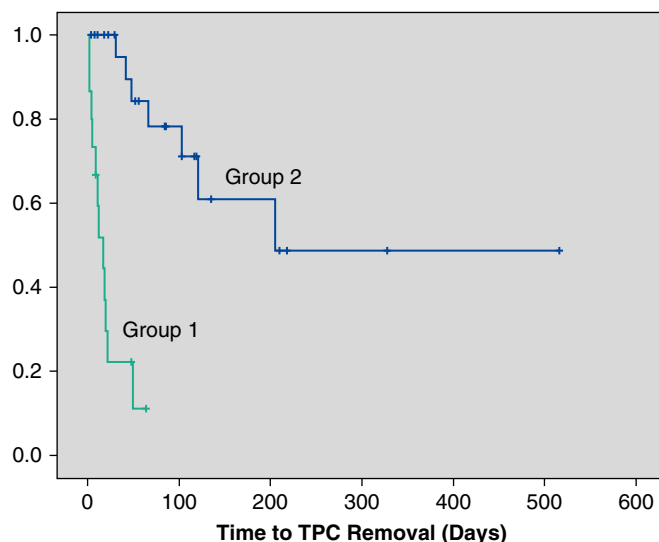


Figure 1. Time to tunneled pleural catheter (TPC) removal according to whether TPC was placed with thoracoscopy and talc poudrage (group 1) or alone (group 2).

Table 3. Adverse events of tunneled pleural catheters

	Total (%)	Group 1	Group 2
Hypotension	1 (2)	1	
Cellulitis	3 (7)	2	1
Empyema	1 (2)		1
Parapneumonic effusion	1 (2)		1

successful pleurodesis were achieved after intervention (25%). Subsequently, seven catheters were removed (25%).

Readmissions, Pleural Interventions, and Time for Catheter Removal

A total of 46 hospital admissions (15 in group 1 and 31 in group 2) due to CHF were recorded during a 6-month period before catheter insertion compared with 15 (6 in group 1 and 9 in group 2) 6 months after the intervention ($P < 0.05$). In addition, during the same period, there were 96 therapeutic thoracenteses (33 in group 1 and 63 in group 2) compared with 8 (3 in contralateral chest in group 1 and 5 in contralateral chest in group 2) 6 months after intervention ($P < 0.05$). Patients in group 2 had a longer time to tunneled pleural catheter removal than those in group 2 (Figure 1).

Complications

There was one case of periprocedural hypotension in group 1 probably related to anesthetic medications (Table 3). Three patients developed cellulitis (7%): two in group 1 and one in group 2. Two cases of pleural space infection, both occurring in group 2 (Table 3), were treated successfully with antibiotics and fluid drainage through the catheter. None of the catheters required removal secondary to adverse events. No other complications were reported in either group.

Discussion

Although pleural effusions are common in the context of CHF, it is unusual for them to be refractory to contemporary medical treatment. Symptomatic pleural effusions can develop, sometimes recurrently, despite maximal medical treatment or because complications such as low blood pressure,

syncope, or renal dysfunction necessitate a reduction in medical treatment. Repeated pleural procedures and frequent hospital or clinic attendances in this patient population of symptomatic patients, where anticoagulant or dual antiplatelet agent use is common, increases the risk of procedure-related complications and is undesirable. In these circumstances, recurrent therapeutic thoracentesis or occasionally talc pleurodesis may be attempted.

Several small case series have reported good outcomes with talc pleurodesis in this context (3–5) despite some concerns regarding the possibility of translocating the fluid to another anatomical location (6). Medical thoracoscopy for administration of talc to achieve pleurodesis is an available option for patients with refractory pleural effusion (11).

Tunneled pleural catheters have an established role in the palliation of malignant pleural effusions (12–14), demonstrating effective relief of dyspnea, reduction in bed-days (15, 16), and cost effectiveness (13). For these reasons, there is growing interest in the role of catheters in patients with benign pleural effusions (1, 8, 17–19), but their utility in the context of CHF, although appealing, has not been well defined.

In this retrospective review of 43 procedures performed on 36 patients performed at one institution over 10 years, we found that tunneled catheter placement is feasible and often efficacious for patients with symptomatic, refractory pleural effusions caused by CHF. In our study of highly selected patients, pleurodesis was achieved more frequently when catheter placement was combined with thoracoscopy and talc poudrage. This translated to a higher catheter removal rate and less time of catheter remaining *in situ*. However, it is important to emphasize that patients in group 1 were younger with lower baseline NYHA score and thus were able to better

tolerate a thoracoscopy procedure. Similarly, our finding of a significantly longer time to pleural catheter removal in group 2 than in group 1 probably reflects selection bias, because patients who had lower NYHA score and/or were younger were enrolled in group 1.

Provoking or worsening preexisting renal failure remains a major challenge in patients with CHF. Standard practice of increasing the dose of diuretics in response to worsening symptoms often leads to renal dysfunction (20). This often defines the ceiling of medical therapy and limits the extent to which symptoms may be controllable. In this study, there was no significant difference in serum creatinine 6 months before and up to 6 months after catheter insertion, suggesting that catheter drainage does not further compromise renal function in selected patients with severe CHF.

We acknowledge several important limitations to our study. This was a retrospective cohort review without a control group (medical therapy only) or a study arm comparing chest tube and talc slurry. Although dyspnea and NYHA classification for functional limitation were recorded, there were no standardized measures of quality of life specific before or after intervention. In addition, pleural fluid drainage frequency in group 1 was more intensive as per our institutional protocol and may have contributed to the higher pleurodesis rates. Finally, as there are no evidence-based guidelines for the optimal management of this population of patients, there is an inherent referral and selection bias depending on clinician and institutional experience and preferences. Due to small number of cases per institution, there is a need for larger prospective studies to try to define optimal management strategies in this area.

In conclusion, our study adds support to the slowly enlarging corpus of data suggesting that catheter placement in selected patients with refractory pleural effusions secondary to CHF is feasible (18, 19). Catheter insertion with the addition of a pleural sclerosant is an approach gaining interest and is worthy of further study in this group of patients. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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