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Use of tunnelled catheters for malignant pleural effusions in patients fit for pleurodesis

A. Tremblay, C. Mason and G. Michaud

ABSTRACT: The aim of the present study was to examine the effectiveness of tunnelled pleural catheters (TPC) in patients with malignant pleural effusions who would otherwise be candidates for pleurodesis.

Patients were selected from a previously reported database of 250 TPC insertions. The study group was selected based on lung re-expansion and survival as a surrogate maker of eligibility for pleurodesis procedure, as defined by survival of ⩾90 days and lung re-expansion ⩾80% post-drainage on a standard chest radiograph 2 weeks post TPC placement.

There were 109 procedures in 97 patients that met the entry criteria. Spontaneous pleurodesis (SP) was achieved following 70% of procedures and correlated with symptom control. The mean time to SP was 90 days. There was no need for a repeat procedure in 87% of cases overall and in 92% of patients experiencing SP. There were few complications and no procedure-related deaths.

Tunnelled pleural catheters are an effective way of controlling malignant pleural effusions when used as first-line treatment in patients who appear to be candidates for pleurodesis procedures.

KEYWORDS: Cancer, dyspnoea, pleural effusion, pleurodesis

Malignant pleural effusions (MPE) can develop as a result of various types of disseminated or advanced cancers and cause significant dyspnoea, decreased exercise tolerance and impaired quality of life. Thus management of MPE is an important aspect of palliation of patients with advanced cancer. Attempts at pleurodesis *via* chest tube or thoracoscopy have been the standard method of treating MPE [1].

Previous studies have concluded that the use of thoracoscopy with talc insufflation (TTI) and chest tube insertion with talc slurry (TS) are effective methods for achieving pleurodesis [2–6]. However, each of these methods is associated with significant morbidity and risk of mortality, whilst the impact on quality of life and symptom control has rarely been reported with these techniques. An alternative method of palliating MPE involves the use of tunnelled pleural catheters (TPC), which are inserted on an outpatient basis and have minimal associated risks or complications [7–16]. However, critics of this procedure suggest it should only be offered to patients not considered for pleurodesis procedures [17, 18].

Given that studies investigating the use of TPC include patients with poor functional status, trapped lung as well as short life expectancy, comparing outcomes from these studies to published results regarding pleurodesis is difficult. The current study was designed to assess the outcome of patients treated with TPC who otherwise would appear to be reasonable candidates for pleurodesis procedures by selecting patients with good lung re-expansion and excluding those with very short survival.

MATERIALS AND METHODS

Study subjects

Subjects were drawn from a database of TPC procedures. Details regarding the clinical approach taken within the current study for the TPC procedure, the design of the database and overall results have been published previously [11, 16]. All patients were instructed on catheter use and referred to a palliative nursing home-care programme for assistance with catheter maintenance and drainage. The database was established with the approval of the Conjoint Health Research Ethics Board of the University of Calgary (Calgardy, AB, Canada).

Study design

The current study is a retrospective analysis of a previously established database that was prospectively developed and maintained by the authors. The database included the following information: patient identification; sex; age; primary malignancy; size of effusion on pre-treatment chest radiograph (CXR); side of effusion; dates of

AFFILIATIONS
Divisions of Respiratory Medicine, University of Calgary, Southern Alberta Cancer Research Institute, AB, Canada.

CORRESPONDENCE
A. Tremblay
Division of Respiratory Medicine
Health Sciences Center
3330 Hospital Drive NW
Calgary
AB
T2N 4N1
Canada
Fax: 1 4039441577
E-mail: alain.tremblay@ucalgary.ca

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insertion; removal; death (if known); complications; symptom control at 2 week follow-up (complete, partial, absent), size of effusion on CXR weeks post-procedure; ipsilateral pleural procedures prior to TPC; ipsilateral pleural procedures following TPC treatment; contralateral TPC placement; and date of last follow-up visit at the cancer centre if still alive.

The database analysed for the present study includes the initial 250 TPC insertions in the current authors' centre (University of Calgary) for patients with known or highly suspected malignant pleural effusions. During this time period five TPCs were inserted for nonmalignant diagnoses and were not included in the database.

Methods

Patients were selected from the database for analysis according to pleurodesis eligibility. Criteria for pleurodesis eligibility were determined from a literature review. Two main factors appeared to be generally accepted as the contraindication to pleurodesis, these were poor short-term survival and incomplete lung re-expansion following drainage.

Accordingly, the current study subgroup was defined to include all procedures where patient survival was >90 days, and ⩽20% residual pleural effusion was noted following 2 weeks of drainage.

All dates were calculated from the day of TPC insertion. Spontaneous pleurodesis (SP) was perceived to occur when drainage decreased to <50 mL of fluid on three consecutive drainage attempts without progressive symptoms or re-accumulation of fluid on CXR, and without the use of sclerosing agents. The date of SP was calculated according to the date of TPC removal and not the date on which fluid stopped draining. Dyspnoea control was determined at a 2 week follow-up evaluation and described on a simple three point scale as follows. 1) Complete: if the patient noted the absence or minimal presence of symptoms; 2) partial: if the patient described significantly improved but persistent dyspnoea; 3) absent: if no significant improvement of dyspnoea was noted. The current authors did not differentiate between other contributing causes of dyspnoea, unless there was complete re-expansion of the lung and absence of residual fluid.

The size of effusion was analysed semi-quantitatively by one of the investigators as a fraction of the hemithorax filled with fluid prior to TPC insertion and at the 2 weeks follow-up visit on a standard posterior–anterior and lateral CXR. Complications as well as any ipsilateral pleural procedures required post-TPC placement or post-SP were also recorded. Chemotherapy, radiation treatments and supportive care were administered as per standard of care.

Analysis

The original database was available in a statistical computer software program. Patients meeting the above definitions were extracted. Descriptive statistics were used to summarise patient characteristics, SP rates, symptom control rate, size of effusion, complication rates and repeat procedures. The Chi-squared test was used to compare frequencies between groups.

RESULTS

Patient characteristics

The current authors identified 109 procedures in 97 patients that met the study criteria out of the 250 procedures in the original database. A total of 36 (26%) of the excluded effusions had >20% residual effusion at 2 weeks and 47 (33%) were associated with survival ⩽90 days. Nine procedures were in patients with previous contralateral TPC and three with prior ipsilateral TPC. Data on the demographics and effusions are described in table 1 and the underlying diagnosis is outlined in table 2.

Spontaneous pleurodesis and duration of drainage

SP occurred following 76 (70%) out of 109 procedures at a mean of 90 days. Six additional patients received a sclerosing agent (talc) *via* the TPC, at a mean of 91 days post-placement.

Four different patients had the TPC removed without experiencing SP (one catheter dislodged, three following empyema). One patient was alive with bilateral TPCs at the last follow-up, and 21 (19%) catheters stayed in place until death at a mean of 183 days post-placement.

Symptom control

Complete or partial symptom control was achieved in 100% of patients at the 2 weeks follow-up, while complete symptom control was achieved following 67% of procedures.

Procedures leading to SP were also more likely to lead to complete symptom control (75 *versus* 48.5%, p=0.009). A nonstatistically significant trend for patients with breast cancer more likely to have complete symptom control than lung cancer patients was noted (70 *versus* 54%, p=0.21).

Requirement for repeat procedures

Following successful TPC placement, no further ipsilateral pleural procedures were required in 87% of cases. Repeat procedures performed in the remaining patients included: repeat TPC placement (n=6); pleural fibrinolysis (n=4); standard chest drain (n=2); and thoracentesis (n=2).

In patients achieving SP, repeat procedures were required in six (7.9%) out of the 76 procedures. These were thoracentesis (n=2) and repeat TPC placements (n=4). As such, long-term

TABLE 1 Patient and effusion description

Procedures	109
Mean age yrs	65
Male	52
Female	57
Effusion	
Right	68
Left	41
Contralateral TPC	9
Baseline effusion size#	0.56
Effusion size after 2 weeks#	0.11

Data are presented as n, unless otherwise stated. TPC: tunnelled pleural catheters. #: see Methods section.

TABLE 2 Frequency of underlying malignancy cell type

Lung cancer nonsmall cell	35 (32.1)
Breast cancer	30 (27.5)
Mesothelioma	13 (11.9)
Ovarian cancer	8 (7.3)
Other	23 (21.1)

Data are presented as n (%).

successful pleurodesis was achieved in 70 (64%) out of the 109 effusions.

Following the six talc procedures, 50% of patients required further procedures. Two patients underwent repeat chest tube placement and administration of intrapleural thrombolytics (empyema: n=1; symptomatic loculation: n=1) and a third patient required re-insertion of a TPC for recurrent effusion. Three patients achieved pleurodesis, one of which was partial. These repeat procedures are also included in the overall results given previously.

Complications

The study complications are listed in table 3. The most common complications were symptomatic and asymptomatic loculations and reaccumulation of fluid post-TPC removal. Empyema occurred following 4.6% of all procedures. The remaining complications occurred in $\sim\leqslant$2% of procedures. There was no incidence of mortality associated with TPC placement.

Recurrent fluid or symptomatic loculation of fluid occurred in three incidences and empyema in one out of the six hemithoraces given a sclerosing agent through the TPC, for an overall complication of 66% post-attempted pleurodesis *via* TPC. These complications are also tabulated in the overall results given previously.

DISCUSSION

The ideal approach to palliative management of MPE remains an area of controversy. There is no consensus with respect to the optimal method for management of MPE among physicians. The current authors believe MPE treatment should have a high efficacy in improving symptoms, have minimal complications and discomfort and should minimise the need for hospitalisation.

TABLE 3 Study complications

Symptomatic loculation	12 (11.0)
Asymptomatic loculations	8 (7.3)
Reaccumulation of fluid	4 (4.4)
Empyema	5 (4.6)
Combined total PTX/SQ Air/BPF	3 (2.8)
Cellulitis	2 (1.8)
Bleeding	1 (0.9)
Tumour seeding	1 (0.9)
Dislodged	1 (0.9)

Data are presented as n (%). PTX: pneumothorax; SQ: subcutaneous; BPF: bronchopleural fistulae.

Recently, the use of TPCs has been described as a successful treatment for MPE [7–16]. The current authors' experience with this technique suggests that high rates of symptom control can be achieved on an outpatient basis and with minimal complications [8, 11, 16]. There is little doubt that this technique should be considered in the management of patients with MPE and trapped lung syndrome [7] or short life expectancy and poor functional status. Controversy remains as to the role of this technique in patients otherwise felt to be appropriate candidates for standard pleurodesis procedures [17, 18]. This study was designed to document outcomes of TPC treatment in this patient population.

The current authors found that 70% of patients in this study achieved spontaneous pleurodesis following TPC treatment, and 64% met the European Respiratory Society (ERS)/American Thoracic Society (ATS) statement definition for successful pleurodesis [1]. This compares very favourably to the results of the largest prospective study on TTI and TS for MPE, which found that patients with >90% lung re-expansion and still alive at 30 days had successful pleurodesis rates of 78 and 71% for TTI and TS, respectively [3]. Although higher pleurodesis success rates have been published, especially with TTI, these studies often used a short-term outcome and variable follow-up periods and have employed retrospective study designs [2, 4]. If long-term follow-up of patients is performed, failure rates can be significant. One study of TTI by LOVE *et al.* [19], showed delayed recurrence of MPE in 23 (38%) out of 60 cases while in the study by DRESLER *et al.* [3] the recurrence of effusion in patients after 30 days was 33 and 22% for TTI and TS, respectively. The SP achieved with TPC appears to be long lasting, as few patients (<10%) required further interventions after SP.

Symptom improvement, arguably a more clinically important end-point than pleurodesis, was achieved in all patients in the current study (67% complete, 33% partial). As such, only 13% of cases requiring additional procedures could be labelled as failed pleurodesis using the ERS/ATS statement definitions [1]. Measurements for symptom control have rarely been reported in MPE treatment studies, but a recent TTI series found that 77.3% of patients improved while 20.3% had no change in symptoms and 2.4% actually deteriorated [2]. A randomised study of TPC *versus* doxycycline pleurodesis found no differences in Borg scores or quality of life score between the two groups [15]. It is safe to conclude that patients with MPE treated with TPC have at least as good symptom control as those treated with other techniques.

A major advantage of TPC use on both quality of life and cost, relates to the outpatient nature of the treatment. All TPC procedures are performed on an outpatient basis unless the patient is already in hospital. While rapid [20] as well as outpatient [21] pleurodesis has been advocated, length of stay (LOS) was not reported in the rapid study and success rate was only 48%, whereas only 10 patients were studied in the outpatient report, which has yet to be replicated. LOS following thoracoscopy is frequently said to be short but often not clearly reported in studies [3, 4, 22, 23]. Published data

suggests mean duration of chest tube drainage of 3–7 days [2, 22–24] and LOS of 7–8 days [2, 24]. Interestingly, drainage time and LOS following thoracoscopical procedures does not appear to be shorter than chest tube pleurodesis in controlled studies [23, 24]. The current authors estimate that 1 week in hospital represents 5% of an MPE patient's remaining life expectancy, time that may be more beneficial spent at home with family and friends.

Finally, it is clear that any palliative procedure should be associated with the lowest complications as is possible to achieve relief of symptoms. Significant complications of TPCs in the current study population included cellulitis (1.8%), empyema (4.6%) and symptomatic loculation of fluid (11%). No procedure related mortality occurred or has ever been reported with this technique. The safety profile of TPC appears to compare favourably with other methods of palliation for MPE, which have been associated with severe complications, such as arrhythmias, respiratory failure (in up to 8%) and treatment related deaths (3%), in addition to those seen with TPC such as empyema [2–4]. The current authors felt that the low complication rates seen with this approach are likely to have been made possible by home-care support utilised in the care of these patients.

In conclusion, the current authors believe that the use of tunnelled pleural catheters is justified in patients who are otherwise candidates for pleurodesis procedures, given comparable, if not favourable, effect on symptom control and safety profile in comparison with other techniques. The spontaneous pleurodesis rates noted in this patient population approaches those seen with talc pleurodesis, while avoiding the costs associated with hospitalisation. Most importantly, patients are allowed to remain in the comfort of their home with family and friends without compromising comfort and symptom control.

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