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Original Article

Use of Indwelling Pleural Catheter in the Outpatient Management of Recurrent Malignant Pleural Effusion

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ABSTRACT

Introduction: To analyse the effectiveness and safety of the indwelling pleural catheter in the management of recurrent malignant pleural effusion.
Patients and methods: A prospective multicentre study was performed in 63 consecutive outpatients from four Spanish hospitals. A total of 43 men and 20 women were included, with a median age of 67 years. In seven of the cases treatment with pleurodesis had failed; in five other cases their lung was trapped; in another five cases after repeat therapeutic thoracocentesis, and the rest of them as a preference choice to pleurodesis. All patients had an indwelling pleural catheter inserted (PleurX®, Denver Biomedical).
Results: Most of patients (94.5%) reported an improvement in their respiratory symptoms (cough and dyspnoea) and their ability to function independently. Average length of the catheterisation was 45 days (6-222). Average amount of drained pleural effusion was 75 ml, with a frequency of drainage of between 3 and 4 times per week and once fortnightly. Spontaneous pleurodesis was achieved following 34.9% of procedures. No complications occurred during the insertion of the catheter. The post-catheterisation complications were empyema (3 cases), chest pain (2 cases), and tumour metastasis (3 cases).
Conclusions: The use of an indwelling pleural catheter is an effective palliative treatment in the outpatient management for patients suffering malignant pleural effusion. It is also a simple treatment that can be easily applied, does not require hospitalisation and can be easily managed by the patient at home, with a low rate of complications.

Uso del drenaje pleural permanente en el manejo ambulatorio del derrame pleural maligno recidivante

Palabras clave:
Derrame pleural maligno
Catéter pleural tunelizado permanente
Paciente ambulatorio

RESUMEN

Introducción: El objetivo del estudio ha sido analizar la eficacia y seguridad del catéter de drenaje pleural permanente en el manejo de pacientes con diagnóstico de derrame pleural maligno.
Pacientes y métodos: Se ha realizado un estudio prospectivo y multicéntrico de 63 pacientes consecutivos de 4 hospitales españoles. Se incluyó a 43 varones y 20 mujeres, con una mediana de edad de 67 años, diagnosticados de derrame pleural maligno sintomático. En 7 casos el tratamiento se indicó tras fracaso de pleurodesis, en 5 por encontrarse el pulmón atrapado, en otros 5 tras toracocentesis repetidas y en el resto como indicación preferente a la pleurodesis. A todos los pacientes se les insertó de forma ambulatoria un catéter tunelizado permanente (PleurX®, Denver Biomedical).

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Resultados: La mayoría de los pacientes (95,4%) refirió mejoría parcial o completa de los síntomas respiratorios (tos y disnea) y de su capacidad funcional. La mediana de duración de uso del catéter fue de 45 días (rango: 6-222). La mediana diaria de líquido pleural drenado fue de 75 ml. En 22 casos (34,9%) se produjo una pleurodesis espontánea. No se registraron complicaciones durante la inserción del catéter. Las complicaciones durante el seguimiento fueron las siguientes: empiema (3 casos), dolor torácico (2 casos) y diseminaciones del tumor por el lugar de inserción del tubo (3 casos).
Conclusiones: El catéter de drenaje pleural permanente es eficaz en el manejo ambulatorio del paciente con derrame pleural maligno sintomático. Es un procedimiento sencillo que no precisa ingreso hospitalario, de fácil manejo para el paciente en su domicilio y con escasas complicaciones.

Introduction

The presence of malignant pleural effusion (MPE) assumes the establishment of an advanced state of disease in patients with neoplastic disorders. It constitutes a frequent clinical problem in these patients associated with a poor prognosis and worsened quality of life.[1] Equally, the vital prognosis is darkened and the survival average decreases by 3 to 12 months.[2]

The most frequent aetiology of MPE is the bronchogenic carcinoma, followed by breast carcinoma and lymphoma. Other less frequent aetiologies are gastrointestinal tumours, carcinoma of the ovary and the mesothelioma.[3] However, in 7 to 15% of MPE, the primary tumour is unknown after an exhaustive extension study.[4] Dyspnoea is the most common symptom in these patients and it occurs in more than half of the cases.[3] Other frequent symptoms are coughing, chest pain and constitutional symptoms.[4,5]

Various palliative techniques for the improvement of MPE have been developed to alleviate these respiratory symptoms. Repeated thoracocentesis is a simple and widely used technique that is often insufficient for the treatment of recurring MPE. This is due to the fast and symptomatic re-accumulation of liquid that can occur four days after the thoracocentesis.[6] Another frequently employed technique is pleurodesis. With this technique, longer lasting effects are obtained provided an adequate drainage of the pleural liquid is achieved, as well as subsequent symphysis of both pleural sheets. Various symphysant agents were used for this. The most commonly currently employed are talc, doxycycline and bleomycin. However, the success of the pleurodesis can be compromised when the analysis of the pleural liquid reveals low pH and glucose values.[1,7,8] On other occasions, this technique cannot be performed because of a lack of pulmonary reexpansion after the thoracocentesis or due to a trapped lung.

The use of small calibre catheters in outpatients constitutes a new option in the palliative treatment of patients suffering MPE. With the intention of knowing the initial experience in four Spanish hospitals, we began a prospective and descriptive study of a series of patients with recurrent MPE. The aim of the study was to analyse the clinical benefit and safety of the indwelling pleural catheter in outpatients with MPE.

Patients and Methods

Study Design

Between June 2005 and November 2008, a prospective and observational follow up study was performed in the Pneumology Units from four hospitals: La Fe University Hospital in Valencia, University Clinic of Pamplona, San Pedro de Alcántara Hospital in Cáceres and Salamanca University Hospital. A total of 63 consecutive patients diagnosed with MPE were included from the Pneumology and Medical Oncology Units. The patients were treated through the insertion of a permanent indwelling tunnelled pleural catheter (PleurX®, Denver Biomedical). Inclusion criteria were as follows: patients over 18 diagnosed with symptomatic MPE (coughing and/or dyspnoea) and life expectancy under 3 months that were not candidates for pleurodesis; or patients with a life expectancy over 3 months and failure in the treatment or previously ineffective pleurodesis; or patients with trapped lung syndrome. Patients with coagulation alterations, deformities in the chest cavity, active infection in the pleural space or organised pleural effusion were excluded.

The following data were collected: age, sex, harmful habits, malignant primary neoplasia, blood test and pleural liquid data, received oncological treatment, size and location of the effusion. The level of physical activity of the patient is evaluated according to the Karnofsky Index, which scores the patient's general state with values from 100 to 0, where 100 corresponds to the absence of symptoms and 0 is the absence of life.

Insertion of the Pleural Catheter

In every case, a PleurX® (Denver Biomedical) pleural catheter was used. It is a silicon catheter measuring 66cm in length and 15.5 Fr. thick, with fenestrations through the length of 24 cm in the distal part. The proximal part has a unidirectional safety valve that allows the placement of an air-tight container, with a maximum of 650 ml of pleural liquid per container. The catheter is placed in an outpatient procedure under local anaesthesia with 2% mepivacaine or lidocaine. After locating the pleural liquid, an intrathoracic line is introduced in the postero-caudal sense, then an opposed incision is performed on an inferior level to create a tunnel of approximately 5cm for the catheter. This is then introduced through the inferior incision through the tunnel to the proximal incision. Through this incision, and with the aid of a rubber guidewire, the catheter is introduced into the pleural cavity. The catheter is then fastened to the skin with a suture. Drainage starts immediately and after its positioning 1,000 to 1,500ml are evacuated (fig. 1 and fig. 2). All of the patients signed the informed consent form before collocation of the permanent pleural effusion (PPE) catheter.

Patient Monitoring

Both the patient and their family were instructed on the use and maintenance of the catheter after positioning. Medical visits were programmed for all the patients at 15 and 45 days after positioning of the pleural catheter and subsequently, every 2 months. They were advised to drain the pleural liquid intermittently depending on the presence of respiratory symptoms.

Besides the insertion and removal dates of the PPE, the data base also included: presence of complications, control of respiratory

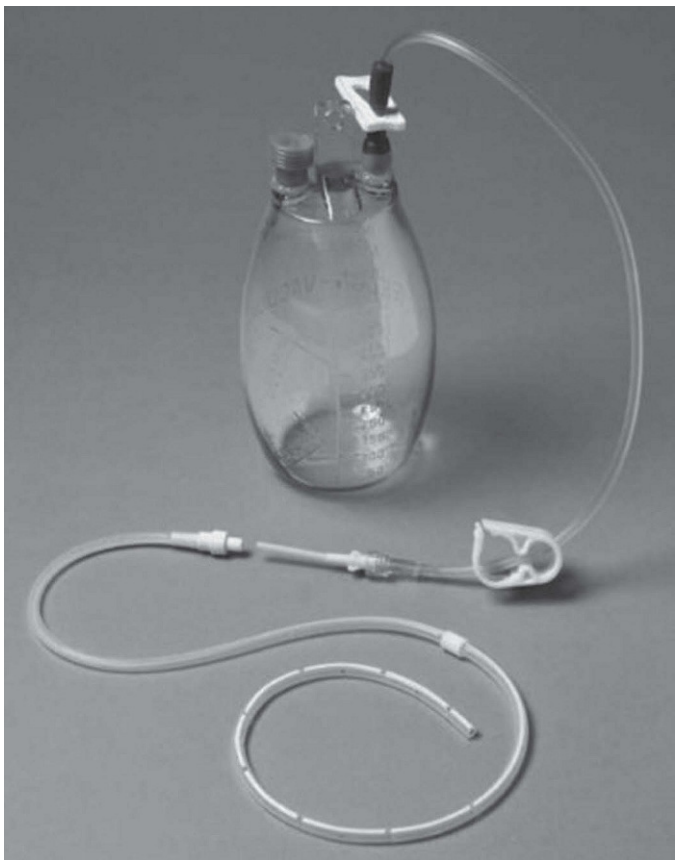

Figure 1. Drainage bottle with the end that is inserted in the unidirectional catheter valve for the evacuation of the pleural liquid. Pleural catheter with unidirectional valve in the distal end.

Figure 2. Detail of the pleural drainage location during the evacuation of the pleural liquid in the patient's home.

symptoms, amount of liquid drained (in millimetres), frequency of drainage, appearance of spontaneous pleurodesis and death. It was considered that the pleurodesis had failed if the pleural effusion recurred after an initially satisfactory pleurodesis. The size of the pleural effusion was measured before the insertion of the pleural drainage through a chest x-ray and/or a transthoracic ultrasound. According the affectation of the hemithorax, it was adjusted by one third, two thirds and massively. Control of the respiratory symptoms was assessed a fortnight after the insertion of the catheter and subsequently in each control visit. It was classified following a scale of 3 categories, complete (absence or minimum presence of symptoms), partial (significant improvement but persistence of dyspnoea or other respiratory symptoms) and absent (insignificant improvement of symptoms). It was considered that a patient had developed spontaneous pleurodesis when the volume of drainage decreased to less than 50ml in 3 consecutive drainages, with no progression in symptoms or new accumulation of liquid in the chest x-ray.[9] The catheter was removed on decease of the patient or after a spontaneous pleurodesis.

Statistical Analysis

The statistical analysis was performed with the SPSS system (version 12.0). The results obtained were analysed expressing the quantitative variables as mean and range or average. The comparison of continual variables was performed with the Mann-Whitney U test. In the case of the deceased patients, the average time was calculated from collocation of the catheter to death. A level of statistical significance was accepted with a probability value below 0.05.

Results

From June 2005 to November 2008, 63 consecutive patients were treated, –43 males and 20 females– with symptomatic MPE through the insertion of a permanent pleural catheter. The average age was 67 years old (range: 27-92). In 90.4% of the patients, the Karnofsky Index was equal to or below 70; the mean score was 52.45. As far as location of the effusion, it was on the right in 37 patients, bilateral in 2 and on the left in 25. The most frequent primary tumour was of pulmonary origin, 33 cases (table 1).

In most of the cases, the PPE was inserted due to the presence of MPE after its first relapse following a pleural tap with symptomatic relief. Pleurodesis was performed on 7 patients as a first option and, after this failure, permanent drainage was inserted. In 5 cases more than one thoracocentesis was performed before inserting the drainage. Permanent drainage was indicated due to the presence of trapped lung syndrome in 5 cases, one for endobronchial obstruction. In the remaining PPE cases, it was inserted as a first option after the diagnosis (table 2).

The average drainage duration was 45 days (range: 6-222 days). The average daily amount of drained pleural liquid was 75ml (range: 10-384ml). The frequency of drainage varied from 3-4 times a week to once a fortnight. Spontaneous pleurodesis occurred in 22 patients (34.9%). The average period between insertion of the tunnelled drainage and patient decease was 56.5 days. Table 3 summarises the results of PPE use in a patient subgroup according to a history of pleurodesis prior to the insertion of the drainage. As far as size of the effusion, it took up one third of the hemithorax in 9 cases, two-thirds in 26 cases and it was massive in 28.

Control of respiratory symptoms (measured in 44 patients) reached 95.4%. Symptomatic control was complete in 65.9% and partial in 29.5% of the cases. Only two patients experienced no improvement.

Table 1
Demographic and clinical characteristics of the patients (n = 63), distributed by participating groups

	Hospital La Fe Valencia (n = 16)	Navarra University Clinic (n = 18)	San Pedro de Alcántara Hospital (n = 23)	Salamanca University Hospital (n = 6)	Total
Average age (years)	69.6 (range: 27-90)	62.8 (range: 41-92)	67 (range: 36-85)	65.4 (range: 42-81)	67 (range: 27-92)
Sex: males/females	12/4	13/5	14/9	4/2	43/20
Karnofsky Index, medium	60	51.6	36.1	56.6	52.45
Location					
Right	10	12	10	5	37
Left	6	6	12	1	25
Bilateral	1	–	1	–	2
Diagnosis					
Lung	10	9	12	2	33
Mesothelioma	–	1	1	1	3
Digestive system	1	3	4	1	9
Breast	2	–	2	1	5
Other locations	1	4	4	1	10
Unknown source	2	1	–	1	3

Table 2
Indications for the insertion of permanent tunnelled pleural drainage

	N	%
First intention after diagnosis	46	73
After pleurodesis failure		
With talc	3	4.7
With doxicicline	4	6.3
After repeated thoracocentesis	5	7.9
As first intention per trapped lung	5	7.9

Repeated thoracocentesis are considered as more than one evacuating thoracocentesis.

Table 3
Characteristics of the permanent tunnelled pleural drainages in the group of patients indicated as a first intention after diagnosis, and in those who had previously undergone pleurodesis

	Without prior pleurodesis (n = 46)	With prior pleurodesis (n = 7)	*P*
Duration of drainage (days)	41 (10-222)	99 (19-181)	0.04
Period between drainage insertion and decease (days)	37 (8-660)	161 (19-272)	NS
Daily amount of drained pleural liquid (ml)	75 (10-384)	142 (98-182)	NS
No. of spontaneous pleurodesis	18	1	–

NS: not significant.
Data expressed as average and range.

Figure 3. Dissemination of an adenocarcinoma through the tunnelled pleural drainage insertion channel. A subcutaneous node is observed in the catheter entry point in the skin and another larger one in the catheter entry point to the pleural cavity.

During monitoring, the following complications were reported: Three cases of empyema, two cases of chest pain, that required reinsertion of the catheter, and three cases of tumour dispersion in the area of the inserted tube, treated with radiotherapy. These dispersions occurred in two patients with adenocarcinoma and another with mesothelioma (fig. 3). Tunnelled drainage was not possible in just one case which required insertion of conventional drainage. There were no deaths connected with the technique.

Discussion

The PPE achieved control of the symptoms in 95.4% of the patients. The main advantage of this method in handling the PPEs is that hospitalisation is avoided. This fact, together with the decrease in the number of pleural punctures, favours improved quality of life of the patients. This is the main aim of every treatment with palliative intentions in patients with advanced neoplastic diseases. In the randomised study with 144 patients, Putman et al.[10] compared the average hospitalisation between patients treated with tunnelled catheter and patients treated through pleurodesis with doxycycline; the hospital stay average for those treated with tunnelled catheter was one day, while in the group of patients treated through pleurodesis with doxycycline was 6.5 days ($p < 0.001$). In our case, almost every drainage was inserted in outpatients, which proved hospitalisation unnecessary for the insertion of a pleural catheter.

The PPE can be inserted as a first option when faced with symptomatic MPE, as in the majority of cases, or in cases of failed pleurodesis. In our series, we found almost no differences in patient survival, or in the amount of liquid drained. However, we concur with other authors in that more randomised studies are needed, which include both patients treated with pleurodesis and those with permanent catheter, before indicating this treatment as a first option.[11] On the other hand, in the trapped lung syndrome, this type of treatment is widely accepted as safe and effective, and is considered as elective.[12]

Survival of patients treated with permanent catheter does not vary with respect to those treated conventionally. The average survival in our study was 45 days, slightly inferior to that reported in other studies, which oscillate from 56 to 144 days.[10,11,13] This can be explained by the grade of gravity of our patients that presented a low Karnofsky score. We believe that the deterioration of our patients is the factor that most influenced in this data, keeping in mind, also, that the permanent catheter has a palliative application. On the other hand, 7 of our patients had previously undergone failed pleurodesis, which forced a delay in the insertion of the tunnelled drainage, causing differences with respect to other studies.

Musani et al.[14] summarised their experience in a retrospective study with 24 patients after the outpatient insertion of PPE in recurring symptomatic MPE. They concluded that the pleural drainage was cost effective and achieved relief of the respiratory symptoms associated to MPE. Van den Toorn et al.[15] reported similar results in their study with 17 patients diagnosed with MPE who underwent an outpatient insertion of a pleural catheter, and proved that it was a relatively simple method, able to alleviate the respiratory symptomatology as well as improving patient's quality of life. Complications were limited. One of the broadest series published to date is by Tremblay and Michaud,[11] who, after analysing 250 patients, reached similar conclusions. The most distinguishing features of this study are the low rate of complications and the outpatient handling of the permanent catheter. The results obtained in our study with respect to respiratory improvement and the increase in patient independence coincide with those previously described. Symptoms were controlled in 95.4% of the patients in our series; this fact is of great importance in this type of disease in which a palliative treatment is attempted.

Results with respect to the average daily amount of drained pleural liquid are similar to those published.[13,15-17] In the aforesaid study by Putman et al.,[10] 21% of the patients treated through pleurodesis with doxycycline had recurring symptoms of the pleural effusion, versus 13% of the patients treated with permanent drainage. There were no cases registered of effusion recurrence or failure in our series. Furthermore, spontaneous pleurodesis occurred in 34%. This is a situation reported in previous studies,[18,19] in which the rate of appearance of spontaneous pleurodesis was close to 50%.[10,11,14,20,21] We believe that the mean survival slightly lower than the average explains the lower percentage of spontaneous pleurodesis in our group of patients. The mechanisms involved in the appearance of spontaneous pleurodesis are still unknown. However, it is quite infrequent for patients treated with repeated pleural taps to experience this.[22] Various mechanisms have been proposed in an attempt to explain spontaneous pleurodesis. The fact that the pleural space can be totally drained daily would favour contact between the two pleural sheets and its subsequent symphisis. Another favourable circumstance would be the elimination, together with the pleural liquid of proteins, waste cells and other factors present in the MPE that could interfere with the union of visceral and parietal pleura. There are certain inflammatory markers in the pleural liquid (interleukin-2, tumour necrosis factor-alpha and transforming growth factor-beta type) liberated by the pleural surface or by the MPE tumour cells that can act as endogenous sclerosing agents once the pleural sheets are in contact. Finally, a permanent drainage tube lodged in the pleural space can act as a physical irritant and therefore stimulate the inflammatory response and enable pleural symphysis. It has recently been observed that spontaneous pleurodesis is more frequent in MPEs of mammary or gynaecological origin.[23]

Complications related with the insertion and maintenance of the catheter were limited and easily controlled. The drainage required repositioning during its insertion in one case. Before positioning the drainage, a transthoracic ultrasound is recommended to choose the best place of insertion.[24] However, not every centre has ultrasounds in the pleura units. The only late complication registered was an infection of the pleural space in 3 patients, which was controlled in all of them with intravenous antibiotherapy without removing the drainage. In other series, the most frequent complications related with this type of drainage are infections and displacement of the catheter. Cellulite and pain have also been reported in the catheter placement area, as well as haemothorax, pneumothorax and obstruction of the catheter, not observed in this series. Exceptionally, cases of tumour dissemination in the catheter trajectory have been reported by lymphoma and adenocarcinoma.[25,26] Three cases of tumour dissemination through the catheter insertion region occurred in our series. Two patients were diagnosed with adenocarcinoma and one with mesothelioma. This complication with tunnelled catheter has been communicated by other authors.[9,10] It is known that the mesothelioma is a tumour that frequently invades the line, both from the pleural biopsy needle as well as the thoracic tube or the thoracoscope.[27]

Our study proves that, with the use of the permanent pleural catheter, the symptomatic MPE can be effectively managed from the outpatient clinic. This system controls the respiratory symptoms in most patients, thanks to a minimally invasive technique and very few complications.

Conflict of Interest

The authors affirm that they have no conflicts of interest.

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