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Recurrent Pleural Effusion: Who Benefits from a Tunneled Pleural Catheter?

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- tunneled pleural catheter
- malignant pleural effusion
- entrapped lung
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Abstract

Recurrent malignant pleural effusion (MPE) is a common concomitant phenomenon of malignant disease, which can worsen the patient's quality of life and lead to significant morbidity. Tunneled indwelling pleural catheters (TIPC) offer new modalities in patients with recurrent MPE and impaired dilatability of the lung. We report on our experience with 100 consecutive patients suffering from recurrent benign (n = 12) and malignant pleural effusion (n = 88) who were treated with TIPC. The catheter was placed during a VATS procedure or under local anesthesia in an open technique. The median residence time of the TIPC was 70 days; spontaneous pleurodesis was achieved in 29 patients. The rate of complications was low: pleura empyema (n = 4), accidental dislodgement (n = 2), malfunction of the drainage (n = 3). In conclusion, TIPC is a useful method for the palliative treatment of patients with recurrent malignant or nonmalignant pleural effusions and 3 groups of patients seem to benefit most: a) patients with the intraoperative finding of a trapped lung in diagnostic VATS procedure; b) patients after a history of repeated pleuracenteses or previously failed attempts at pleurodesis; c) patients in a reduced condition with a limited lifespan due to underlying disease.

Introduction

Recurrent malignant pleural effusion (MPE) is a common concomitant phenomenon of malignant disease, which can worsen the patient's quality of life and lead to significant morbidity. Survival is typically poor and may vary depending on the histology [1,2]. Pleurodesis is the classic treatment to prevent repeated pleuracenteses. If the lung is completely dilatable, the instillation of sclerosing agents – talc, doxycycline, tetracycline, bleomycin, silvernitrate – via a chest tube or talc insufflation by VATS induces local inflammation to achieve pleural symphysis [3–6]. The optimal methods are controversial and costs and charges may vary [7,8]. In recent years the use of talc has become controversial because of a growing number of reports on severe pulmonary complications following talc pleurodesis [9–11].

In subjects with impaired dilatability of the lung treatment can be difficult because of the improbability of inducing adhesions between parietal and visceral pleura. Repeated pleuracenteses can become necessary to treat recurrent and symptomatic pleural effusion. Tunneled indwelling pleural catheters (TIPC) have been used (in the US since 1997, in Europe since 2003) for outpatient intermittent drainage of pleural effusion to prevent repeated pleuracenteses and have gained in popularity over the past few years.

Several studies recommended TIPC as a safe and effective option, especially for the outpatient treatment of recurrent malignant effusions. The authors stressed the advantage of a short hospitalization time. The largest series have been reported from the US and Canada, whereas the concept is not yet widely used in Europe [12–15]. In this analysis we report on our experience with 100 patients suffering from recurrent benign and malignant pleural effusion, treated with TIPC.

Material and Methods

Patients

From April 2005 to November 2007 a total of 100 patients underwent insertion of a total of 107 TIPCs. Sex distribution was balanced (male = 52, female = 48) with a mean age of the patients of

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Table 1 Patients' characteristics.

Underlying disease	Number	Median age (years)	Age range (years)
Lung cancer	23	61	41–82
Breast cancer	20	62	46–88
Mesothelioma	11	70	62–81
Ovarian cancer	4	71	50–85
Pancreatic cancer	5	65	53–82
CUP	5	67	43–91
Other malignant disease	19	62	30–79
Nonmalignant	13	71	42–81
All patients	**100**	**65**	**30–91**

64 years. The number of 107 procedures included 6 contralateral procedures and 1 repeated ipsilateral procedure after accidental removal by the patient himself. Left-sided procedures (n = 65) prevailed. The origin of the pleural effusion in most patients was malignant disease (n = 88), in twelve patients there was a nonmalignant origin. A summary of the clinical data is presented in ◉ **Table 1**.

TIPCs were offered to patients with recurrent malignant or nonmalignant pleural effusion who presented with distinct intraoperative or preoperative findings: the first group included patients with the intraoperative finding of a trapped lung (pleural surfaces – parietal and visceral – did not come into contact under full ventilation of the lung) undergoing a diagnostic VATS procedure for pleural effusion. In patients with the intraoperative finding of malignant pleural effusion and a fully expandable lung, talc poudrage was the standard treatment. The intraoperative suspicion of pleural empyema was a contraindication for placement of a TIPC. In the second group of patients who had a history of previously failed attempts at pleurodesis, we decided to implant a TIPC under local anesthesia, as a further attempt at pleurodesis did not appear promising. The third group of patients presented with recurrent pleural effusion and was in a reduced clinical condition. These patients were not suitable for general anesthesia and an alternative VATS procedure with talc pleurodesis, so that in these patients a TIPC was placed under local anesthesia.

Prior treatment

In a total of 54 patients, diagnostic or therapeutic approaches (pleurocentesis, pleurodesis) to treat the pleural effusion were performed before inserting the TIPC. A total of 36 patients underwent a diagnostic VATS procedure before TIPC placement: in 21 of theses patients, intraoperative talc pleurodesis was performed for the intraoperative finding of pleural carcinosis; in 15 patients no pleural treatment was carried out. In a total of 13 patients repeated pleuracenteses preceded TIPC placement. Another 5 patients with previous major lung resection (lobectomy: n = 3, bilobectomy: n = 2) had undergone repeated pleuracenteses for recurrent pleural effusion during their subsequent follow-up.

Technique of TIPC placement and drainage protocol

The placement of TIPCs was performed by a thoracic surgeon – in most cases (n = 98) as an inpatient procedure. The insertion of the catheter was performed under sterile conditions in the operating room under local anesthesia, occasionally with supplemental sedation or during a VATS procedure. Under local anesthesia catheters were inserted using the Seldinger technique as recommended by the manufacturer in the midaxillary line with subcutaneous tunneling at a distance of about 5 cm. No additional standard chest tube was placed in these patients; drainage of recurrent effusion was provided by the system's vacuum drainage bottle.

In patients undergoing a VATS procedure the catheter was induced into the thoracic cavity concurrently; the catheter was inserted into the thoracic cavity passing one of the VATS incisions via subcutaneous tunneling at a distance of about 5 cm. In all VATS procedures a standard chest tube was placed for 24 hours; subsequently recurring effusion drainage was provided by the system's vacuum drainage bottle.

Patients and relatives or home care nursing staff were instructed in TIPC care and drainage through specific training on the catheter system. Subsequent drainage of the catheter system was performed three times weekly and thereafter according to the symptoms (dyspnea, pain) or the volume of fluid. If the fluid drainage volume was less than 50 ml at three sequential drainage procedures, performed once a week in an expanded lung at X-ray, the TIPC was removed in these patients.

The removal was performed under local anesthesia as an outpatient procedure. The observation period ended in February 2008 for patients with a resident TIPC; the other patients were followed-up until removal of the catheter or the patient's death. A retrospective analysis of the records was performed with the approval of the Ethics Board of the University of Heidelberg (No: 080/2006).

Results

A total of 107 TIPCs inserted into 100 patients suffering from recurrent pleural effusion were included in this analysis. The origin of the pleural effusion in most patients was malignant disease (n = 88); in twelve patients it was nonmalignant disease. Genesis of nonmalignant effusions were cirrhosis of the liver (n = 2) and chronic exsudative pleurisy (n = 10). In a total of 56 procedures TIPC was inserted during a VATS procedure with the intraoperative finding of a trapped lung. A total of 30 procedures were performed under local anesthesia after previous failed treatment for pleural effusion. A total of 21 TIPC procedures were performed under local anesthesia in patients in a reduced clinical condition.

Follow-up

Patients were followed-up until February 2008. The median residence time of the TIPC was 70 days (min: 2 days, max: 384 days) in all patients.

In a total of 52 procedures the TIPC remained indwelling until the patients' death (median period: 47 days; min: 2 days, max: 319 days). In all of these patients further relief of recurrent effusion was provided by the drainage system. None of these patients required repeated investigations (pleuracenteses or surgical interventions). A total of 16 TIPCs were still *in situ* at the end of the observation period with a median indwelling time of 87 days (min: 30 days, max: 389 days). These patients still required relief for recurrent pleural effusion. A total of 39 catheters were removed after a median indwelling time of 80 days after recording a decreased drainage volume and a gradually expanded lung ("spontaneous pleurodesis"). In one patient with a TIPC *in situ* the lung expanded gradually without cessation of the pleural effusion;

Table 2 Course of TIPC procedures in the different patient groups.

Patient groups	Median indwelling time (days)	Numbers of procedures n (%)	TIPC at the end of the observation period		
			removed (n)	indwelling (n)	indwelling until patient's death (n)
I (VATS)	78	56 (100%)	30 (54%)	9 (16%)	17 (30%)
II (LA)	64	30 (100%)	8 (27%)	3 (10%)	19 (63%)
III (LA, frail)	57	21 (100%)	1 (5%)	4 (19%)	16 76%)
All procedures	**70**	**107 (100%)**	**39 (36%)**	**16 (15%)**	**52 (49%)**

Table 3 Course of TIPC procedures in different underlying diseases.

Underlying disease	Numbers of procedures (n)	Median indwelling time (days)	TIPC at the end of the observation period		
			removed (n)	indwelling (n)	indwelling until patient's death (n)
Lung cancer	25	73	7	8	10
Breast cancer	22	73	5	2	15
Mesothelioma	12	111	6	3	3
Ovarian cancer	5	65	2	0	3
Pancreatic cancer	5	22	1	0	4
CUP	5	14	0	0	5
Other malignant disease	19	62	8	2	9
Non malignant	14	80	10	1	3
All procedures	**107**	**70**	**39**	**16**	**52**

this patient subsequently underwent a VATS procedure and talc pleurodesis, resulting in no symptomatic pleural effusion occurring in the further follow-up. A summary of the course of TIPC procedures in the three patient groups is given in **Table 2**.

Patients with carcinoma of unknown primary (CUP) origin and pancreatic cancer had the worst outcome. In most patients the catheter remained *in situ* (median time: 22 and 14 days) until the patient's death. Lung cancer and breast cancer patients showed comparable courses with a median catheter residence time of 73 days. Patients with malignant pleural mesothelioma had a median catheter residence time of 111 days. A summary of the course of the TIPC procedures for the different underlying diseases is shown in **Table 3**.

Morbidity

In a total of nine patients the catheters had to be removed for TIPC-related complications. Four patients developed pleural empyema after a median time of 98 days (min: 23 days, max: 291 days). Subsequent treatment was by local means (i.e., VATS, drainage) and antibiotics in three patients; one patient required a small thoracostoma. Two of these patients had senile dementia. At the request of one other patient, the drainage was removed after 14 days due to pain at the location of the catheter insertion. Accidental dislodgement by the patient himself occurred twice. In one patient the volume of pleural effusion had decreased and therefore a new TIPC placement was not necessary; in the other patient a repeated TIPC placement was performed. Bronchopleural fistula occurred over the course of time in one patient with a resident TIPC and progressive tumor growth; it remains unclear whether the fistula was due to the TIPC. In one patient the TIPC was occluded and was therefore removed and reinserted. In two patients recurrent pleural fluid occurred which could not be drained by the resident TIPC; a repeated TIPC placement was required. A summary of TIPC-related complications is given in **Table 4**.

Table 4 Complications post-TIPC placement.

Complication	Numbers
Empyema	4
Pain requiring removal of TIPC	1
Accidental dislodgement by the patient	2
Bronchopleural fistula	1
Occlusion of drainage	1
Recurrent fluid – new TIPC placement	2

Mortality

A total of six patients died during hospital stay after insertion of a TIPC: four patients (7.8%) after insertion by VATS procedure (group 1) on postoperative days 2–4; two patients (4.1%) after insertion under local anesthesia (group 3) on postoperative days 2–3. Reasons for death were either rapid progressive malignant disease or respiratory failure due to the underlying malignant disease.

Discussion

Our experience with a number (n = 107) of TIPC procedures for the treatment of malignant and nonmalignant pleural effusion in 100 patients adds more data to the hitherto published reports on this technique. In our series, TIPC placement was indicated in three groups of patients: those with a trapped lung who were not promising candidates for pleurodesis; those with recurrent pleural effusion after failed attempts at pleurodesis; and those in a very poor physical condition who were not suitable candidates for VATS procedure. Compared to other series, this represents a selected collective, because patients with malignant pleural effusion and fully expandable lungs in a good clinical condition were not offered TIPC placement – they were given

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talc poudrage during a VATS procedure as the standard treatment (a total of n = 384 during the reported period of time in our institution).

Placement of the catheter was a safe procedure during VATS as well as under local anesthesia by a small pleural incision; early complications (hemothorax, extrapleural placement, bronchial fistula) did not appear. In patients in a very poor physical condition VATS procedure can have a high postoperative mortality rate; therefore, TIPC placement under local anesthesia is less invasive and the postoperative mortality rate should tend towards zero. The reasons for death in our series were progressive respiratory failure related to the underlying disease; self-critically we have to admit that those patients were not good candidates for an aggressive or semi-aggressive invasive procedure. In patients with a very limited lifespan according to the underlying disease, the indication has to be considered carefully. In patients with a life expectancy of only a few days or weeks according to the underlying disease the insertion of a not-tunneled pleural minicatheter may be an alternative palliative treatment.

Patients with nonmalignant pleural effusion fulfilling our criteria for TIPC placement (trapped lung, previous unsuccessful pleurodesis, poor clinical condition) also underwent TIPC placement. We consider nonmalignant pleural effusion to be a good indication for use of the TIPC with a rate of 77% of catheters being removed due to decreased drainage volumes and spontaneous pleurodesis after a median indwelling period of 89 days.

Compared to other reports in the literature our overall rate of catheter removal after decreased drainage volume ("spontaneous pleurodesis") was quite low (29 patients) compared to a rate of up to 58% in reported series [14,16–18]. In patients undergoing TIPC placement during diagnostic VATS procedure and the intraoperative finding of a trapped lung (group 1), the rate of spontaneous pleurodesis was 58%. There may be an interesting subgroup in this group of patients: those patients with the intraoperative finding of a partially trapped lung may be candidates for talc poudrage as well as TIPC placement. In a small number of patients (n = 9) we decided on performing talc poudrage plus TIPC placement. In this group of patients it was possible to remove the catheter after a median period of 65 days. The partially entrapped lungs showed a further increase in expansion in repeated radiological controls. At the time of catheter removal the amount of fluid drainage was < 50 ml at three sequential drainage procedures. In our opinion this group of patients with partially entrapped lungs is worth further investigation in a randomized trial.

The number of patients with an indwelling catheter until death was relatively high in our collective (n = 48, median time: 47 days). This may be explained by the selection of our patients. We decided on performing a VATS procedure and talc poudrage in patients with recurrent pleural effusion (malignant or nonmalignant) and a good clinical status. In the other published series these patients were included and underwent TIPC placement as an alternative to VATS procedure and talc poudrage [13,14,19].

Complications in the long-term follow-up in our series are comparable to those reported by other authors [13,19]. Pleural empyema occurred in four patients after a median time of 98 days. Accidental dislodgement of the catheter by the patient himself occurred in two patients with senile dementia and a low level of compliance. We have not seen any tumor seeding at the place of catheter insertion; in the literature a few cases of tumor-seeding have been reported with a rate up to 6.7% [14,20]. Especially in patients with a mesothelioma and a median catheter indwelling time of 111 days, this result was surprising; none of the mesothelioma patients received local radiotherapy during the observation time; eight patients had palliative chemotherapy during the observation period.

Conclusion

TIPC is a useful method for the palliative treatment of patients with recurrent malignant or nonmalignant pleural effusions and the rate of short and long-term complications is sustainable. Critical evaluation is necessary when considering patients with a very low level of compliance. In our experience three groups of patients seem to benefit most: a) patients with the intraoperative finding of a trapped lung in a diagnostic VATS procedure who are not candidates for talc pleurodesis; b) patients with a history of repeated pleuracenteses or previously failed attempts at pleurodesis; c) patients in a reduced clinical condition with a limited lifespan according to the underlying disease.

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