Videothoracoscopic debridement of the postpneumonectomy space in empyema

Peter H. Hollaus*, Franz Lax, Peter N. Wurnig, Dan Janakiev, Nestor S. Pridun

Department of Thoracic Surgery, Pulmologisches Zentrum Vienna, Sanatoriumstraße 2, A-1145 Vienna, Austria

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Abstract

Objective: Simple irrigation has proven to be an efficient method to treat postpneumonectomy empyema provided that bronchopleural fistula is not present or successfully closed. However, with this treatment modality, infected material inside the thoracic cavity is not removed and this can be a potential source of empyema recurrence if the patient's immune system is compromised. The removal of the infected material should result in a lower recurrence rate.

Methods: As soon as diagnosis of postpneumonectomy empyema was established, a chest tube drainage was inserted. A concomitant bronchopleural fistula was evaluated bronchoscopically. If the fistula was smaller than 3 mm, bronchoscopic sealing with fibrin glue (Tissucol, Immuno, Vienna) was initiated. Fistulas closed surgically were excluded from this analysis. The thoracic cavity was cleared of infected material by videothoracoscopy and bacteriological samples were taken. Immediately after operation antibiotic irrigation according to culture sensitivity was started via a single chest tube drainage twice a day. After instillation of antibiotics the drain was kept clamped for 3 h. Culture samples were obtained twice a week. Empyema was considered eradicated, if three subsequent cultures showed no bacterial growth. After drain removal the patients were kept in hospital for another week and observed for clinical signs of infection; WBC and CRP were controlled.

Results: Nine patients (five men, four women) between 55 and 72 years (mean 61, SD 6), all initially operated on for malignancy, were successfully treated with this regimen. In three cases a concomitant bronchopleural fistula was successfully closed before videothoracoscopy. The interval between primary operation and empyema was between 7 and 436 days (mean 93, SD 141). There was no postoperative mortality and no procedure related morbidity. Operating time ranged from 45 to 165 min (mean 92.7, SD 36.6), the suction volume (consisting of blood, debris and pus) was 300 to 1000 ml (mean 880, SD 600). Duration of thoracic drainage was 12±38 days (mean 22, SD 9), duration of hospital stay after videothoracoscopy 21±46 days (mean 29, SD 9). During the follow-up period of 204-1163 days (mean 645, SD 407) no recurrence of tumour or empyema was observed.

Conclusions: Videothoracoscopic debridement of the postpneumonectomy space with postoperative antibiotic irrigation of the pleural space is an efficient method to treat postpneumonectomy empyema, provided that a concomitant bronchopleural fistula can be closed successfully. No early empyema or fistula recurrence were observed. However, late recurrence may occur many years after operation, therefore close follow-up is indicated. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Videothoracoscopy; Postpneumonectomy; Empyema; Bronchopleural fistula; Pleural irrigation

1. Introduction

The treatment of postpneumonectomy empyema (PPE) varies but an aggressive surgical approach is appropriate if bronchopleural fistula is present. However, small fistulas can be successfully closed by bronchoscopic submucosal fibrin injection [1], thus transforming complicated PPE into 'simple' PPE. In isolated or 'simple' PPE the aim of some authors is to obliterate the pleural space. Others accept its existence, obtain its sterilisation and trust in the formation of fibrothorax, which can be expected if the causative infection is eradicated. Being aware of the fact that there is no treatment which is appropriate in all cases, in our opinion aggressive surgery can be avoided if fistula closure can be achieved bronchoscopically and should be reserved for patients with PPE, which is recalcitrant to conservative measures.

In recent years videothoracoscopy has enriched our surgical armamentarium. We report our experience of videothoracoscopic debridement of the postpneumonectomy space with a review of the current literature.

2. Patients and methods

Between 1992 and 1998, 367 pneumonectomies were...
performed in our department. In a retrospective analysis, the hospital charts of patients treated for postpneumonectomy empyema were reviewed. Pneumonectomy was performed under antibiotic prophylaxis with a second-generation cephalosporin. Routinely the bronchial stump was resected tangentially to the trachea. Postoperative ventilation was not required. The chest drainage was removed on the day following resection irrespective of the drainage volume. The following parameters were recorded: age (years), sex, side, interval between operation and empyema diagnosis (days), duration of thoracic drainage after videothoracoscopy (days), operating time (minutes), suction volume (ml), the postoperative course and follow-up (days).

Clinical symptoms leading to diagnosis of fistula were dyspnea, fever, cough, haemoptysis, foetid breath, and an increase in white blood cells (WBC) and C-reactive protein (CRP). Presence of bronchopleural fistula and fistula size were diagnosed by direct bronchoscopic visualisation or fistulography. A stump biopsy was only taken if the stump showed visible signs of malignant mucosal changes.

Isolated postpneumonectomy empyema was suspected in case of fever and rise of WBC and CRP.

Treatment consisted of immediate intercostal drainage after diagnosis. Bacteriology was obtained by diagnostic thoracic puncture or from the drainage fluid. Patients with a negative bacteriology were excluded from this analysis. If a bronchopleural fistula bigger than 3 mm was diagnosed, patients underwent surgical fistula closure with intercostal muscle flaps and were also excluded from the study. If a fistula smaller than 3 mm was present bronchoscopic sealing was started immediately. The principles and results of bronchoscopic treatment of bronchopleural fistula have been outlined in a previous publication [1]. Videothoracoscopy was performed in supine position during the same anaesthesia. A camera port and a working port were inserted cranially to the thoracotomy scar. Intrathoracic debris was mobilised and removed with a long plastic suction unit, endoscopic forceps, a swab on a stick or with a sharp spoon. Large chunks were simply extracted. Again specimens for bacteriological culture were sampled. At the end of the procedure the entire thoracic cavity was irrigated with 1000 ml of Chloramin 0.1%, ports closed and a chest drain inserted at the most caudal point of the thoracic cavity.

In the ward the empty hemithorax was irrigated with antibiotics according to culture results twice a day. After irrigation the drain was clamped for 3 h. Cultures were obtained twice a week. After three consecutive sterile cultures the infection was considered eradicated and the drain was removed. Thereafter the patients were kept in hospital for another week, CRP and WBC being controlled regularly. If there were no clinical signs of infection and the blood results were within the normal levels, the patient was discharged.

3. Results (Table 1)

All patients with ‘simple’ postpneumonectomy empyema and all patients who underwent successful fistula closure were treated this way. There were nine cases (five men and four women), all initially operated on for malignancy. In four cases the empyema was located on the right side. Age ranged from 55 to 72 years (mean (SD) 61.3 (14)). In one patient (T.G.) suffering from adenoidcystic carcinoma, histology revealed lymphangiosis carcinomatosa of the bronchial stump. She developed isolated PPE and underwent irradiation after successful empyema treatment.

Interval ranged from 7 to 436 days (mean (SD) 93 (141.2)). Two patients had clinical signs of infection (elevation of CRP and WBC) during their initial hospital stay. However, puncture of the postpneumonectomy space, which took place on the 9th and 11th postoperative days, respectively, did not reveal any bacterial growth. They were treated with parenteral antibiotics resulting in a drop of CRP and WBC to normal levels, allowing discharge, and were readmitted 13 and 50 days after discharge, respectively.

Two patients developed empyema 9 and 11 days after

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<th>TNM Stage</th>
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<th>Sex</th>
<th>Side</th>
<th>Operation time (min)</th>
<th>Suction volume (ml)</th>
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* squcc, squamous cell carcinoma; adca, adenocarcinoma; adcyte, adenoidcystic carcinoma (with lymphangiosis carcinomatosa in the bronchial stump).
operation during their initial hospital stay and a chest drain had to be reinserted.

In three patients a minifistula was diagnosed by fistulography. The fistula occurred during their initial hospital stay in two cases, the third patient was readmitted 82 days after discharge. All fistulas were successfully closed with a single submucosal injection of fibrin sealant (Tissucol, Immuno). The bronchoscopic intervention and videothoracoscopic debridement were performed during a single anaesthesia.

Operating time ranged between 45 and 165 min (mean (SD) 92.7 (36.6)). Suction volume (consisting of pus and blood) was 300 to 1000 ml (mean (SD) 800 (289.2)). The average interval between videothoracoscopy and removal of drainage was 12–38 days (mean (SD) 22.4 (8.6)). After videothoracoscopic intervention patients stayed in hospital for 21–46 days (mean (SD) 29 (8.9)).

There was no postoperative mortality and no procedure related morbidity. One patient required two blood units in the postoperative course. Another developed antibiotic colitis, which was successfully treated with vancomycin.

The follow-up period was 204 to 1163 days (median 689). During this time no recurrences of empyema or fistula were observed. All patients are alive without signs of tumour recurrence.

4. Discussion

Postpneumonectomy empyema is a well-known postoperative complication in thoracic surgery. Its incidence ranges from 2% to 13% [2] resulting in a rise of the associated perioperative mortality up to 25%, even if no fistula is present [3,4] and reaches 70% in the event of a concomitant bronchopleural fistula [5]. Initial therapy consists of immediate drainage of the pleural space followed by routine search for associated bronchopleural fistula, found in approximately 40% of patients [2]. Isolated or ‘simple’ PPE is quite uncommon, occurring 1 week to even 35 years after operation [3]. If a small bronchopleural fistula is present, closure can be achieved by submucosal injection of fibrin sealant [1]. In such cases ‘complicated’ PPE is converted to isolated PPE without major surgical intervention and further management of empyema follows the same guidelines as in ‘simple’ PPE.

The literature concerning isolated PPE is still controversial. Management depends on the general condition of the patient on admission and options of fenestration [7,8], reinforcement of the bronchial stump even if no fistula is present [6], the Claggett procedure, muscle flap closure of the postpneumonectomy space [9] or in rare cases, thoracoplasty [10].

However, in ‘simple’ postpneumonectomy empyema initial aggressive surgical treatment has not proven to be more effective than the Claggett procedure or simple pleural rinsing. Early recurrences are usually observed within 3 months after the end of treatment. late recurrences can occur many years later. Pairolero et al. [6], favouring intrathoracic muscle transposition, presented an overall success rate of 56%. Sixteen PPs were treated, of whom three died during treatment; four recurrences were observed.

Michaels et al. [9], employing muscle transposition combined with thoracoplasty to reduce the postpneumonectomy space, treated four patients with simple PPE with one recurrence; the length of follow-up was not given. Wong et al. [11] reported five recurrences in a group of 13 patients treated with initial open-window thoracostomy, which was closed subsequently after successful pleural irrigation. Weber et al. [8] reported no recurrence with open-window thoracostomy; however, their mortality rate was 29% in a group of 14 patients.

The Claggett procedure entails a prolonged course of irrigation before closure of the chest can be achieved. An open thoracostomy is uncomfortable for the patient and the majority have to face a second operation for closure of the thoracostomy. A considerable number of patients remain who cannot be reoperated [6,11], and thus have to await spontaneous closure of the thoracostomy [7], face later thoracoplasty, or simply have to accept permanent thoracostomy for the rest of their life.

In 1971 Provan [12] proposed antibiotic irrigation of the empty hemithorax via a single chest tube drainage with a first time success of 50%. In 1976 Kärkölä et al. [13] reported two patients with simple PPE cured without recurrence after antibiotic irrigation and closed chest drainage, using two drains. Rosenfeldt et al. [14] also found no advantage for aggressive surgical treatment compared with pleural irrigation. Goldstraw, initially advocating immediate fenestration [15], later concluded after successful eradication of empyema in 13 cases with irrigation that this mode of treatment replaces fenestration in most cases [11].

We agree with the above-mentioned authors that aggressive surgery should be reserved for recalcitrant empyema. If bronchopleural fistula is excluded or successfully closed endoscopically, irrigation is a worthwhile alternative, which should be taken into consideration as an initial approach. However, one major drawback of simple irrigation is the fact that debridement of the empty hemithorax is not achieved. Even if infection has subsided, the remaining intrathoracic debris still harbours germs as a potential source for late recurrence.

Videothoracoscopy alone does not allow the exclusion of a fistula diagnosis, as the bronchial stump is often covered with a thick layer of granulation tissue, making visual localisation impossible, especially if the fistula is small. Bronchoscopy and videothoracoscopy can be performed during one anaesthesia. Even if no bronchial stump insufficiency is seen, fistulography may reveal a minifistula, which can be easily closed by submucosal fibrin injection. Closure of the fistula is crucial, because the danger of aspiration during postoperative irrigation is imminent [16]. Videothoracoscopic debridement is a simple procedure. In contrast to open-window thoracostomy, a second intervention to close
the thorax is unnecessary. However, the operating time can be quite lengthy. In two cases we initially had to create a space by digital means, that allowed manoeuvring of the endoscopic instruments. Although the time of occurrence was 15 months after pneumonectomy, detritus could be removed easily with strong suction and a sharp spoon. There was no postoperative morbidity or mortality, making this procedure comparable with fenestration or the Clagett procedure [7,11], clearing all infected material and opening all isolated chambers. However, one major drawback of the technique remains the complete debridement of the deep regions of the costodiaphragmatic recess, since these are extremely difficult to reach with videothoracoscopy.

Although the literature advises maintenance of thoracic drainage, until the mediastinum is fixed before irrigation is started [11,17], we did not observe any problems that could be attributed to mediastinal shifting during treatment. Since the danger of aspiration does not depend on the size of a fistula [16], no clinical signs of a fistula should be present when irrigation is commenced. During the postoperative hospital stay we observed no case where the pleural cavity became obliterated. Serothorax developed after discharge from hospital, leading to fibrothorax later on in the majority of cases. Until now no fistula or empyema recurrence have been observed. In accordance with Goldstraw and Pairolero we have confidence in the natural organising process of obliteration, which can be expected if the causative infection is eradicated. Therefore, we refrain from surgical reduction of the postpneumonectomy space.

5. Conclusion

Videothoracoscopic debridement of postpneumonectomy empyema proved to be an efficient method in a series of nine patients. It is an easy technique without procedure-related morbidity and mortality. The fact that no early recurrence was observed is encouraging, but long-term follow-up is necessary to exclude late recurrence. If a concomitant bronchopleural fistula can be closed endoscopically, the same treatment may be applied as in isolated postpneumonectomy empyema. This concept is confirmed by the fact that no fistula recurrence occurred. Since the method proved to be successful from the beginning, it has become our routine practice in the treatment of postpneumonectomy empyema without bronchopleural fistula and has now replaced open-window thoracostomy for this complication. If a bronchopleural fistula is present its closure must be achieved before videothoracoscopy, as reinfection of the postpneumonectomy space via the open fistula takes place immediately.

References