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Thoracic Surgery

Open Window Thoracostomy for Surgical Management of Postpneumonectomy Empyema

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Abstract **Original Research Article**

Introduction: Empyema of the pleural cavity is a rare but serious complication of pneumonectomy.Its incidence ranges from 2% to 15% and its mortality is superior to 10% [1].the management of empyema is controversial. All authors admit treatment must be done urgently. Despite use of various therapeutic approaches and techniques during the last five decades, successful therapy remains difficult and is often associated with high morbidity. ***Methods:*** We retrospectively reviewed 14 patients underwent open-window thoracostomy with rib resection for a postpneumonectomy empyema (PPE). The treatement consists of radical debridement of the pleural cavity and packing with saline-soaked dressings. This was repeated in the operating theatre every second day, until the chest cavity was macroscopically clean. ***Results:*** fourteen patients with postpneumonectomy empyema (PPE) underwent open-window thoracostomy. 4 patients died, 4 patients have recovered well, 6 patients amenable for subsequent closure. ***Conclusions:*** Open-window thoracostomy with radical debridement enables successful treatment of postpneumonectomy empyema and is a well-tolerated concept, allowing rapid surgical closure.
Keywords: Empyema, pleural cavity, thoracostomy, pneumonectomy.

INTRODUCTION

Infection of the pleural cavity and the development of empyema are potential dangers after lung tissue resection procedures, mostly after pneumonectomy. In spite of the decrease in frequency of postpneumonectomy empyema (PPE) formation, this is still a serious complication. This complication may cause a great danger, especially if it combines together with bronchopleural fistula [3,4]

The Pleural Disease Guideline Group of the British Thoracic Society (BTS) published in 2010 a comprehensive guideline document for the medical management of pleural infection [6], with the aim to cover all aspects of surgical practice related to the treatment of pleural empyema. It is the aim of the European Association for Cardio-Thoracic Surgery (EACTS) to assess the topics of pleural empyema focusing on surgical treatment of empyema in adults and in children, and on surgical treatment of post-pneumonectomy empyema (PPE).

Nearly 40 years ago, Clagett and Geraci [5] introduced a two-stage procedure for treatment of PPE. This procedure combined an open pleural drainage (thoracostomy) with repetitive irrigation of the infected cavity with an antibiotic solution.

The aim of this communication is to review the authors' experience of the management of postpneumonectomy empyema with or without BPF.

PATIENTS AND METHODS

From January 2009 to December 2015, 14 consecutive patients with PPE were managed at the university hospital center ibno rochd of Casablanca.

There were 3 women and 11 men with a mean age of 40 years (range, 25 to 65 years). Eight patients underwent right pneumonectomy (5 bronchial carcinoma, 3 benign disease), and 6 had left pneumonectomy (3 tuberculosis, 3 hydatic cyst).

BPF was diagnosed in 8 (6 right, 2 left) of the 14 patients (57.14%). All of the 14 patients had their chest incision closed at the time of pneumonectomy and subsequently developed a PPE.

The records of these 14 patients were reviewed for age, sex, comorbidities, smoking history, indication for pneumonectomy, side of pneumonectomy, time

interval between pneumonectomy and PPE, presence of BPF, type of procedures, complications and outcomes. Time to the development of PPE was calculated from the date of pneumonectomy to the date of diagnosis of PPE.

Every patient underwent preoperative fiberoptic bronchoscopy to evaluate the presence of a potential BPF, and chest computed tomography for optimal preoperative planning. The diagnosis of empyema was made on the basis of the macroscopic appearance of the intrathoracic fluid and the microbiologic findings (microscopy and cultures) in the purulent pleural fluid.

Appropriate systemic antibiotic treatment was initiated preoperatively, in general with tazobactam/piperacillin or according to the microbiologic findings. Before surgery the 14 patients were treated with closed chest tube drainage.

The patients were discharged after wound healing and normalization of the inflammatory parameters in the blood tests (white blood cell counts, C-reactive protein).

Table-1: Characteristics of subjects

Sexe	Age	Previous pneumonectomy	Previous pathology	On set of empyema after surgery	BPF
Male: 11 Female: 3 Overall 14	Mean: 40 Range: 25-65	Right side: 8 Left side : 6	-Bronchogenic carcinoma: 5 -Infectious disease: 9	-Early : 8 -Late : 6	-No fistula: 6 -Fistula: ➔ 6 right ➔ 2 left

BPF: bronchopleural fistula.

Operative Technique

All 14 patients with PPE were treated in the following way: patients were intubated endotracheally, or with a double-lumen endotracheal tube if a BPF was present, and placed in a lateral decubitus position. The previous thoracotomy was reopened and removing 6–8 cm of the underlying rib and up to three of the adjacent ribs; then a radical debridement of the pleural cavity by partial pleurectomy and curettage of all necrotic and fibrous infected tissue was performed and followed with irrigation. The presence of BPF was confirmed by flooding the chest cavity with saline and observing escaping air bubbles from the mediastinum. The skin edges where then sutured to the parietal pleura to create a skin-lined fenestra. At the end the pleural cavity was packed with saline-soaked dressings. Avoiding a mediastinal shift through overstuffing.

Every 48 hours, the antiseptic packing was changed and the surgical debridement repeated in the operating room until the chest cavity was macroscopically clean. Parenteral antibiotic treatment started preoperatively was continued.

For two patients the open bronchus was subsequently closed with an omental pedicle used as a patch. The pedicle was placed on the stump without tension to cover the opening and fixed, achieving airtight closure. To expose the omentum, a short upper midline incision was performed, and the omentum was freed from the transverse colon and mesocolon. It was then dissected from the stomach along the greater curvature. Pediculated on the right gastroepiploic artery, it was placed in the pleural cavity through an incision in the diaphragm, and fixed with interrupted sutures at the bronchial wall. In addition, the omentum was fixed to the mediastinum with several sutures.

RESULTS

At the beginning of treatment, eight patients included in the study had a bronchopleural fistula (BPF). At 4 months, six patients were noted to have reduced infectious signs or more than a 50% reduction in the size of thoracic cavity; the treatment in these patients was considered successful. The assessment performed 3months later showed and ~80% reduction in size.

Patients whom underwent omentoplasty; 6 months later, The cavity size decreased by more than 70% and 3 months thereafter, it was completely closed.

For two remaining survival patients, empyema developed within the postpneumonectomic effusion after the operation. The drainage was inadequate, an OWT was opened, and the patients were followed with daily dressing changes. Two years after, a 20 to 30% reduction in cavity volume was observed.

Outpatient follow-up with a repeat chest x-ray and inflammatory markers had being arranged for all patients, the follow-up time ranged from 24 to 70 months (mean, 47 months).

The long-term survival of patients with pleural infection is good. In our series of 14 patients followed, the mortality was 28,5%. Two patients succumbed to tumor progression and two patients due to sepsis from the empyema.

Table-2: Results of fenestration [7]

Author	Lengh of treatement	No	First time success	Interval to failure	Second time success
Adler and plant (1972)	5-12 weeks	3	100%	---	---
Stafford and clagett (1972)	4-8 weeks	18	61%	1/12 – 6 yr	60%
Virkkula and Eerola (1974)	5-6 months	13	77%	---	---
Zumbro and all(1973)	6-8 weeks	3	100%	---	---
P-Goldstraw	40 days	22	77%	2/52 – 52/12	40%
Present study	5-6 months	14	60%	---	---

DISCUSSION

Successful treatment of postoperative empyema remains a challenge for thoracic surgeons. Adequate pleural drainage is the cornerstone of the initial treatment of empyema complicating pulmonary resections. In our series, as well as in the experience of several authors [7- 9] closed chest tube drainage represented the initial part of management of postresection empyema and allowed for stabilization of the patients' clinical conditions. However, closed drainage often fails to completely drain the cavity with subsequent unsatisfactory control of the infection; in these cases open drainage is performed [7-9].

In our study, open window thoracostomy was carried out according to the standard technique [8]; the entity of rib resection was as limited as possible to ensure adequate drainage and easy changes of dressings. For severely ill patients we preferred to limit the surgical trauma as much as possible, and therefore no attempt was made to close a BPF when present. This approach is probably responsible for the low incidence of complications observed in the present series. Furthermore, similar to others' experience [8], in 53.8% of cases, the BPF closed spontaneously after open window thoracostomy, probably because of improvement of the infective condition of the pleural cavity. Other authors have advocated more aggressive management of early postresection empyema and BPF. Pairolero and colleagues [10] suggested immediate open pleural drainage by reopening of the entire thoracotomy incision. In the presence of BPF they performed restapling of long bronchial remnants (if present) or complete reopening and resuture of short stumps. Immediate muscular transposition is used to protect the suture line or to cover the fistula if resuture is not possible [10]. They suggested open window thoracostomy, closure with the second stage of the Clagett procedure [5].

Pairolero and colleagues [10] reported a successful outcome in 26 (57.8%) of 45 patients; 6 (13.3%) operative deaths were also observed, and a mean of 5 surgical procedures were necessary.

On the other hand, several authors have used the 2-step Clagett procedure (without flap transposition) in the treatment of postresection empyema. This technique is possible only in the absence of BPF, and the results are very variable in different authors' experience. In the series of Stafford and Clagett[16], sterilization of empyema and definitive closure of the open window thoracostomy, were accomplished in 11 (61%) of 18 patients at the first attempt. Goldstraw[7] reported successful results in 17 (77.3%) of 22 patients in whom the entire procedure could be completed, whereas in the experience of Shamji and colleagues,[9] in only 2 of 5 patients who underwent the second step of the procedure was a permanent closure of the open window thoracostomy, achieved.

In our experience after open window thoracostomy, intrathoracic omental transposition was used for two patients to obliterate the pleural space and, at the same time, to close a possibly associated BPF. It has been reported that omentum[11,13] and muscle[8,14,15] flaps may play an important role in infection control.

Our results are in agreement with those reported in previous studies in which similar techniques and timing were used in smaller series of patients [8, 12]. In particular, Garcia-Yuste and colleagues [8] reported a successful outcome in 21 of 22 patients with tuberculous empyema and in 14 of 18 patients with postresection empyema by using open window thoracostomy, followed by intrathoracic muscular transposition.

CONCLUSION

Successful treatment of PPE is based on the creation of an open window thoracostomy. In patients with previously treated lung cancer and good performance status, open window thoracostomy, closure might be scheduled in the absence of disease recurrence regardless of stage-related prognosis. An early open window thoracostomy, with bronchial stump reinforcement shortens the process of obliteration of the pleural space. When the pleural cavity shows healthy granulation tissue and no BPF, the open window thoracostomy, procedure is safe and effective to obliterate the pleural cavity. Obliteration by omentum flap transposition can be reserved for patients with persistent or recurrent BPFs.

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