Benign emptying of the post-pneumonectomy space: recognizing this rare complication retrospectively

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Abstract

Patients presenting with a sudden drop in the pleural fluid level after a pneumonectomy in the absence of a recognizable bronchopleural fistula (BPF) have been classified as cases of benign emptying of the post-pneumonectomy space (BEPS). A retrospective study of 1378 pneumonectomies identified 4 cases of BEPS (0.29%). The patients were men; median age 64 years and all had undergone a right pneumonectomy. The median time at diagnosis was 31 days postoperatively and the median follow-up time was 31 months. None of the patients experienced a documented BPF or empyema. Although BEPS is an extremely rare complication, early recognition and close patient monitoring will prevent unnecessary interventional strategies.

Keywords: Pneumonectomy • Complication • Empty • Pleural space

INTRODUCTION

The incidence of post-pneumonectomy bronchopleural fistula (BPF) has been reported to vary from 0.8 to 4.5% [1, 2]. Prompt recognition of BPF is crucial. Striking clinical manifestations include fever, dyspnoea and productive cough. Chest radiology reveals drop of the air-fluid level within the pleural cavity [3]. Confirmation is usually done by bronchoscopy. Other methods include multi-detector row computed tomography scan, contrast bronchography, intrapleural methylene blue and ventilation scintigraphy [4].

Treatment of a clinically evident BPF depends on severity ranging from non-operative bronchoscopic interventions to surgical options including open drainage [5, 6].

In 2011, Merritt et al. described a subset of patients who presented inconsistently with a sudden drop in the pleural fluid level following pneumonectomy without the clinical features and in the absence of a recognizable BPF using the term ‘benign emptying of the post-pneumonectomy space’ (BEPS) [7]. We herein describe our cumulative experience with this rare clinical entity.

RESULTS

All 4 patients were men, aged 51–72 (median 64) years and underwent right pneumonectomy, for non-small-cell lung carcinoma 2 of them intrapericardial. One patient received induction and 2 postoperative chemotherapy. Three patients had stapled closure of the bronchial stump and in 2 the bronchial stumps were covered with a vascularized pedicle a pericardial fat pad and an intercostal muscle flap, respectively.

Time to diagnosis varied from 22 to 45 (median 31) days postoperatively. In one patient with the delayed diagnosis (45 days), the post-pneumonectomy pleural space was fully evacuated while, in the remaining, the fluid level dropped down to \( \sim 1/5 \) of this space (Fig. 1A and B). Flexible fibre-optic bronchoscopy inspection of the bronchial stump in 2 the bronchial stumps were covered with a vascularized pedicle a pericardial fat pad and an intercostal muscle flap, respectively.

Thoracic tube drainage was performed immediate after diagnosis in 2 patients. The fluid was macroscopically clear and repeated tests for cytology and cultures were returned negative.

At median follow-up of 31 months, none of the patients developed a documented BPF or empyema. In one patient, the right
hemithorax never accumulated the expected postoperative amount of fluid while, in the remaining, this was fully restored confirmed by a typical post-pneumonectomy chest X-ray film (Fig. 1C).

**DISCUSSION**

BPF occur at an increased frequency after right-sided pneumonectomies, interestingly so did all our BEPS cases [8]. In the absence of existing guidelines for treating these patients, the approach selected in each case was a matter of surgeon's choice. This was close patient monitoring and in 2 of them chest tube drainage, although in retrospect, we feel the latter was rather unnecessary.

All patients made a full recovery and required no further treatment. The rarity of this complication makes it extremely difficult to draw safe conclusions regarding causes and appropriate treatment. Even so, a fluid shift between compartments due to homeostasis has been proposed [9]. Another hypothesis involves the presence of an obscure valve-like operating BPF that heals spontaneously [10]. A further refinement of this theory suggests that

**Table 1:** Characteristics of patients with BEPS

<table>
<thead>
<tr>
<th>Age, gender</th>
<th>Hemithorax</th>
<th>Tx/stage</th>
<th>Lymphatic dissection/ sampling</th>
<th>Intrapericardial Neoadjuvant/ adjuvant</th>
<th>Postoperative day of diagnosis</th>
<th>Cough, fever, dyspnoea</th>
<th>CXR infiltration</th>
<th>WBC (cells/mm³)/ C-reactive protein</th>
<th>Pleural thickening</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>68, male</td>
<td>Right</td>
<td>T2b/IIA</td>
<td>Sampling</td>
<td>No</td>
<td>None</td>
<td>29</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Chest tube</td>
</tr>
<tr>
<td>79, male</td>
<td>Right</td>
<td>T3/IIIA</td>
<td>Extensive dissection</td>
<td>Yes</td>
<td>Adjuvant</td>
<td>45</td>
<td>No</td>
<td>No</td>
<td>2.5/5200</td>
<td>Observation</td>
</tr>
<tr>
<td>62, male</td>
<td>Right</td>
<td>T4/IIIA</td>
<td>Extensive dissection</td>
<td>Yes</td>
<td>Adjuvant</td>
<td>45</td>
<td>No</td>
<td>No</td>
<td>2.4/6300</td>
<td>Observation</td>
</tr>
<tr>
<td>51, male</td>
<td>Right</td>
<td>T3/IIIA</td>
<td>Extensive dissection</td>
<td>Yes</td>
<td>Neoadjuvant</td>
<td>25</td>
<td>No</td>
<td>No</td>
<td>1.5/5800</td>
<td>Chest tube</td>
</tr>
</tbody>
</table>

BEPS: benign emptying of the post-pneumonectomy space; CXR: chest x-ray; WBC: white blood cell.

Figure 1: Post-pneumonectomy chest X-ray films in patient with BEPS. (A) Post-pneumonectomy chest X-ray film showing the fluid level in the right hemithorax after discharge from the hospital. (B) Post-pneumonectomy chest X-ray film complicated by BEPS on the 25th postoperative day showing the drop in the level, which had taken up to 1/5 of post-pneumonectomy space (same patient). (C) Post-pneumonectomy chest x-ray film, 3 months after the diagnosis and conservative management of BEPS. Right hemithorax was then again filled with fluid and X-ray film was consistent with a typical right post-pneumonectomy depiction (same patient). BEPS: benign emptying of the post-pneumonectomy space.
BEPS represents an ‘occult bronchopleural fistula’ that is too small to allow free passage of fluids to the airway and bacteria into the pleura, yet large enough to permit air into the post-pneumonectomy space [7]. The increasing pressure within the space created by air forces fluid into surrounding tissues or cavities via three routes: diaphragm fenestrations, defects in the diaphragm and peritoneum developed at the time of extrapleural pneumonectomy (EPP) or a loose chest wall closure [7]. However, in our cases, there was no evidence of porous syndrome intraoperatively and none of our patients underwent EPP. In addition, clinical laboratory work-up following readmission did not reveal ascites in any patient.

A most attractive conjecture is that BEPS is caused by a transient microscopic BPF that closes spontaneously. As a result, the negative pleural pressure equalizes to that of the atmosphere, the hydrostatic balance is reversed and fluid is subsequently absorbed through the parietal pleura. This explains the absence of cough, seroma or ascites in these patients [7]. Merritt et al. described 3 of 7 BEPS cases occurring in patients with right EPP for mesothelioma. The time of BEPS diagnosis in these cases was longer when compared with those of isolated pneumonectomies [7]. Removal of the entire pleura and diaphragm probably delays fluid absorption and therefore the development of BEPS.

Of interest remains the case in which the fluid was never restored to the expected level; one could speculate on persistence or recurrence of BEPS, nevertheless without further clinical consequences.

BEPS is certainly an unusual post-pneumonectomy complication and despite its similarities with BPF has a mild natural history and runs a benign course. It seems that close observation for early detection of a true BPF is all that is needed. This will prevent unnecessary interventional strategies, which contribute to morbidity and cost. Nonetheless, extensive multicentre studies are required to set appropriate guidelines for this condition.

Conflict of interest: none declared.

REFERENCES


