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Sequential Management of Bilateral Pneumothorax: A Case Report of Combined Chest Tube and Indwelling Pleural Catheter Interventions

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Abstract

We present the case of a patient with advanced lung cancer who initially experienced breathlessness and right-sided chest pain. A chest X-ray revealed a large right-sided pneumothorax, for which a right-sided chest tube was inserted. Due to a persistent air leak, a right indwelling pleural catheter (IPC) was placed. One week later, the patient developed a left-sided pneumothorax. To reduce the length of hospital stay, a left IPC was inserted. However, two days after this intervention, the patient returned with worsening breathlessness. A chest X-ray revealed bilateral pneumothorax despite the presence of the indwelling pleural catheters (IPCs). The bilateral IPCs were connected to an underwater sealed device, and bubbling was observed in the right IPC but not in the left. Consequently, a large-bore intercostal chest tube was inserted on the left side, resulting in significant improvement and full lung expansion. The right pneumothorax persisted, necessitating the insertion of a large-bore chest tube. Due to the continued air leak in both lungs, pleurodesis was performed, successfully resolving the pneumothorax. This case underscores that managing pneumothorax in advanced lung cancer patients may require various minimally invasive procedures and a transition from IPC to chest tube insertion when the initial approach fails. Prompt adjustment of treatment strategies can lead to the successful resolution of persistent air leaks and full lung expansion.

Subject Areas

Respiratory Medicine

Keywords

Pneumothorax, Indwelling Pleural Catheter, Persistent Air Leak

1. Introduction

Spontaneous pneumothorax can occur as an initial manifestation or a late complication in primary lung cancer. The estimated incidence of pneumothorax in primary lung carcinoma is rare, ranging from 0.03% to 0.05% [1] [2]. The clinicopathological features of lung malignancy-related pneumothorax are poorly defined, posing significant clinical challenges in management.

2. Case Report

A male in his early 40s presented to the emergency department with a one-day history of worsening shortness of breath. His medical history included advanced lung adenocarcinoma, for which he had been receiving palliative chemotherapy and recently switched to a combination of vinorelbine and carboplatin.

Two weeks before the current presentation, the patient presented to another hospital with a right pneumothorax with a persistent air leak (PAL). The patient declined a CT scan of the thorax. Initially, he was managed with a large bore intercostal chest tube. Due to prolonged hospitalization, a right tunnelled IPC with an ambulatory pneumothorax device was placed. One week after discharged, he again presented to the same hospital with a pneumothorax on the opposite lung. The patient declined a conventional chest tube and chose a left tunnelled IPC for home management. He was discharged with bilateral IPCs inserted in both lungs.

Upon examination, his vital signs were: blood pressure: 116/70 mmHg, heart rate: 108 beats/min, respiratory rate: 28 breaths/min, temperature: 37.2˚C, SpO_2: 94% on high flow non-rebreather mask (15 L/min). Lung examination revealed reduced breath sounds bilaterally, with no subcutaneous emphysema and bilateral IPCs in place. Arterial blood gases on room air indicated hypoxic respiratory failure (pH 7.40, pO2 52 mmHg, pCO2 30 mmHg, bicarbonate 26 mmol/L). A chest radiograph showed bilateral large pneumothoraces with IPCs in situ and diffuse nodular opacities (**Figure 1(A)**). The bilateral IPCs were connected to an underwater sealed device; bubbling was observed in the right IPC, but not in the left IPC.

Despite being connected to the wall suction, the left IPC still did not bubble. A large-bore intercostal chest tube (24 Fr) was inserted in the left (**Figure 1(B)**), resulting in significant improvement in dyspnea and weaning of oxygen supplementation to a face mask at 5 L/min. The left lung fully expanded after the chest tube insertion. The right pneumothorax persisted, requiring the insertion of a large-bore chest tube (**Figure 1(C)**).

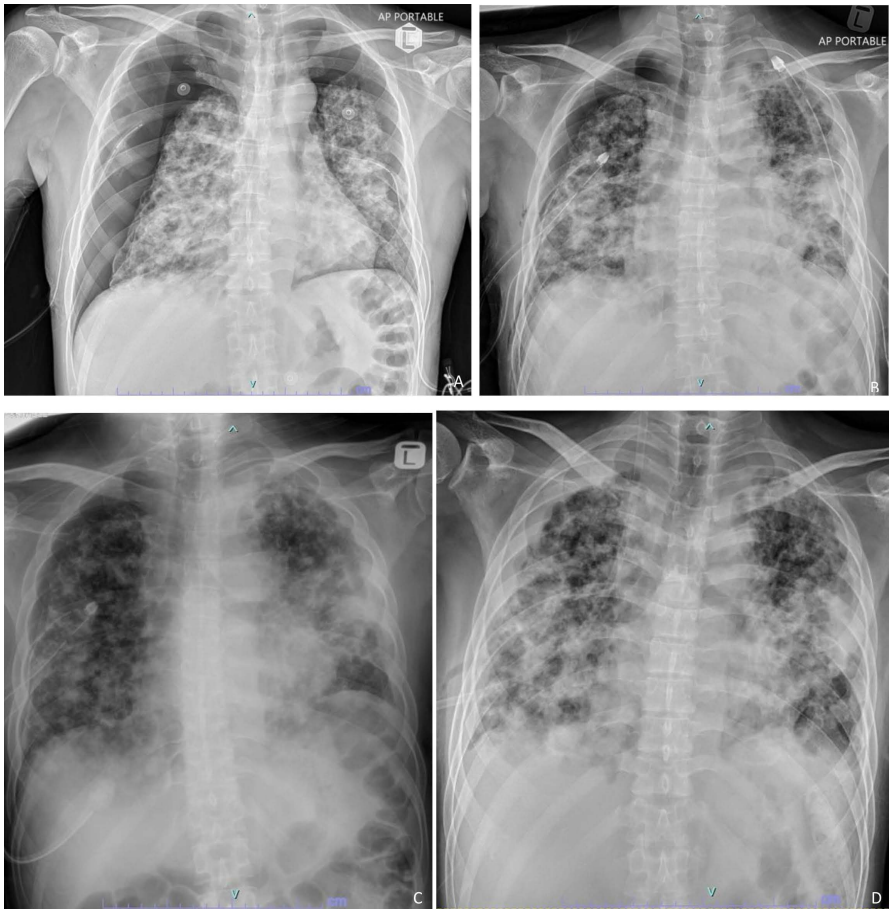

Figure 1. (A) Chest radiograph showing a large bilateral pneumothorax with diffuse nodular opacities and indwelling pleural catheter in situ; (B) Chest radiograph after the insertion of a large-bore intercostal chest tube on the left side, showing re-expansion of the left lung; (C) Chest radiograph demonstrating right large-bore chest tube insertion; (D) Follow-up chest radiograph one week later, showing no recurrence of pneumothoraces.

Investigations for opportunistic pulmonary infections, including MTB/RIF GeneXpert and Pneumocystis jirovecii PCR, yielded negative results. By the third day of admission, the left pneumothorax had resolved. Due to ease with a 3-way stopcock, a left talc pleurodesis was performed via the IPC, followed by removal of both the left chest tube and IPC the following day. His SpO_2 was maintained at 95% on 3 L/min nasal prongs.

Despite a PAL on the right side, the patient chose to discharge himself from the hospital to reunite with his family, considering his prolonged absence from home. To facilitate this, the right chest tube was connected to a P-Eggy chest drain valve prior to discharge. The right IPC was retained in view of the potential use during pleurodesis. He was scheduled for re-admission one week later. Upon reassessment, the right pneumothorax had resolved, and a talc pleurodesis was performed via the IPC. He was discharged the next day following the removal of the chest tube and IPC. At a two-week and four-week follow-up, there was no recurrence of the pneumothorax (**Figure 1(D)**).

3. Discussion

The exact mechanisms by which primary or metastatic lung malignancies lead to pneumothorax remain unclear. Several hypotheses include rapid tumour regression or necrosis due to cancer treatment, bronchial wall compression by the tumour causing air trapping and subsequent alveolar rupture, and pleural or vascular invasion by the tumour leading to bronchopleural fistula formation [3] [4]. In the present case, chest radiography indicated that cystic changes in the lung parenchyma with ruptured cysts were likely the cause of the pneumothorax.

Tunnelled IPC has been effective in minimizing symptoms related to pleural effusions, particularly in malignant pleural effusions, reducing the need for additional pleural interventions, and hospital stays, and improving breathlessness [5] [6]. However, the use of IPC in pneumothorax is controversial due to the absence of clinical trials demonstrating its benefits. Two cases reported the use of IPC for PAL in lung adenocarcinoma and lymphangioleiomyomatosis with PAL, demonstrating spontaneous resolution of pneumothorax without complications [7] [8]. Despite these successes, small-bore chest tubes (≤14 F) carry intrinsic risks such as obstruction, kinking, and rupture, with reported blockage rates of 8.1% for small-bore compared to 5.2% for large-bore chest tubes [9].

Communication between the alveoli and the pleural space results in a persistent air leak (PAL). This alveolar-pleural fistula leads to pneumothorax and prevents proper lung expansion. While most pneumothoraces resolve with thoracostomy tube drainage, some persist for days following the lung injury. An air leak that lasts more than 5 to 7 days is classified as a persistent air leak (PAL).

Patients with symptomatic large spontaneous pneumothorax often require chest tube insertion. The British Thoracic Society (BTS) suggests initial needle aspiration followed by chest drainage if lung re-expansion fails. The American College of Chest Physicians guidelines recommend initial treatment with chest tubes. All guidelines concur that in clinically stable patients, small-bore chest drains are sufficient [10]-[12]. The BTS guidelines recommend chemical pleurodesis to prevent the recurrence of secondary pneumothorax. For patients with PAL who are unfit for surgery, blood patch pleurodesis or endobronchial therapies may be considered. If the lung fails to re-expand or if there is a PAL, suction via a high-volume, low-pressure system may be utilized. Some physicians may replace a small-bore tube with a large-bore one to increase the total air flow rate. In our patient, the use of IPC led to recurrent bilateral pneumothorax, likely due to rapid air leaks and ineffective air drainage. Resolution was achieved with the insertion of a large-bore chest tube, followed by talc pleurodesis to prevent recurrence.

This case highlights the challenges in managing pneumothorax in patients with advanced lung adenocarcinoma undergoing palliative chemotherapy. Such patients often require prolonged chest tube drainage, which can be effectively managed with chest tube insertion and talc pleurodesis. The role of IPC in these scenarios should be carefully re-evaluated in randomized controlled trials.

Authors' Contributions

Ng, B.H., Sharil, N.S., and Nik Abeed, N.N., have written up the case under the continuous supervision of Low, H.J., and Ban, A.Y.L. Ng, B.H., Sharil, N.S., and Nik Abeed, N.N., discussed the case presentation, investigations, and management. Ban, A.Y.L., Osman, R.A. and Azmi, M.I. supervised and guided the patient's management.

Ethics Statement

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

Conflicts of Interest

The authors declare no conflicts of interest.

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