

HIGH RISK PERSISTENT AIR LEAKS IN GIANT AND DIFFUSE BULLAE LUNG DISEASE SALVAGED BY URGENT ENDOBRONCHIAL VALVE (EBV) INSERTION

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ABSTRACT:

Persistent air leak (PAL) is a common complication of pneumothorax despite intercostal drainage. Neither pneumothorax management guidelines from the American College of Chest Physicians (2001) nor the British Thoracic Society (2010) recommended bronchoscopy, much less endobronchial valves as management for PAL. We describe a case of a 62-year-old gentleman, an active smoker of 40 pack-years, who had a history of left-sided pneumothorax in 2019 that was treated conservatively. In August 2021, he presented with shortness of breath and right-sided chest discomfort. His Chest X-ray revealed a right tension pneumothorax. A chest drain was inserted with much clinical improvement. However, he had a persistent air leak despite 30 days on a chest drain. Because of his refusal of surgical intervention, the patient underwent endobronchial valve insertion as a salvage procedure into his right upper lobe. His PAL was resolved within 24 hours, and he was discharged the next day.

Keywords: Bronchoscopy lung volume reduction, Endobronchial valve, Persistent air leak, Pneumothorax, Pulmonary Valve

INTRODUCTION:

Persistent air leak (PAL), a common complication of pneumothorax, can be caused by either an alveolar-pleural fistula or a bronchopleural fistula. It is associated with increased morbidity, prolonged hospital stays and high resource utilization. A PAL is arbitrarily defined as an air leak that lasts longer than 5–7 days [1]. The most common causes of PAL include thoracic surgery, secondary spontaneous pneumothorax and cavitary pulmonary infections (especially tuberculosis). In general, surgical management is considered when the air leak persists for more than 5 days [1]. However not all patients are suitable for surgery, and some may refuse surgical intervention. To date, the American College of Chest Physicians (2001) and British Thoracic

Guidelines (2010) have not recommended an endobronchial valve (EBV) as a solution for PAL. However, its use has been approved by the FDA under the Humanitarian Device Exemption. We wish to report a case of a right-sided pneumothorax with a persistent air leak which resolved with a one-way endobronchial valve insertion.

CASE PRESENTATION:

Mr T is a 62-year-old gentleman with a 40-pack year smoking history, no co-morbid, not on any long-term medication and has no past surgical history. He had a history of left-sided pneumothorax in the year 2019 secondary to a left upper lobe bulla, in which he sought medical attention at a private hospital. He was

conservatively treated, without any drainage as he refused intervention. In August 2021, he presented with sudden onset of shortness of breath and right-sided chest discomfort. He denies any fever, prolonged cough, loss of weight or appetite. His blood tests showed Hb 15.4g/dL and WBC 6.2 x 10⁹. His renal and liver function were normal. On examination, his oxygen saturation (SPO₂) was 88% under room air, trachea central, with reduced air entry over the right hemithorax. The chest radiograph revealed a right-sided pneumothorax. A chest tube was inserted in the emergency department with successful symptom relief. He was admitted, and placed on supplementary nasal prong oxygen of 2L/min. He remained well in the ward, with SPO₂ of 100%. However, after 5 days, his chest tube was still continuously bubbling during inspiration and expiration (Cerfolio grade 4).

An immediate high-resolution CT (HRCT) thorax showed a large right pneumothorax with a large bulla in the mid and posterior thoracic cavity measuring 10cm x 10cm x 13cm. The right upper lobe was completely collapsed with partial collapse of the middle and lower lobe. (Image as attached)

Surgical management - video-assisted thoracic surgery or thoracotomy with bullectomy and pleurodesis was offered to the patient. However, the patient was not keen, and his PAL persisted for more than 30 days, requiring him to remain inpatient. A multidisciplinary team discussion (radiologist, thoracic surgeon and pulmonologist) for further treatment modality was done, during which on review of CT images, the interlobar fissures were intact. Hence, EBV placement for PAL was discussed with the patient as a salvage procedure and he was agreeable. A total of 5 Zephyr EBV (Pulmonx) were deployed into the right upper lobe apical-posterior and anterior segments via rigid bronchoscopy under general anaesthesia. Post-procedure, his PAL resolved, chest tube bubbling ceased, and his oxygen saturation improved to 96% under room air. He was discharged well on day one post-procedure.

DISCUSSION:

The standard routine treatment for PAL is by surgical approach. However, for those unfit for surgical management, this poses a challenge. Known that surgical management may incur a lot

of risks such as perioperative risk related to the presence of underlying chronic lung disease. Various endobronchial methods of management have been described e.g coils, balloons, fibrin or tissue glue, and autologous blood patches [2]. Watanabe spigot has been reported to be effective in managing air leaks via endobronchial occlusion. [3]

EBV was initially designed for severe emphysema treatment; its function was to obstruct the airway and allow a unidirectional airflow, causing parenchyma atelectasis and drainage of distal secretions. The lung atelectasis will inadvertently result in a cessation of air leak. The EBV has an edge; ease of deployment and repositioning to achieve functional success and subsequent removal should any EBV-related complication arises. EBV placement can be confirmed with plain chest radiographs on follow-up.

The success of Zephyr EBV usage was reported in a case series by Travaline et al, in which 37 of 40 (93%) patients had either complete or partial resolution of air leak [4]. The cohort of cases described was spontaneous, post-operative, traumatic and iatrogenic pneumothorax. The median time for the liberation of the chest tube was reported as 7.5 days. Another licensed EBV available is the Spiration IBV, in which Gillespie et al reported its use in 7 PAL cases (3 secondary spontaneous pneumothorax and 4 post-operative pneumothorax). The author described its achievement in air leak cessation in all patients, leading to the removal of chest tubes after a median of 16 days [5].

The role of EBV in the management of PAL has not yet been widely recognized. This minimally invasive procedure coupled with its ease of insertion can be considered a therapeutic option, especially in instances when surgical intervention is not feasible. As for our patient, with the presence of bilateral lung bullae and PAL, his risk of anaesthesia and major surgery is high. The insertion of EBV as a last effort salvage procedure has benefitted in cessation of PAL. Nevertheless, a prospective randomised controlled trial with a large sample should be carried out to shed further light on the long-term effectiveness and safety of EBV usage in PAL.

CONCLUSION:

Endobronchial valve insertion for the management of persistent air leaks in pneumothorax is currently not widely practiced. However, its usage may provide an option of treatment should conventional interventions are contraindicated or failed. This case report highlights the successful usage of EBV in the context of a high risk patient, unsuitable for surgical management.

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STATEMENT OF ETHICS:

Informed consent was obtained from the patient for the publication of this work.

CONFLICTS OF INTEREST:

We have no known conflict of interest to disclose.

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DATA AVAILABILITY STATEMENTS:

Further data can be obtained by contacting the author via email jenlye@hotmail.com.

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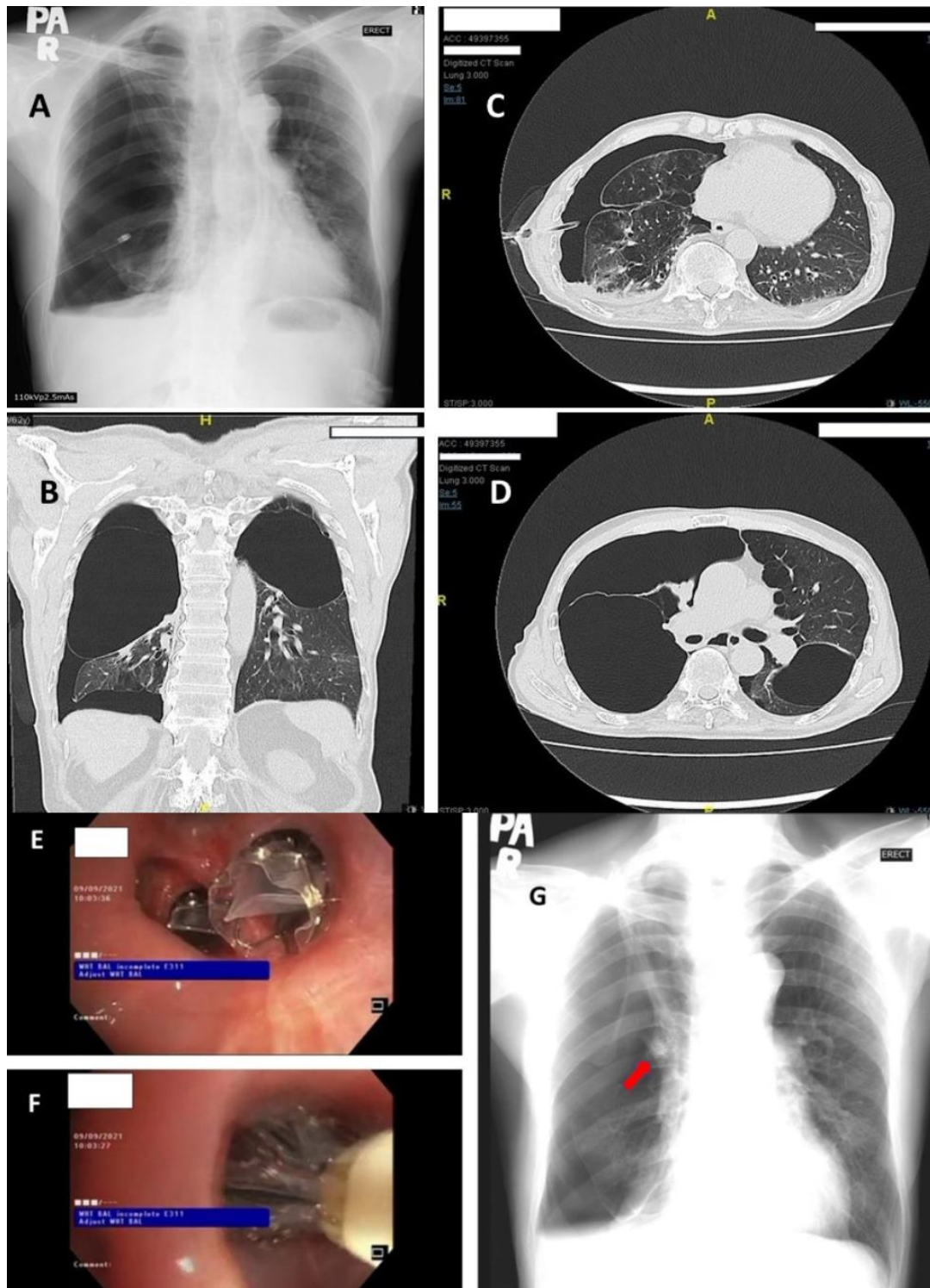


Figure 1: (A) Chest radiograph depicting a right pneumothorax with associated right upper, middle and lower lobe collapse. Right intercostal chest tube is in-situ. (B)-(D) High resolution computed tomography thorax (coronal and axial view) shows a large bullae at the right mid - posterior thoracic cavity measuring 10cm x 10cm x 13cm (AP x W x CC). Right chest tube drainage is in-situ. A large bullae with panlobular and paraseptal emphysematous changes are seen at the left upper lobe and at the lingula segment respectively. (E), (F) The Zephyr (Pulmonx) EBV is implanted in the target bronchus (right upper lobe) using the Zephyr Endobronchial Delivery Catheter (EDC). Deployment of the valve through the EDC. The main body of retainer completely engaged within target bronchus (G) Chest radiograph post procedure. Red arrow shows group of five endobronchial valves with residual right hydropneumothorax.