



# Delayed Response to Endobronchial Emphysema Valve Insertion

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## Abstract

Lobar atelectasis or lobar collapse is markers of clinical response in patients with emphysema who undergo endo-bronchial valve insertion. Most responders demonstrate atelectatic changes in the treated lobe within two weeks of insertion.

We describe a patient in whom a complete response occurred over 18 months after endo-bronchial valve insertion during which time the patient was referred for lung transplantation. The radiological changes were associated with clinical and lung function improvement. Consequently, the decision for lung transplantation was deferred. This phenomenon has not, to our knowledge been described in the literature to date.

**Keywords:** Emphysema; Endobronchial valve; Volume reduction; COPD

## Introduction

Chronic obstructive pulmonary disease is a leading cause of morbidity and mortality affecting up to 2% of the population [1]. A subgroup of these patients has emphysema predominant disease. The destruction of the lung parenchyma distal to the respiratory bronchioles and collapsible airways in these patients causes gas trapping and hyperinflation of the lungs. This hyperinflation has deleterious effect on thoracic wall compliance and the function of adjacent lung units.

Lung volume reduction therapies are good methods that improve symptoms and quality of life as well as various lung function tests in patients with advanced emphysema who are optimised on inhaled therapy. The 2017 GOLD initiatives approved volume reduction in patients with advanced emphysema [1]. In our institution, three methods are approved: lung volume reduction surgery, endobronchial valves or endo-bronchial coils.

Endobronchial valves can be inserted under conscious sedation or under general anaesthesia and are placed within the bronchi supplying the most affected lobe of the lung. The direction of the valve allows secretions and gas to exit the lobe but do not allow entry of gas. This leads to a deflation of the targeted area and subsequent collapse or atelectasis. This in turn causes a volume reduction effect, improving respiratory dynamics and gas transfer in the remainder of the lung.

Radiological atelectasis and loss of volume of the target lobe is a marker of response to valve insertion. This affect is usually seen within a few days or occasionally up to a few weeks [2,3].

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Received Date: 14 Dec 2017

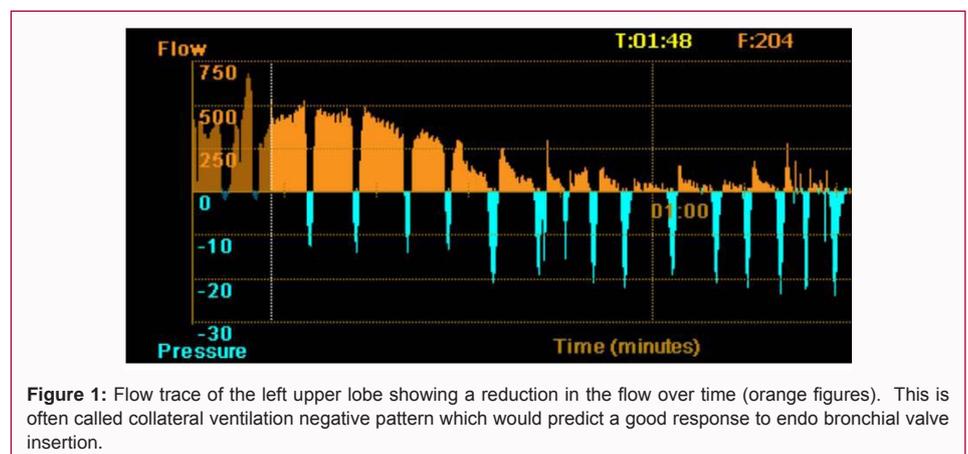
Accepted Date: 28 Mar 2018

Published Date: 05 Apr 2018

### Citation:

Creber P, Bendall O, Jarad N. Delayed Response to Endobronchial Emphysema Valve Insertion. Clin Respirat Med. 2018; 1(1): 1003.

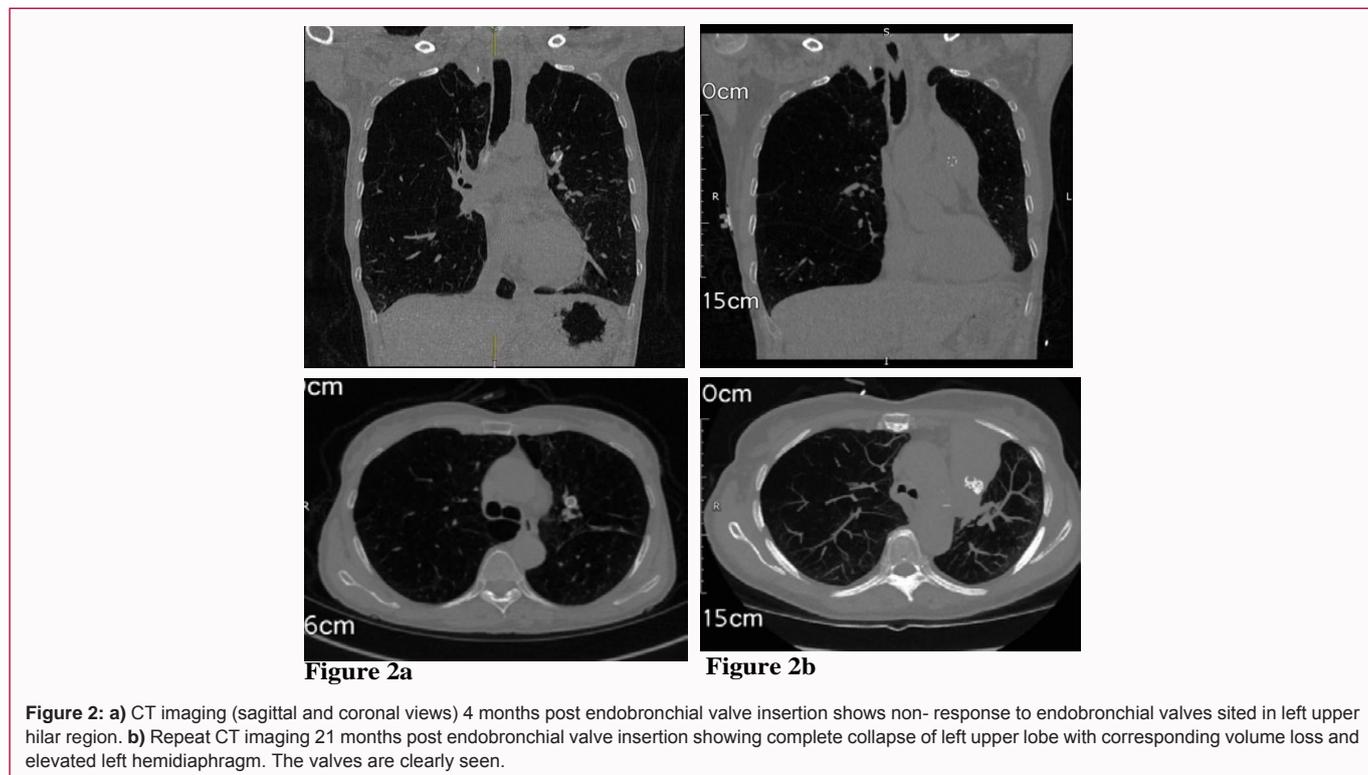
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**Figure 1:** Flow trace of the left upper lobe showing a reduction in the flow over time (orange figures). This is often called collateral ventilation negative pattern which would predict a good response to endo bronchial valve insertion.

**Table 1:** Relevant assessment measurements before and at 2 occasions after insertion of endo-bronchial valves. Please note the marked improvement at the 21 months assessment compared to baseline. Also please note that the patient was able to perform tests after valve insertion that she was not able to perform at baseline.

|                                  | Base line -              | Four months           | 21 months after valve insertion (when lobar collapse is discovered) |
|----------------------------------|--------------------------|-----------------------|---|
|                                  | prior to valve insertion | after valve insertion |   |
| FEV1 (% predicted)               | 0.31 (14%)               | 0.54 (24%)            | 0.49 (23%)  |
| FVC (% predicted)                | 0.9(34%)                 | 0.9 (34%)             | 1.24 (49%)  |
| TLC (% predicted)                | 5.55 (125%)              | 5.26 (116%)           | 3.95 (89%)  |
| RV (% predicted)                 | 4.14 (248%)              | 4.00 (242)            | 2.51 (148%)   |
| RV/TLC ratio (%)                 | 78%                      | 75%                   | 63%   |
| TLco (% predicted)               | Unable to do             | Unable to do          | 1.43 (19%)  |
| Kco (% predicted)                | Unable to do             | Unable to do          | 0.68 (42)   |
| 6 minute walk distance (meters)  | Too breathless to do     | 205                   | 220   |
| COPD assessment test (CAT) score | 25                       | 25                    | 19  |



For non-responders or for those who have loss of efficacy - CT scan and bronchoscope are performed. Valve removal is done in non-responders.

We describe a case in which total lobe atelectasis occurred after 18 months from insertion of valves with a good clinical improvement.

### Case Presentation

A 57-year-old female ex-smoker who was known to have emphysema was referred to the respiratory clinic with a 2 year history of progressive breathlessness which had recently confined her to the house.

A set of lung function tests and a high resolution computed tomography (HRCT) scan of the thorax showed high impact predominantly upper lobe emphysema. She was therefore considered for volume reduction therapy using endo-bronchial valve insertion.

Despite the very low FEV1 (Table 1), the emphysema panel agreed

to insert valves as a bridge for lung transplantation. Based on her CT scan findings the target lobe was identified as the left upper lobe.

Prior to insertion of valves she underwent a lobar flow assessment using a Chartis Catheter in the left upper lobe. The pattern was consistent with absence of collateral ventilation between the left upper lobe and the left lower lobe (Figure 1). This pattern would predict a high likelihood of response to endobronchial valves.

A total of 5 valves were inserted into her left upper lobe. A 4 month follow up assessment demonstrated some lung function improvement in her FEV1 and in her 6 minute walk distance (Table 1). The patient however, did not feel better. COPD assessment test (CAT) score and markers of hyperinflation as estimated by residual volume (RV) did not change. Her HRCT showed only minor volume reduction in the target lobe without any clear post valve atelectasis (Figure 2a).

Based on her advanced COPD and her symptom severity she was

referred for consideration of lung transplantation. This was delayed due to low body mass index which responded to an intense dietetic and exercise regime. This needed 21 months in total.

A re-assessment of her lung status took place prior to listing for lung transplantation when a considerable improvement in almost all subjective and objective assessments was noted (Table 1). Furthermore, the chest CT scan demonstrated a complete collapse of the left upper lobe (Figure 2b). A delayed response to insertion of endobronchial valves.

## Discussion

Bronchoscopic lung volume reduction therapies are becoming an increasingly well-established treatment option for patients with advanced emphysema. Non-response to the procedure is well accepted, with rates reported as high as 40% [3]. Almost all patients show signs of response within a few days to a few weeks. Such a late response has not been previously reported, both within the literature or our centre's experience.

The reason for the late response is not clear. The integrity of the fissures was ascertained radiologically and absence of collateral ventilation was confirmed using a balloon catheter test (Chartis).

We postulate that a minor breach of the fissure may have been present. This would account for the lack of atelectasis after the valves

were inserted. This breach might have become occluded because of a healing infective process.

Alternatively, there may have been a paravalvular leak accounting for the lack of response initially which subsequently sealed off as a result of a local bronchial inflammatory process in response to the insertion of the valves.

## Conclusion

This case highlights the possibility of a delayed response to endobronchial valve insertion. If further experience is shared this should impact the decision to remove a well sited valve after initial non-response in the hope that there may be a delayed response.

## References

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