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# Endobronchial Volume Reduction with Lung Sealant (Aeriseal®); Post Interventional Fever and Malaise Treated with Combined Therapy of Broad- Spectrum Antibiotic and Supportive Prednisolone

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## Abstract

Both our patients with advanced emphysema and hyperinflation underwent endoscopic volume reduction with endoscopic tissue sealant (AeriSeal®), collateral flow was confirmed by using the Chartis system<sup>®</sup>. Both patients experienced transient fever with elevated leukocyte counts and increased serum acute phase protein, malaise, chest discomfort and shortness of breath after the procedure. We gave both patients broad- spectrum antibiotics with supportive prednisolone 30 mg for around 7 days. They both benefited from this combined therapy and were able to recover fast. The follow- up evaluations of those two patients showed improved lung function (increased FEV 1, improved 6- minute walk test and a reduction of RV) with improved quality of life of both patients.

**Keywords:** BLVR (Bronchoscopic Lung Volume Reduction); LVRS (Lung Volume Reduction Surgery); COPD (Chronic Obstructive Pulmonary Disease); NETT (National Emphysema Treatment Trial)

#### Introduction

In order to treat patients with advanced emphysema and hyperinflation, there are four methods for endobronchial treatment. These include: firstly, placement of endobronchial one-way valves designed to promote atelectasis by blocking inspiratory flow, Second, formation of airway bypass tracts using a radiofrequency catheter designed to facilitate emptying of damaged lung regions with long expiratory times, Third, Instillation of biological adhesives designed to collapse and remodel hyperinflated lung; and lastly, airway implants of nitinol coils of 10 to 20 cm in length designed for use in patients with either homogeneous or heterogeneous emphysema. These implants coil up on deployment and tether the lung.

Surgical intervention is not appropriate for many patients. Most patients with advanced emphysema do have damages in their lung tissues, therefore they do have collateral flows as well. The method of lung sealant (AeriSeal) is a relevant method for patients with collateral flows. The side effects of lung sealant are limited.

#### Methods

A novel endoscopic tissue sealant (AeriSeal, Aeris Therapeutics, and Woburn MA, USA) is a liquid foam sealant that collapses hyperinflated lung areas destroyed by emphysema.

The foam of lung sealant AeriSeal<sup>\*</sup> is instilled into the peripheral airways and alveoli where it polymerizes and functions as tissue glue, forming a film of material on the lung surface that seals the target region to cause durable absorption atelectasis.

#### Case 1

A 57-year-old female, ex-smoker (35 pack years) was referred to our center for further management of severe COPD (GOLD IV). She has progressive worsening of the obstructive ventilatory pattern on pulmonary functions. The chest X ray (Figure1a and 1b) and Computed Tomography-scan of the chest revealed severe heterogeneous, centrilobular emphysema with predominant involvement of the left upper lobe (Figure 2).

We decided to treat this patient with endoscopic lung volume reduction. Collateral flow within the targeted upper lobe was confirmed by Chartis system<sup>\*</sup>; therefore the bronchoscopic volume reduction by



Figure 1a: Revealed hyperinflated emphysematous left upper lobe before the endobronchial volume reduction with AeriSeal.

**1b:** Showed reduction of pulmonary hyperinflation and areas of atelectasis in the treated left upper lobes 4 weeks after the volume reduction.

endobronchial valve implantation was not feasible.

The foam is instilled into the peripheral airways of the targeted left upper lobe where it polymerizes and functions as tissue glue, it seals the target region to cause durable absorption atelectasis. The bronchoscopic examination (Figure 3) showed that AeriSeal foam Sealant filled the targeted diseased alveolar region in order to induce atelectasis and to block collateral flow.

After the procedure, our patient experienced transient fever with malaise. Laboratory analysis revealed elevated leukocyte counts and an increase in acute phase proteins CRP (CRP 9.8 mg/dl, leukocyte 10.1 GIGA/l). Blood culture and sputum cytology rendered no clear proof

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Figure 2: Revealed heterogeneous emphysema with destruction of left upper lobe.



Figure 3: AeriSeal foam Sealant filled the targeted diseased alveolar region of left upper lobe.

of microorganism. We decided to initiate broad- spectrum antibiotic therapy with supportive prednisolone for 7 days. She is notably allergic to penicillin; therefore, we gave her levofloxacin 500 mg for 7 days. After a week of combined therapy, acute phase protein CRP declined to 2.7 mg/dl. Four weeks following the polymeric foam sealant application, the patient reported improvement in her symptoms and ability to manage daily life. Follow- up evaluation with chest X-ray (Figure 1b), four weeks after the intervention revealed atelectasis of the left upper lobe. Pulmonary function test showed significant reduction hyperinflation and improvement in the flow rates (Table 1). It is worth to mention, that our first patient did not achieve ideal result during the 6 Min- Walking test. She remained relatively physically inactive after the intervention due to lack of motivation to have regular training sessions.

# Case 2

A 68-year-old female ex- smoker (40 pack years) was also referred

to our center for further treatment options due to increasing dyspnea and recurrent exacerbations of COPD (GOLD IV).

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The initial chest X-ray (Figure 4a and 4b) and CT-scan of the chest showed severe bilateral upper lobe heterogeneous, centrilobular emphysema with severe emphysematous destruction of the right and left upper lobes (Figure 5).

 $\label{eq:constraint} After detecting Collateral flow within the targeted area by using Chartis$ 

Lung function parameter	Before application of AeriSeal	4 weeks after application of AeriSeal
FEV 1 L (% pred)	0.87 (31%)	0.88 (32%)
Forced vital capacity (FVC) L (% pred)	2.79 (83%)	3.04 (90%)
Total lung capacity (TLC) L (% pred)	8.06 (145%)	8.15 (147%)
Residual volume L (%pred)	5.27 (260%)	4.72 (233%)
6-Minute-Walking test (m)	130	200

Table 1: Comparisons of the lung function parameters and 6- minute- walking test before and after endoscopic lung volume reduction.



Figure 4: (a) Revealed hyperinflated emphysematous bilateral upper lobes before the endobronchial volume reduction with AeriSeal.(b) Showed reduction of pulmonary hyperinflation and areas of atelectasis in the treated upper lobes 8 weeks after the volume reduction.



Figure 5: Revealed heterogeneous emphysema with destruction of bilateral upper lobes.

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system<sup>\*</sup>, we decided to treat this patient also with endoscopic volume reduction using lungsealant (AeriSeal<sup>\*</sup>). The bronchoscopic picture image (Figure 6) revealed that AeriSeal Foam filled the subsegmental area of the left upper lobe.

After the procedure, this patient also experienced transient fever with malaise like our first patient. Laboratory analysis also revealed elevated leukocyte counts and an increase in acute phase proteins CRP (CRP 7.5 mg/dl, leukocyte 8.3 GIGA/l). Like our first patient, blood culture and sputum cytology rendered no clear proof of microorganism. We initiated antibiotic therapy with supportive prednisolone for 7 days. We infused antibiosis piperacillin/tazobactam. After a week of combined therapy, acute phase protein CRP declined to 0.8 mg/dl.

8 weeks following the initial treatment with lung sealant, our patient underwent follow-up evaluation. The patient reported on improvement in dyspnea as well as quality in her daily life. The follow- up evaluation with chest X-ray (Figure 4b) showed reduction of pulmonary hyperinflation and areas of atelectasis in the treated bilateral upper lobes. The evaluation of pulmonary function showed improvement of hyperinflation with reduction of residual volume, improved physical capability (6 mwt) with improvement in the flow rates (Table 2).

Our second patient changed her diet completely after the intervention and also she went through rigid training program in order



Figure 6: Showed that AeriSeal Foam filled the subsegmental area of the left upper lobe.

Lung function parameter	Before application of AeriSeal	8 weeks after application of AeriSeal
FEV 1 L (% pred)	0.59 (32%)	0.7 (40%)
Forced vital capacity (FVC) L (% pred)	1.07 (46%)	1.8 (79%)
Residual volume L (% pred)	5.9 (310%)	5.3 (276%)
6-Minute-Walking test (m)	170	310

 Table 2: Comparisons of the lung function parameters and 6- minute- walking test before and after the application of AeriSealant.

to get herself into better physical condition. She achieved better result in the 6 Min-Walking test.

## Discussion

For Patients with severe heterogeneous lung emphysemas, there are very limited treatment options with low long term performance. The primary goal of bronchoscopic lung volume reduction (BLVR) is to reduce hyperinflation in advanced emphysema through endobronchial procedures [1,2]. Both our patients have severe heterogeneous lung emphysemas with recurrent exacerbations.

Four major BLVR procedures are: Placement of endobronchial one-way valves to promote atelectasis by blocking inspiratory flow; Formation of airway bypass tracts using a radiofrequency catheter to facilitate emptying of damaged lung regions with long expiratory times; Instillation of biological adhesives to collapse and remodel hyperinflated lung; Airway implants of nitinol coils of 10 to 20 cm in length [3]. Endobronchial Valve for Emphysema palliation Trail (VENT) and Exhale Airway Stents for Emphysema (EASE) trial showed that treatment was less effective and did not consistently reduce hyperinflation or improve lung function mostly likely due to collateral ventilation present in majority of patients [4,5].

Most patients with hyperinflated lungs do have collateral flows. Valve based reduction systems are inadequate for treatment of emphysematous lung with collateral flows. Bronchoscopic lung volume reduction system with biological sealant/remodeling system is an alternative treatment option especially for patients with significant collateral flow which can be easily measured by Chartis system<sup>\*</sup> [6]. Bronchoscopic lung volume reduction system with biological sealant is an alternative treatment option especially for patients with significant collateral flow. It is also designed to reduce lung volume directly by collapsing and sealing damaged areas of hyperinflated lung in patients with heterogeneous emphysema [7]. The liquid foam of biological sealant flows into the peripheral airways and alveoli, forming a film of material on the lung surface that seals the target region to cause durable absorption atelectasis. The treated area will start to shrink in several weeks after the procedure; it leads to a reduced lung volume and could therefore improve breathing function and quality of life. Surgical LVRS has been shown to provide clinical benefit and also a marginal increase in the survival in a subgroup of patients [8]. However, it is associated with significant morbidity and mortality and it has not been widely used in patients who are ventilator dependent. Lung transplant is another surgical option but poor outcomes have been reported in patients requiring pre-operative mechanical ventilation [9,10].

The majority of patients treated with foam sealant could experience flu- like inflammatory reaction associated with mucosal irritation from contact with the foam sealant. Symptoms are transient fever, cough, bronchospasm, malaise, chest pain, leukocytosis, elevated C-reactive protein and fibrinogen levels. In our cases, both our patients were treated with combined therapy of broad- spectrum antibiotic with supportive prednisolone. Under the combined therapy, our patients were able to recover fast.

Take home message should be, Endoscopic volume reduction with lung sealant remains a new innovative therapy in the field of pulmonology. The postinterventional complication like transient fever could be well controlled with combined therapy of antibiotic and prednisolone. It remains important to recognize and realize transient fever to be able to initiate the therapy. Further case reports are needed to evaluate this common side effect of this procedure. Citation: Falkenstern Ge R, Ingerl H, Kohlhaufl M (2015) Endobronchial Volume Reduction with Lung Sealant (Aeriseal®); Post Interventional Fever and Malaise Treated with Combined Therapy of Broad- Spectrum Antibiotic and Supportive Prednisolone. J Clin Case Rep 5: 480. doi:10.4172/2165-7920.1000480

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#### References

- 1. Maxfield RA (2004) New and emerging minimally invasive techniques for lung volume reduction. Chest 125: 777-783.
- 2. Toma TP (2001) The flexible bronchoscopic approach to lung volume reduction. Pneumologia 50: 97-100.
- Criner GJ, Sternberg AL (2008) National Emphysema Treatment Trial: the major outcomes of lung volume reduction surgery in severe emphysema. Proc Am Thorac Soc 5: 393-405.
- Shah PL, Slebos DJ, Cardoso PF, Cetti E, Voelker K, et al. (2011) Bronchoscopic lung-volume reduction with Exhale airway stents for emphysema (EASE trial): randomised, sham-controlled, multicentre trial. Lancet 378: 997-1005.
- Sciurba FC, Ernst A, Herth FJ, Strange C, Criner GJ, et al. (2010) A randomized study of endobronchial valves for advanced emphysema. N Engl J Med 363: 1233-1244.

- Gompelmann D, Eberhardt R, Michaud G, Ernst A, Herth FJ (2010) Predicting atelectasis by assessment of collateral ventilation prior to endobronchial lung volume reduction: a feasibility study. Respiration 80: 419-425.
- Ingenito EP, Berger RL, Henderson AC, Reilly JJ, Tsai L, et al. (2003) Bronchoscopic lung volume reduction using tissue engineering principles. Am J Respir Crit Care Med 167: 771-778.
- (2003) National Emphysema Treatment Trial Research Group A randomized trial comparing lung-volume-reduction surgery with medical therapy for severe emphysema. N Engl J Med. 348: 2059-2073.
- Trulock EP, Edwards LB, Taylor DO, Boucek MM, Keck BM, et al. (2005) Registry of the International Society for Heart and Lung Transplantation: twenty-second official adult lung and heart-lung transplant report-2005. J Heart Lung Transplant 24: 956-967.
- Smits JM, Mertens BJ, Van Houwelingen HC, Haverich A, Persijn GG, et al. (2003) Predictors of lung transplant survival in eurotransplant. Am J Transplant 3: 1400-1406.