

Editorial

Bronchoscopic Thermal Vapour Ablation: Hot Stuff to Treat Emphysema Patients! ☆



Ablación térmica broncoscópica, con vapor de agua, en el tratamiento de pacientes con enfisema

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Emphysema is characterized by alveolar destruction distal to the terminal bronchioles causing hyperinflation and reduced gas exchange, resulting in dyspnea, and exercise limitation. Lung volume reduction surgery (LVRS) of the hyperinflated emphysematous lung improves elastic recoil and neuromechanical coupling of respiratory muscles, and redirects ventilation to lung segments with better perfusion.¹ In a randomized controlled trial, LVRS in selected patients with upper lobe predominance obtained improvements in symptoms, lung function, exercise tolerance and quality of life relative to the medically treated control group.² LVRS, however, carries significant morbidity and mortality.³ Complications including prolonged air leaks, as well as respiratory and/or cardiac complications with prolonged hospital stays, and have limited the adoption of LVRS as routine therapy for patients with severe emphysema. Subsequently, various bronchoscopic techniques have emerged to achieve lung volume reduction with an improved safety profile. One such method is bronchoscopic thermal vapor ablation (BTVA). BTVA uses heated water vapor that is administered to targeted regions of the lung to produce a thermal reaction leading to an initial localized inflammation followed by permanent fibrosis and volume reduction.⁴ In a prospective, single-arm trial of 44 patients with upper-lobe predominant emphysema, unilateral BTVA at a vapor dose of 10 cal/g lung tissue resulted in a 48% lobar volume reduction and improvements in lung function, exercise tolerance and other patient reported outcomes.⁵ Post hoc analyses of the trial cohort, however, indicated that the occurrence of serious adverse events increased with the volume of the treated lobe with an inflection point at 1700 ml target lobar volume.⁶ Therefore, an alternative approach was required to limit the volume treated per session, which has resulted in the design of the STEP-UP study.

The STEP-UP study was a randomized, controlled open-label trial using vapor ablation in a sequential bilateral treatment to

target individual segments based on their disease state.⁷ Patients included were suffering from GOLD stage III and IV disease and were symptomatic despite optimal medical management. The procedure was performed under conscious sedation with an overall short procedure time. The treatment algorithm of the study required BTVA of 1 segment of an upper lobe during 1 session, followed by BTVA of 2 segments of the contralateral lobe during a second session performed 12 weeks later.⁷ The reduced application of energy per session was expected to reduce the occurrence of serious adverse events and improve the safety profile, while the overall increase in volume of lung treated per procedure was expected to result in similar or improved efficacy profiles. Indeed, the STEP-UP study demonstrated a statistically significant 14.7% inter-group difference in FEV₁ at 6 months post bilateral BTVA treatment in favor of the intervention group, and a 9.7 point reduction in SGRQ. Half of the patients in the treatment group achieved a minimal clinically important difference for FEV₁ and two-thirds for SGRQ at 6 months. Patients in the intervention group experienced a higher pneumonia (18% vs 8%) and COPD exacerbation rate (24% vs 4%) at 6 months post treatment compared with controls, however, all events were managed with standard medical treatment.

There are several potential advantages and limitations of BTVA compared with other endoscopic lung volume reduction techniques. First, the segmental approach described above is theoretically suitable for both patients with heterogeneous and (apparently) homogeneous disease distribution. In the absence of a true definition of emphysema heterogeneity we have previously demonstrated evidence for both interlobar and intralobar heterogeneity when assessing on a segmental level, rather than on a lobar level.⁸ Identification which of the segments is most diseased thus allows selective volume reduction of diseased areas and preservation of lung segments that contribute to better lung function. In fact, with segmental treatment 44% of patients with emphysema may be eligible for bilateral upper lobe treatment, and over 85% of patients could undergo unilateral upper lobe treatment, unilateral lower lobe treatment, or bilateral lower lobe treatment.⁸ Second, BTVA may be used for sequential future

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treatments in the presence of (natural) emphysema progression. Third, the overall pneumothorax rate in patients treated with BTVA (2%) appears to be substantially lower compared with other endoscopic lung volume reduction techniques, such as valve therapy or coil implantation, with rates reported as high as 18%⁹ and 9%,¹⁰ respectively. In contrast to these techniques, BTVA is associated with a rather gradual lung volume reduction that typically occurs over a 4–6-week period. Finally, BTVA has previously been shown to successfully induce volume reduction irrespective of collateral ventilation, a common feature of both normal and emphysematous lungs in humans, which may prevent successful valve treatment.¹¹

However, vapor ablation in emphysema has a number of potential limitations. First, there are no studies comparing risk-benefit profiles of different endoscopic techniques. Given the overlap in patient selection, decision-making in clinical practice becomes difficult in the absence of evidence for superiority of one technique over the other. Second, long-term follow-up data and health-economic data for BTVA treated patients are lacking. Additional data from a 12-month follow-up visit in a previous study indicated that improvements relative to baseline continued to be observed, however, the magnitude of benefit was less than that documented at 6 months.¹² Third, patients with emphysema respond variably to BTVA, and powerful predictors of response are scarce. In this context, the results regarding health-related quality of life data need to be interpreted with caution given the lack of a sham intervention. Finally, like other interventional procedures, patient selection will be crucial for procedural success. Thus, implementation of BTVA should be restricted to high volume centers, in which patient selection is the result of a multidisciplinary team approach, in order to optimize risk-benefit ratio of the procedure.

In summary, there is cumulating evidence of successful volume reduction induced by BTVA using a step-wise, segmental, sequential approach. Clinical benefits have been recently confirmed in the setting of a randomized controlled trial, however, comparative studies with other endoscopic techniques and long-term follow-up data are needed.

Conflicts of interest

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