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[Intervention Review]

Bronchoscopic lung volume reduction procedures for chronic obstructive pulmonary disease

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ABSTRACT

Background

In the recent years, a variety of bronchoscopic lung volume reduction (BLVR) procedures have emerged that may provide a treatment option to participants suffering from moderate to severe chronic obstructive pulmonary disease (COPD).

Objectives

To assess the effects of BLVR on the short- and long-term health outcomes in participants with moderate to severe COPD and determine the effectiveness and cost-effectiveness of each individual technique.

Search methods

Studies were identified from the Cochrane Airways Group Specialised Register (CAGR) and by handsearching of respiratory journals and meeting abstracts. All searches are current until 07 December 2016.

Selection criteria

We included randomized controlled trials (RCTs). We included studies reported as full text, those published as abstract only and unpublished data, if available.

Data collection and analysis

Two independent review authors assessed studies for inclusion and extracted data. Where possible, data from more than one study were combined in a meta-analysis using RevMan 5 software.

Main results

AeriSeal

One RCT of 95 participants found that AeriSeal compared to control led to a significant median improvement in forced expiratory volume in one second (FEV $_1$) (18.9%, interquartile range (IQR) -0.7% to 41.9% versus 1.3%, IQR -8.2% to 12.9%), and higher quality of life, as measured by the St Georges Respiratory Questionnaire (SGRQ) (-12 units, IQR -22 units to -5 units, versus -3 units, IQR -5 units to 1 units), P = 0.043 and P = 0.0072 respectively. Although there was no significant difference in mortality (Odds Ratio (OR) 2.90, 95% CI 0.14 to 62.15), adverse events were more common for participants treated with AeriSeal (OR 3.71, 95% CI 1.34 to 10.24). The quality of evidence found in this prematurely terminated study was rated low to moderate.



Airway bypass stents

Treatment with airway bypass stents compared to control did not lead to significant between-group changes in FEV_1 (0.95%, 95% CI -0.16% to 2.06%) or SGRQ scores (-2.00 units, 95% CI -5.58 units to 1.58 units), as found by one study comprising 315 participants. There was no significant difference in mortality (OR 0.76, 95% CI 0.21 to 2.77), nor were there significant differences in adverse events (OR 1.33, 95% CI 0.65 to 2.73) between the two groups. The quality of evidence was rated moderate to high.

Endobronchial coils

Three studies comprising 461 participants showed that treatment with endobronchial coils compared to control led to a significant between-group mean difference in FEV₁ (10.88%, 95% CI 5.20% to 16.55%) and SGRQ (-9.14 units, 95% CI -11.59 units to -6.70 units). There were no significant differences in mortality (OR 1.49, 95% CI 0.67 to 3.29), but adverse events were significantly more common for participants treated with coils (OR 2.14, 95% CI 1.41 to 3.23). The quality of evidence ranged from low to high.

Endobronchial valves

Five studies comprising 703 participants found that endobronchial valves versus control led to significant improvements in FEV_1 (standardized mean difference (SMD) 0.48, 95% CI 0.32 to 0.64) and scores on the SGRQ (-7.29 units, 95% CI -11.12 units to -3.45 units). There were no significant differences in mortality between the two groups (OR 1.07, 95% CI 0.47 to 2.43) but adverse events were more common in the endobronchial valve group (OR 5.85, 95% CI 2.16 to 15.84). Participant selection plays an important role as absence of collateral ventilation was associated with superior clinically significant improvements in health outcomes. The quality of evidence ranged from low to high.

Intrabronchial valves

In the comparison of partial bilateral placement of intrabronchial valves to control, one trial favoured control in FEV_1 (-2.11% versus 0.04%, P = 0.001) and one trial found no difference between the groups (0.9 L versus 0.87 L, P = 0.065). There were no significant differences in SGRQ scores (MD 2.64 units, 95% CI -0.28 units to 5.56 units) or mortality rates (OR 4.95, 95% CI 0.85 to 28.94), but adverse events were more frequent (OR 3.41, 95% CI 1.48 to 7.84) in participants treated with intrabronchial valves. The lack of functional benefits may be explained by the procedural strategy used, as another study (22 participants) compared unilateral versus partial bilateral placement, finding significant improvements in FEV_1 and SGRQ when using the unilateral approach. The quality of evidence ranged between moderate to high.

Vapour ablation

One study of 69 participants found significant mean between-group differences in FEV_1 (14.70%, 95% CI 7.98% to 21.42%) and SGRQ (-9.70 units, 95% CI -15.62 units to -3.78 units), favouring vapour ablation over control. There was no significant between-group difference in mortality (OR 2.82, 95% CI 0.13 to 61.06), but vapour ablation led to significantly more adverse events (OR 3.86, 95% CI 1.00 to 14.97). The quality of evidence ranged from low to moderate.

Authors' conclusions

Results for selected BLVR procedures indicate they can provide significant and clinically meaningful short-term (up to one year) improvements in health outcomes, but this was at the expense of increased adverse events. The currently available evidence is not sufficient to assess the effect of BLVR procedures on mortality. These findings are limited by the lack of long-term follow-up data, limited availability of cost-effectiveness data, significant heterogeneity in results, presence of skew and high CIs, and the open-label character of a number of the studies.

PLAIN LANGUAGE SUMMARY

Bronchoscopic lung volume reduction procedures for moderate to severe chronic obstructive pulmonary disease

Review question

Do bronchoscopic lung volume reduction (BLVR) procedures improve health outcomes, without leading to an increased chance of death, higher rates of illness after the procedure, while maintaining acceptable costs for people suffering from moderate to severe chronic obstructive pulmonary disease (COPD)?

Background

BLVR procedures are a collection of innovative non-surgical procedures that aim to improve the disease status and lung function of participants suffering from moderate to severe COPD, specifically those participants who remain limited despite conventional treatment.

Study characteristics



Fourteen studies including 1979 participants were identified up to December 2016 which studied BVRs (AeriSeal, airway bypass stents, endobronchial coils, endobronchial valves, intrabronchial valves and vapour ablation). Most studies compared a BLVR procedure to optimal medical care or to sham bronchoscopy, while one studied a specific way to place intrabronchial valves: unilaterally or partial bilaterally.

Key results

Evidence for short-term improvements in disease status were most evident for studies testing endobronchial valves (five studies) and endobronchial coils (three studies), including improvements in lung function and quality of life. Improvements in lung function and quality of life were also found for vapour ablation and AeriSeal, but the quality of that evidence is limited as the study on vapour ablation was small and the study on AeriSeal was terminated early. Neither airway bypass stents (one study) nor partial bilateral placement of intrabronchial valves (two studies) seemed to lead to significant changes in health outcomes, although unilateral placement of intrabronchial valves did lead to better health outcomes as assessed by a small study. Studies that found improvements in health outcomes also found higher rates of potential complications as a result of the procedures, but the current studies did not provide evidence for a higher risk of death after BLVR procedures, although the evidence from the included studies is not conclusive.

Quality of the evidence

The lack of sham bronchoscopy or unclear status of blinding in some studies caused a risk of bias for subjective outcomes (e.g. quality of life and exercise capacity). The lack of long-term follow-up, small size of some of the studies, differences in results between trials, and lack of cost-effectiveness data limits the quality of evidence provided in this review.