Πνευμονικό εμφύσημα. Υπάρχει ρόλος στη χειρουργική θεραπεία;

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Definition and Factors That Influence COPD Development and Progression

Key Points[TS: Set all "Key Points"] boxes as they were in original GOLD (http://www.atsjournals.org/doi/pdf/10.1164/rccm.201204-0596PP).]

- COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases.
- Dyspnea, cough and/or sputum production are the most frequent symptoms; symptoms are commonly under-reported by patients.
- Tobacco smoking is the main risk exposure for COPD, but environmental exposures like biomass fuel exposure and air pollution may contribute. Besides exposures, host factors (genetic abnormalities, abnormal lung development and accelerated aging) predispose individuals to develop COPD.
- COPD may be punctuated by acute worsening of respiratory symptoms, called exacerbations.
- In most patients, COPD is associated with significant concomitant chronic diseases, which increase morbidity and mortality.

Definition and Pathogenesis

COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases.

Global Strategy for Diagnosis, Management and Prevention of COPD, 2017

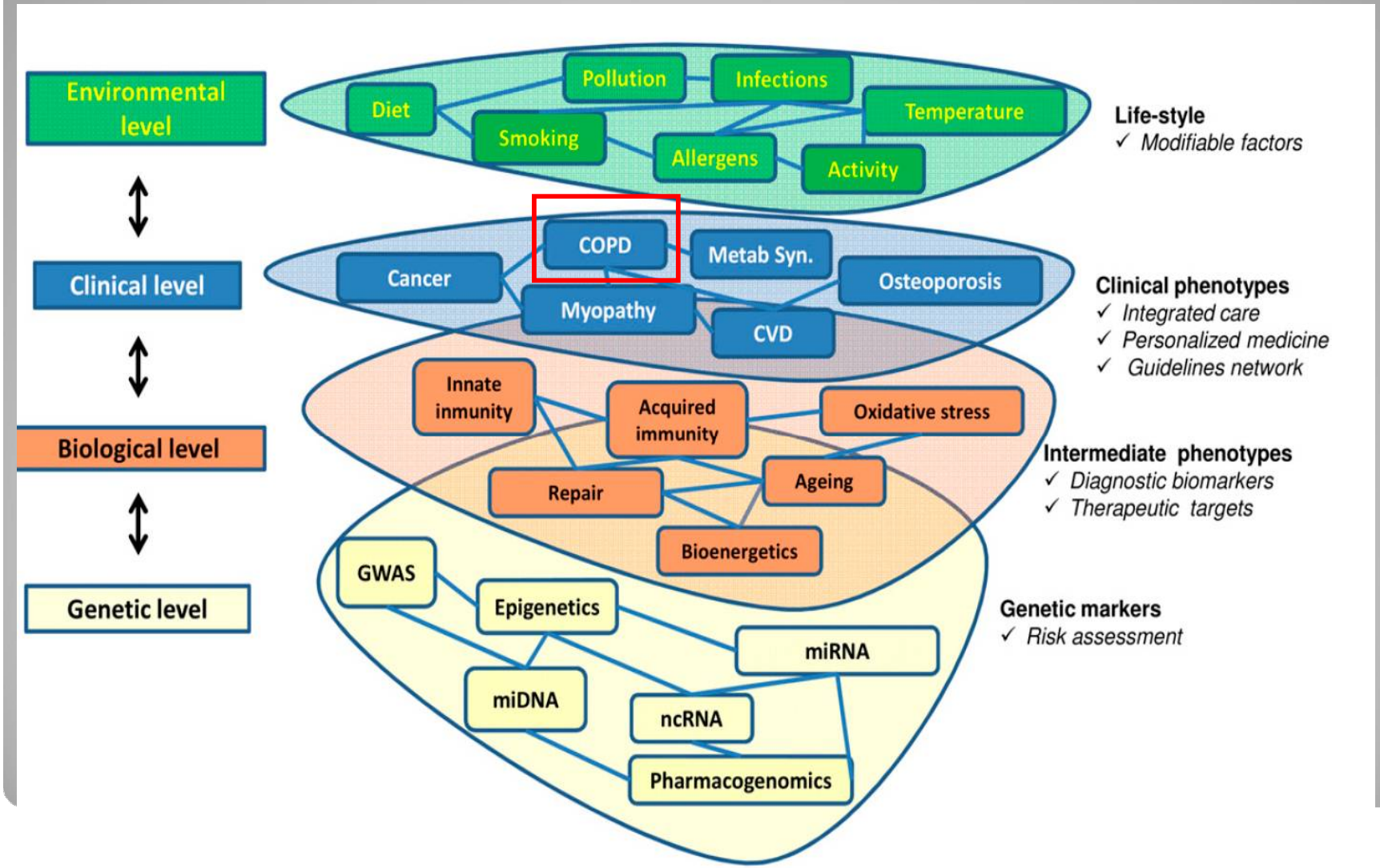
Global Initiative for Chronic
Obstructive
Lung
Disease

GLOBAL STRATEGY FOR THE DIAGNOSIS, MANAGEMENT, AND PREVENTION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Updated 2015

- Definition and Overview
- Diagnosis and Assessment
- Therapeutic Options
- Manage Stable COPD
- Manage Exacerbations
- Manage Comorbidities
- Asthma COPD Overlap Syndrome (ACOS)

The different levels of complexity of COPD



Agustí A and Vestbo J. *AJRCCM* 2011; 184: 507-513.

Επιδημιολογικά στοιχεία

- 2000: 4η αιτία θανάτου
- 2012: 3η αιτία θανάτου

- Στη ΧΑΠ αποδίδονται παγκοσμίως:

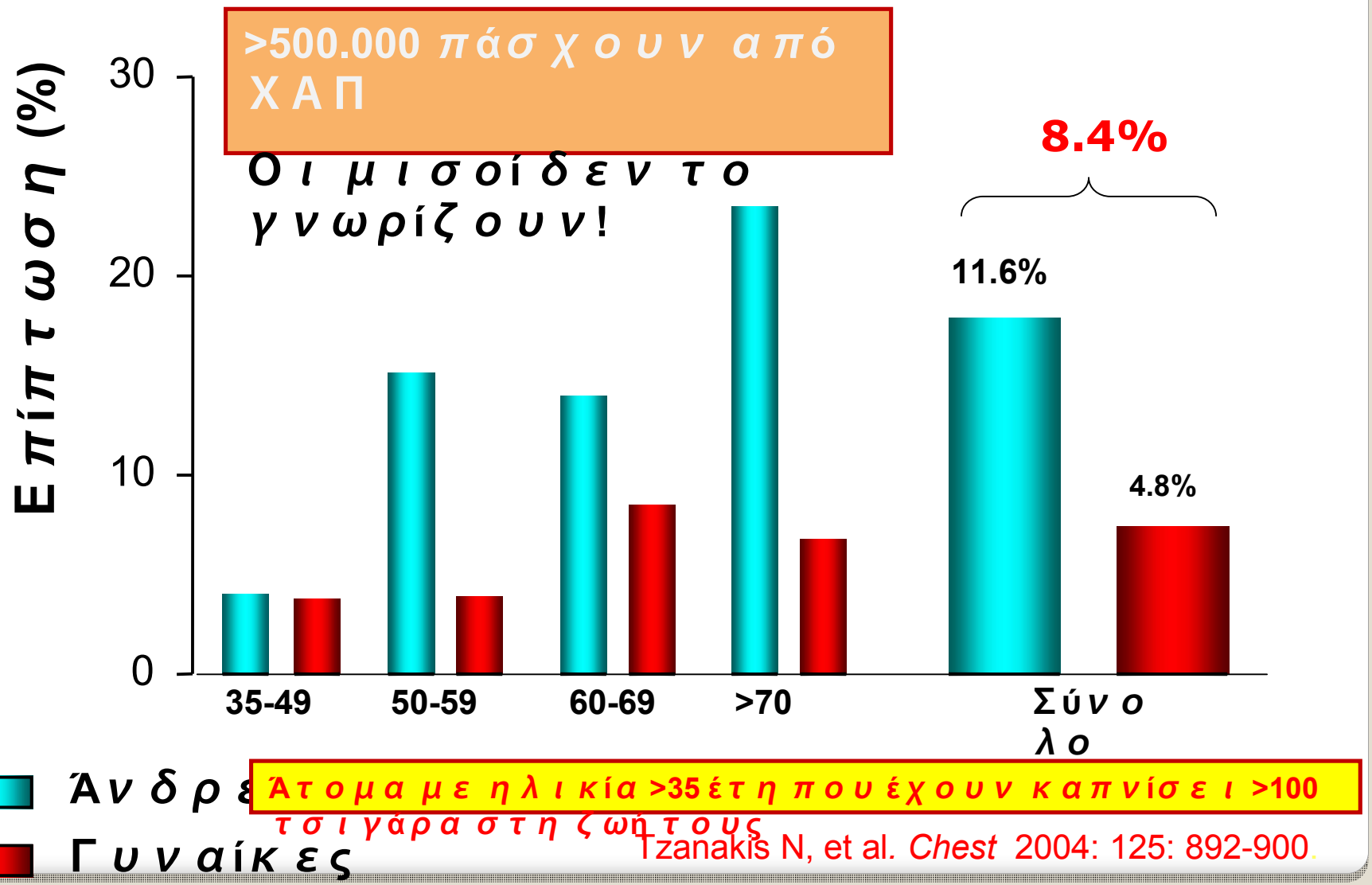
  -3 εκατομμύρια θάνατοι ετησίως

  -το 5.6% των συνολικών θανάτων

  -το 27% των θανάτων που σχετίζονται με το κάπνισμα

World Health Organization

Η έκταση του προβλήματος στην Ελλάδα



Tzanakis N, et al. *Chest* 2004: 125: 892-900.

Review Article

Smoking and Pulmonary Fibrosis: Novel Insights

Katerina D. Samara,[1] George Margaritopoulos,[2] Athol U. Wells,[2] Nikolaos M. Siafakas,[1] and Katerina M. Antoniou[1,2]

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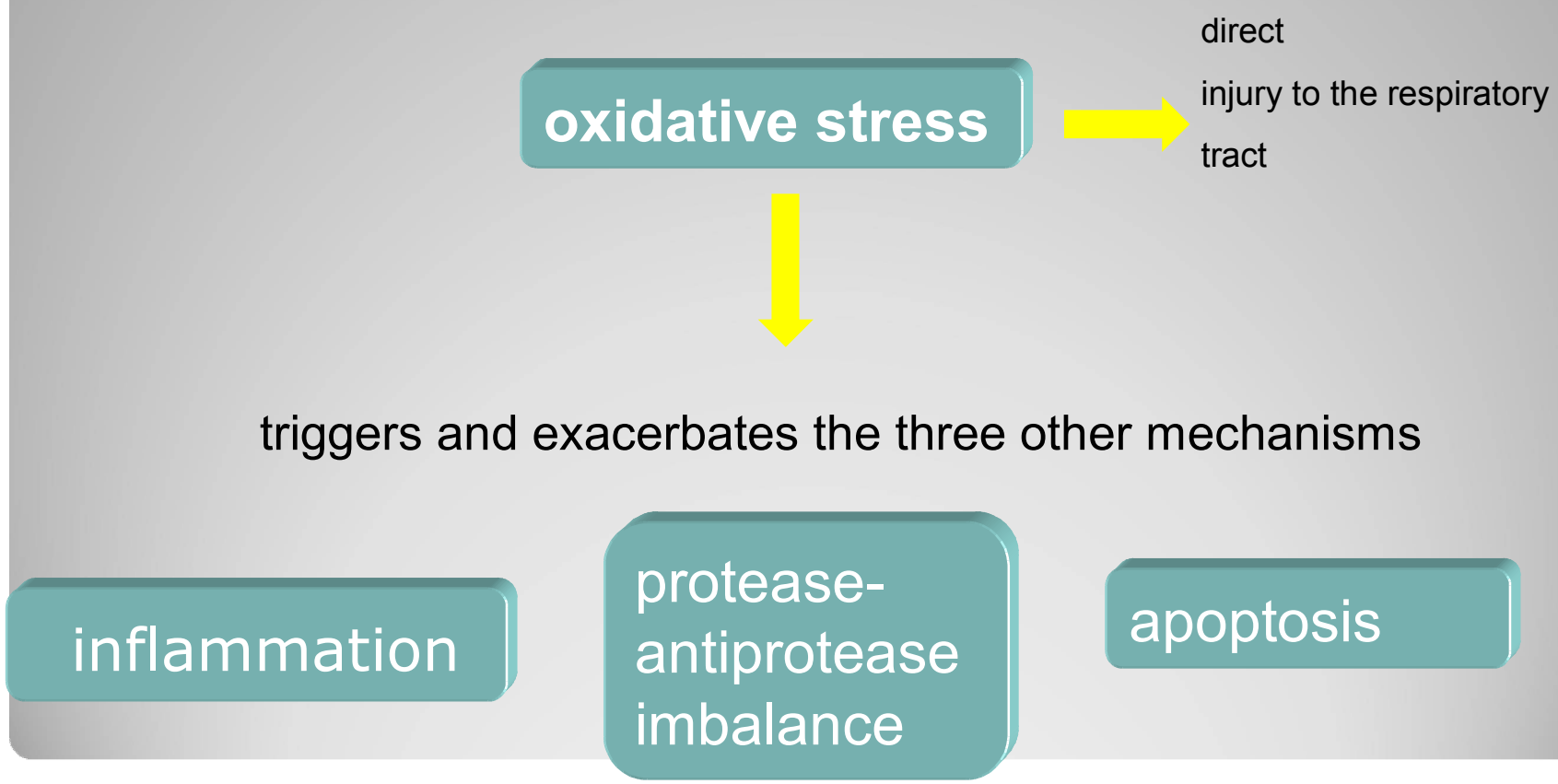
- The direct pathogenetic relationship between cigarette smoking respiratory diseases such as emphysema, (COPD), and lung cancer is well documented.

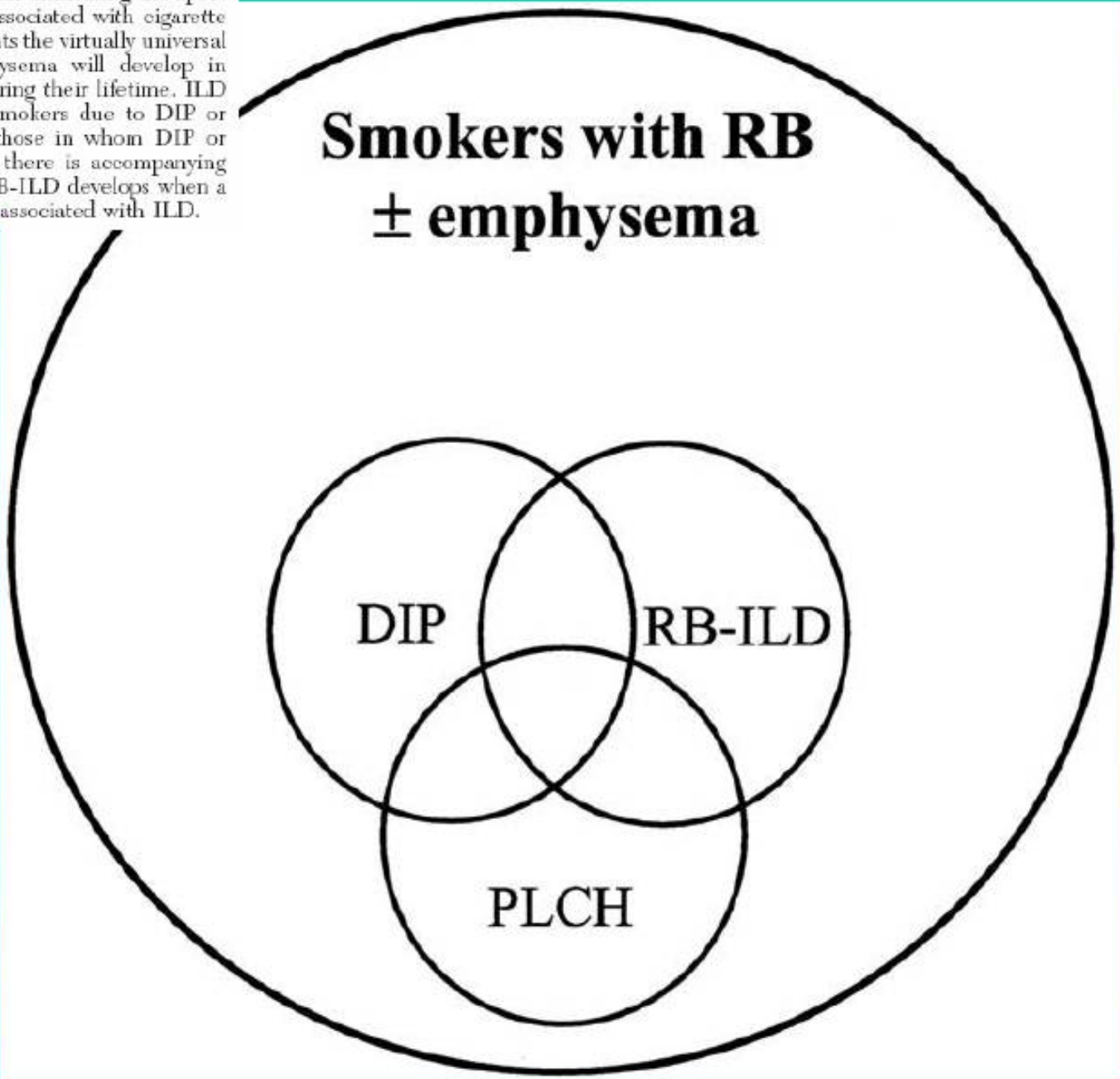
- Regarding interstitial lung damage there is strong evidence providing links with cigarette smoking.

Principal mechanisms responsible for the alterations observed in COPD

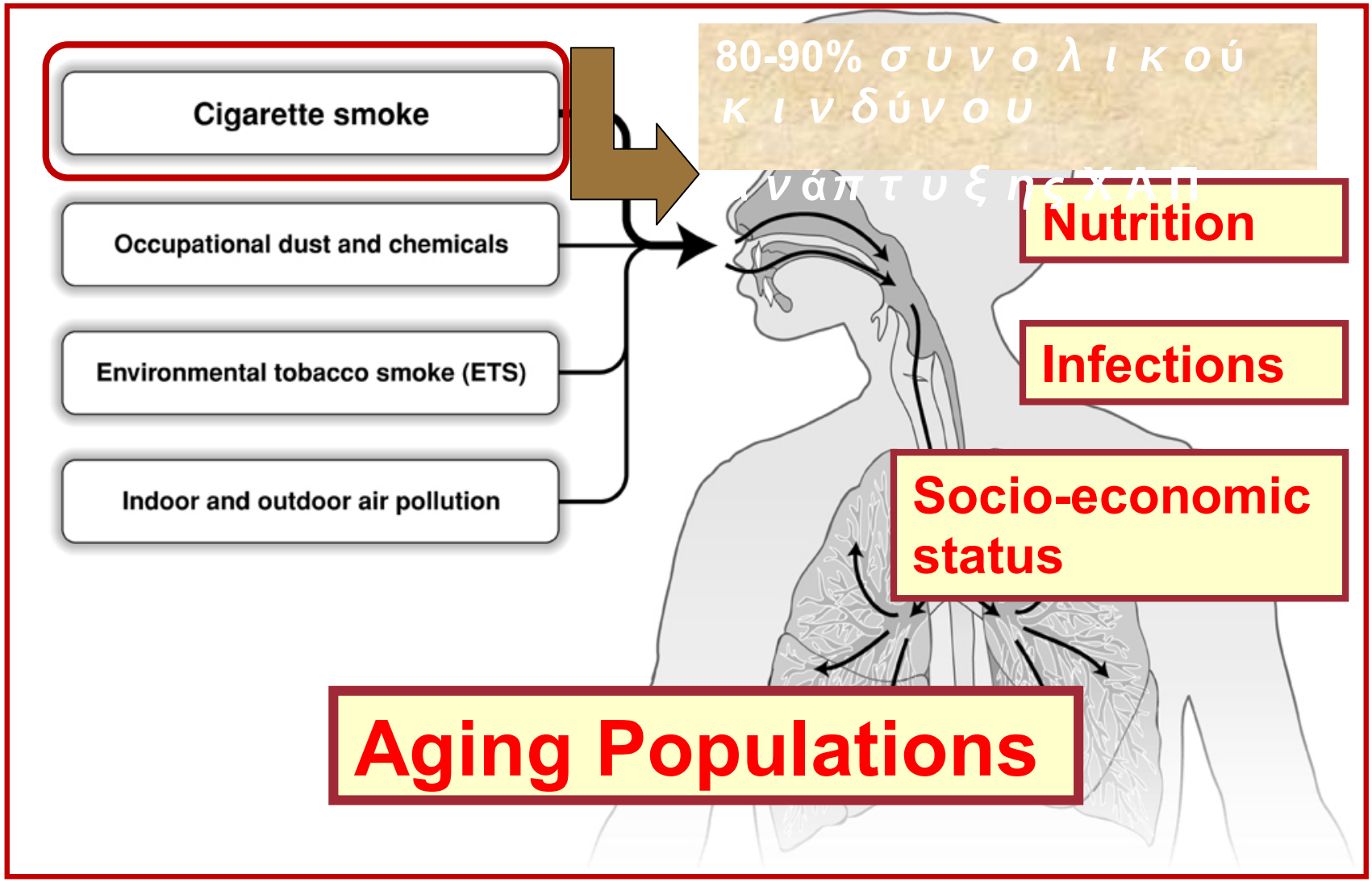


MacNee W. *Proc Am Thorac Soc* 2005; 2: 258-66.

FIGURE 3. Nonproportional Venn diagram illustrating the spectrum of airways and interstitial injury associated with cigarette smoking. The larger outer circle represents the virtually universal occurrence of RB in smokers. Emphysema will develop in approximately 20% of these smokers during their lifetime. ILD will develop in a small proportion of smokers due to DIP or PLCH. In a significant proportion of those in whom DIP or PLCH develops (or overlaps of both), there is accompanying emphysema (as in the current series). RB-ILD develops when a smoker has an exaggerated RB reaction associated with ILD.



ΧΑΠ: Παράγοντες κινδύνου



GOLD 2017

Figure 1. Pathways to the diagnosis of COPD

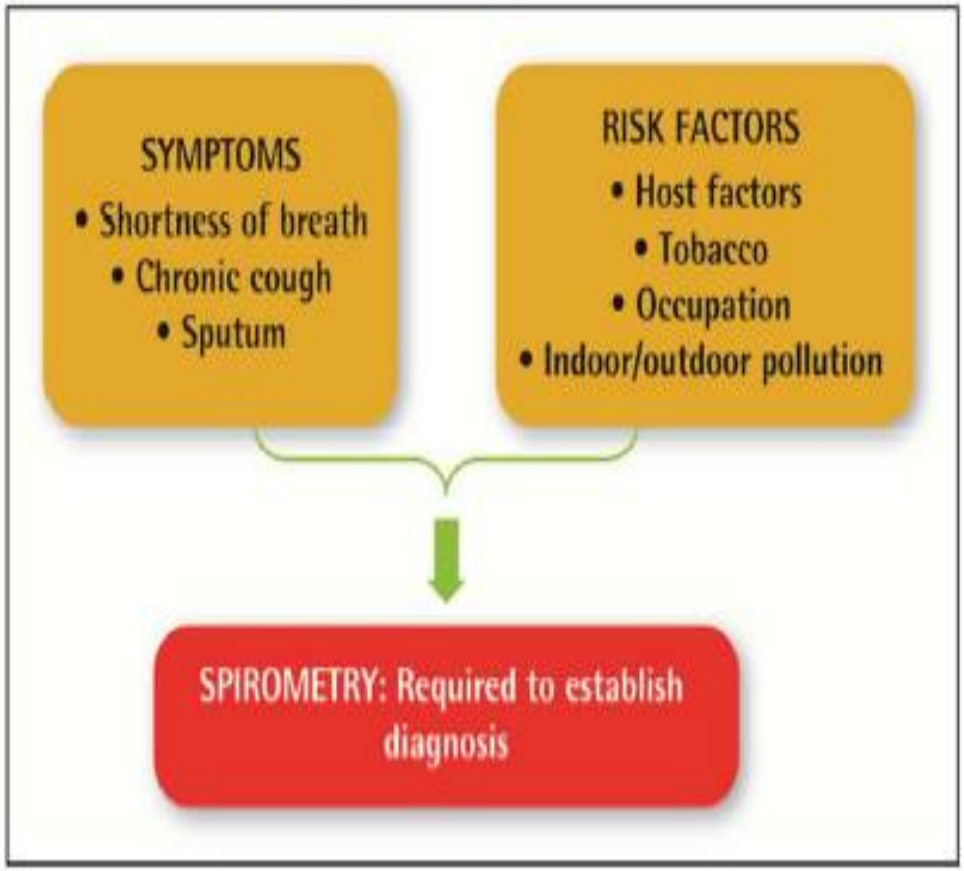
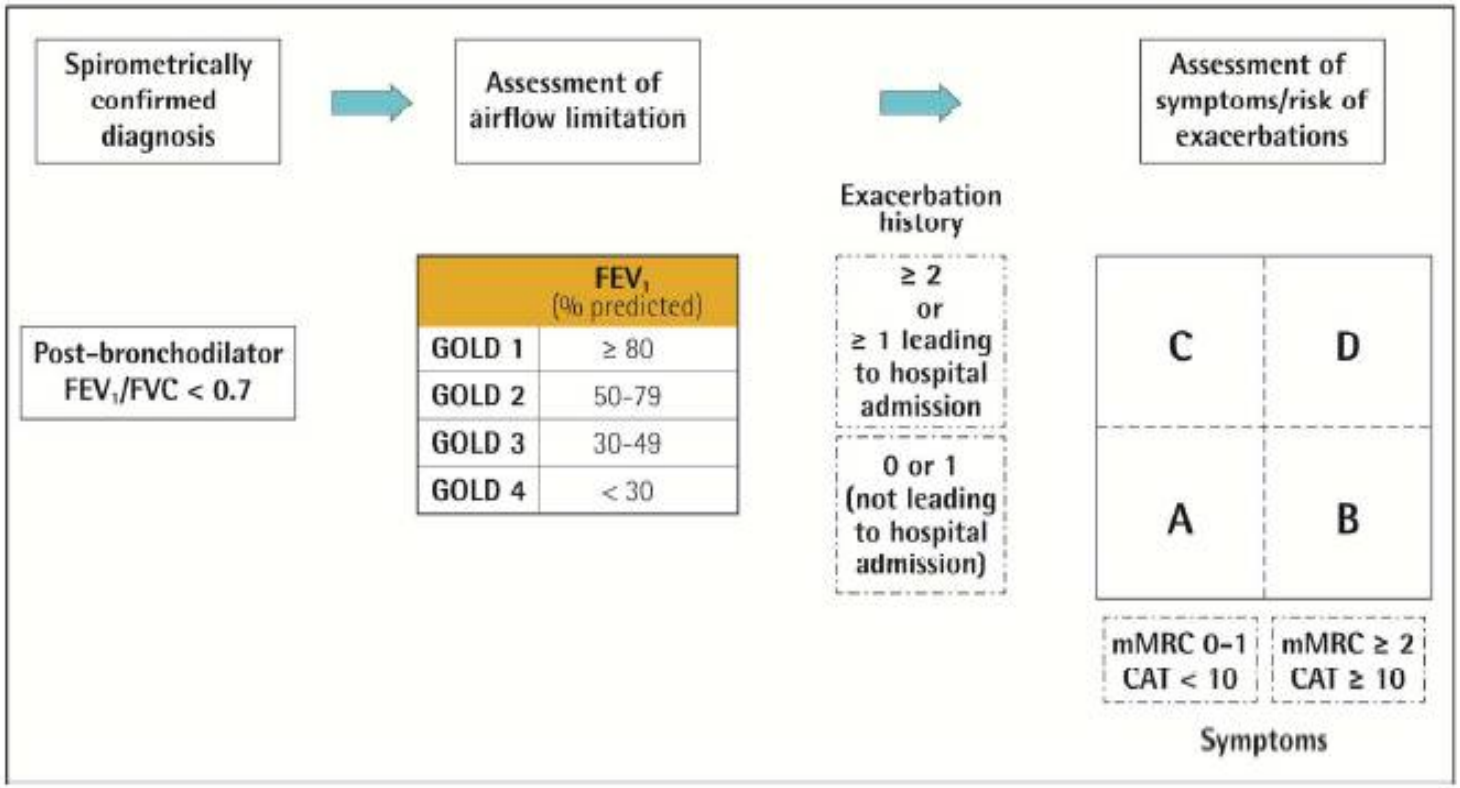


Figure 2. The refined ABCD assessment tool



In the refined assessment scheme, patients should undergo spirometry to determine the severity of airflow limitation (i.e., spirometric grade). They should also undergo assessment of either dyspnea using mMRC or symptoms using CAT™. Finally, their history of exacerbations (including prior hospitalizations) should be recorded.

Combined pulmonary fibrosis and emphysema

Eur Respir J 2005; 26: 586–593
DOI: 10.1183/09031936.05.00021005

CLINICAL FORUM

Combined pulmonary fibrosis and emphysema: a distinct underrecognised entity

V. Cottin*, H. Nunes#, P-Y. Brillet¶, P. Delaval+, G. Devouassoux§, I. Tillie-Leblondƒ, D. Israel-Biet, I. Court-Fortune##, D. Valeyre#, J-F. Cordier* and the Groupe d'Etude et de Recherche sur les Maladies "Orphelines" Pulmonaires (GERM"O"P)**

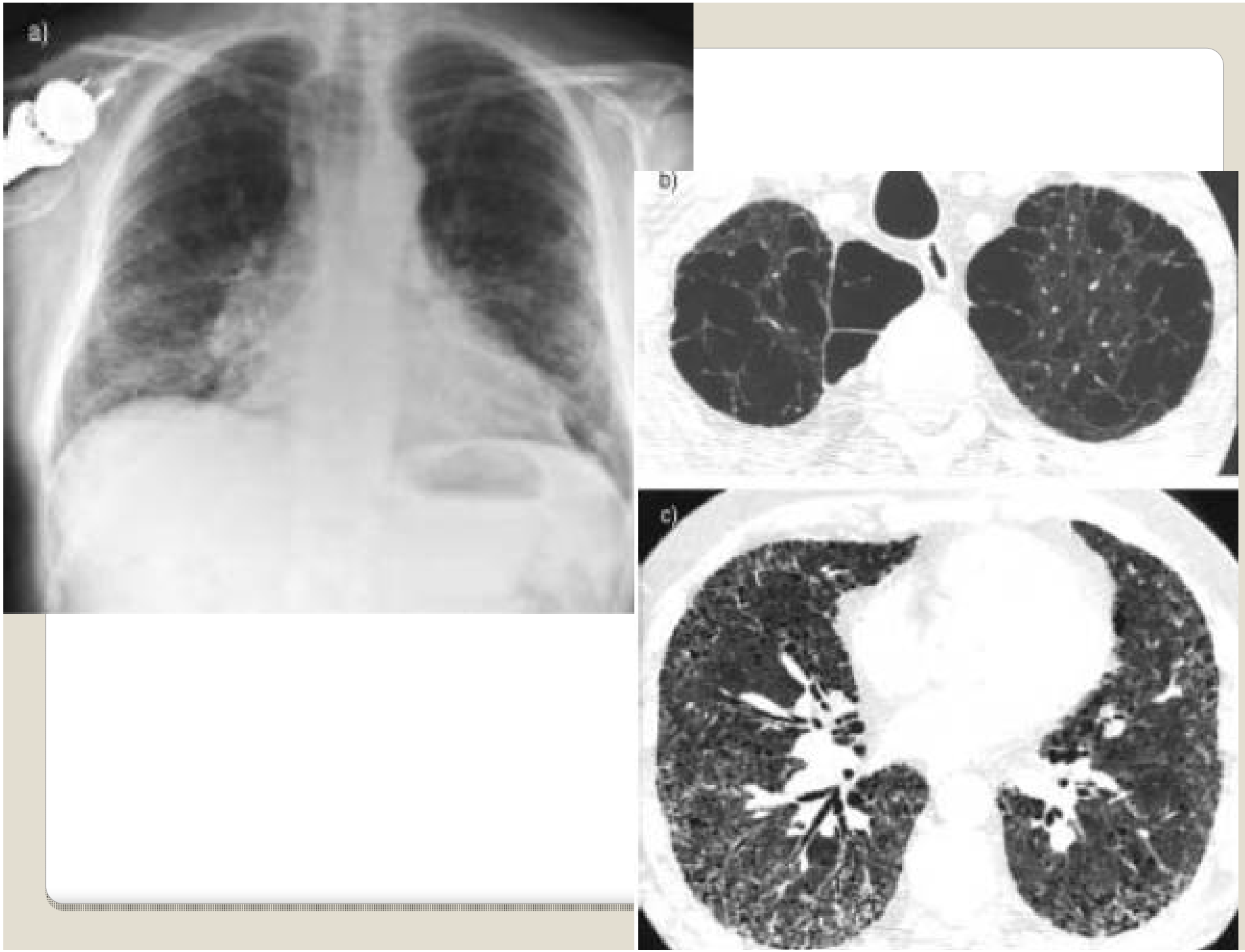
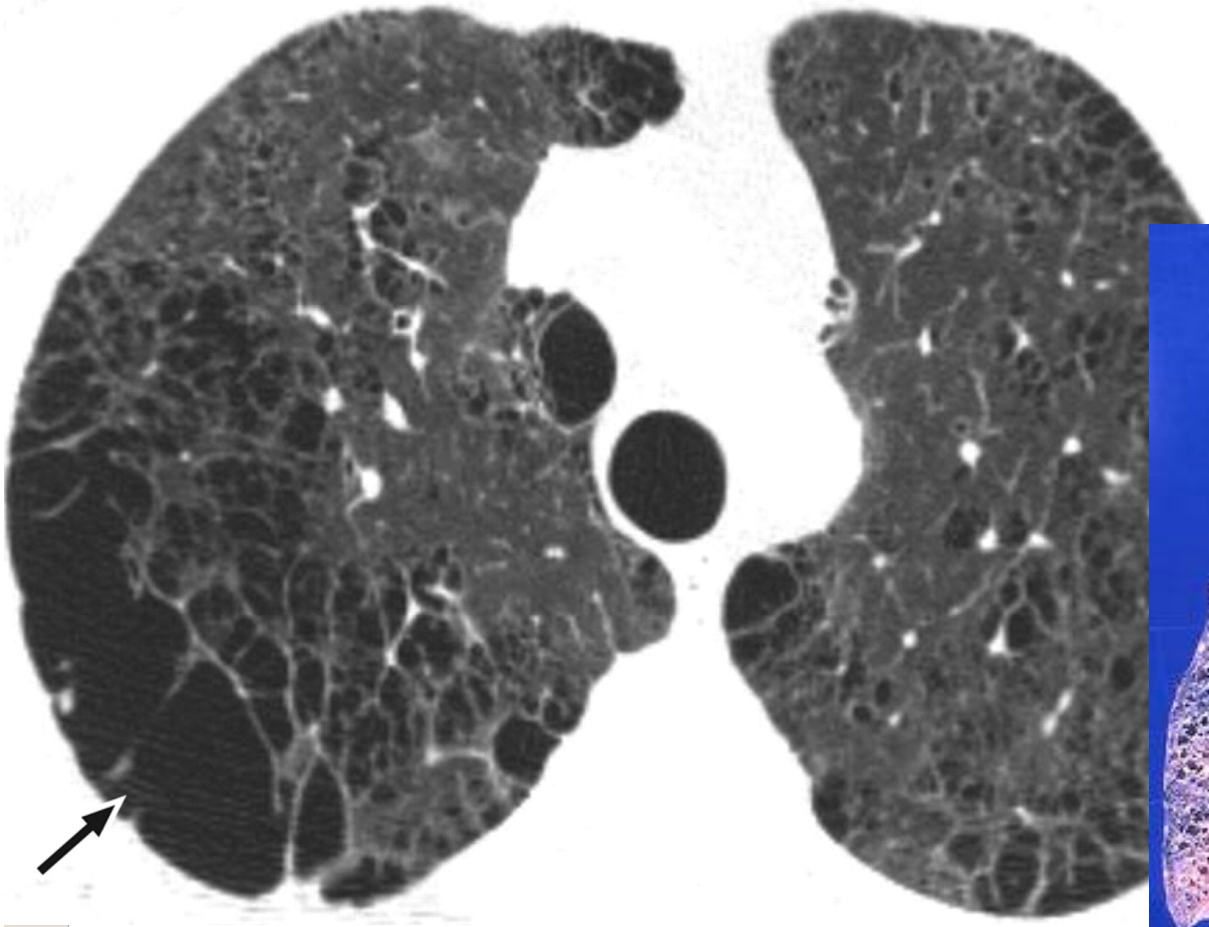

a)
b)
c)

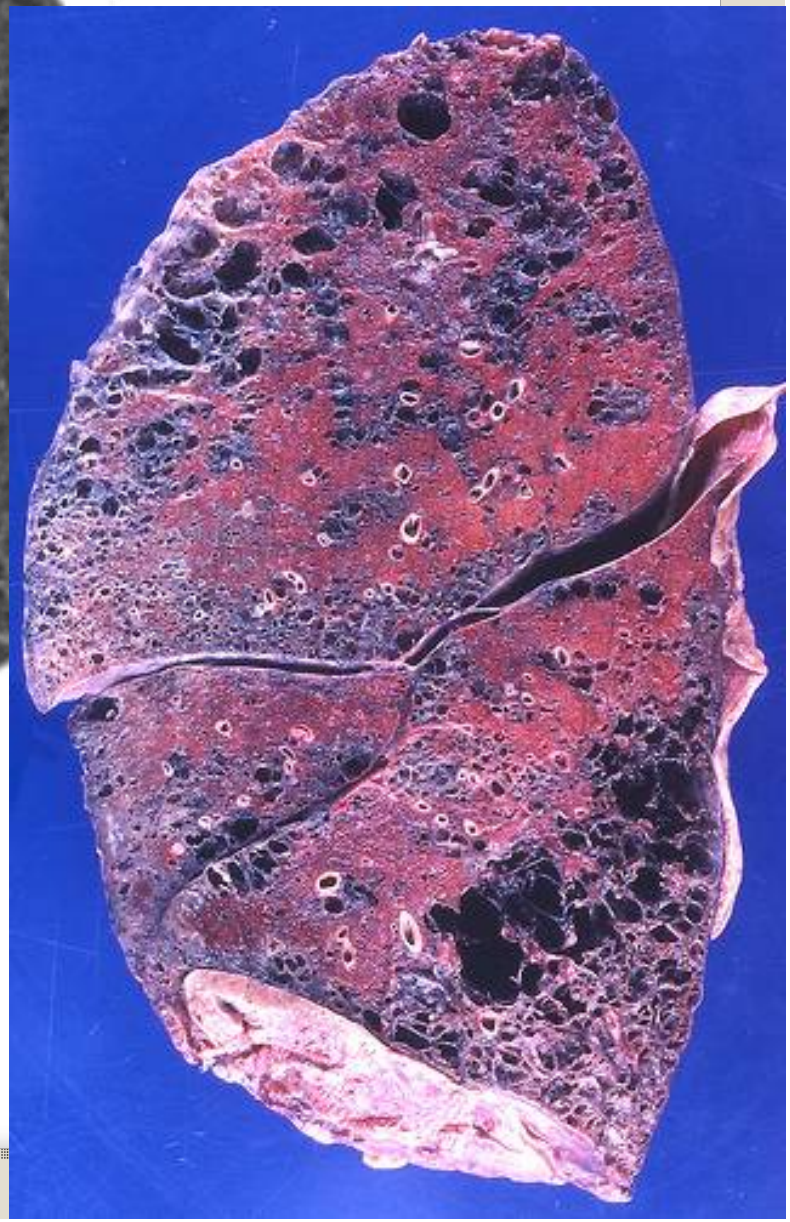
TABLE 3 Computed tomography (CT) findings

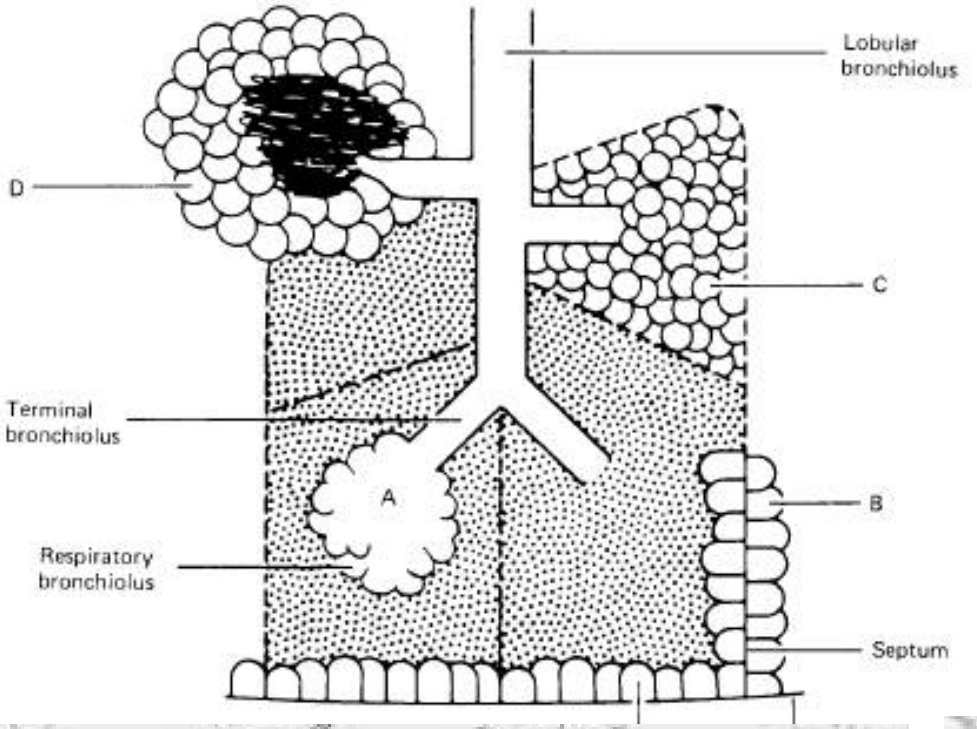
CT finding	
Fibrotic changes	
Honeycombing	58 (95)
Reticular opacities	53 (87)
Traction bronchiectasis	42 (69)
Ground-glass opacities	40 (66)
Architectural or bronchial distortion	24 (39)
Emphysema	
Centrilobular emphysema	59 (97)
Paraseptal emphysema	57 (93)
Bullae	33 (54)

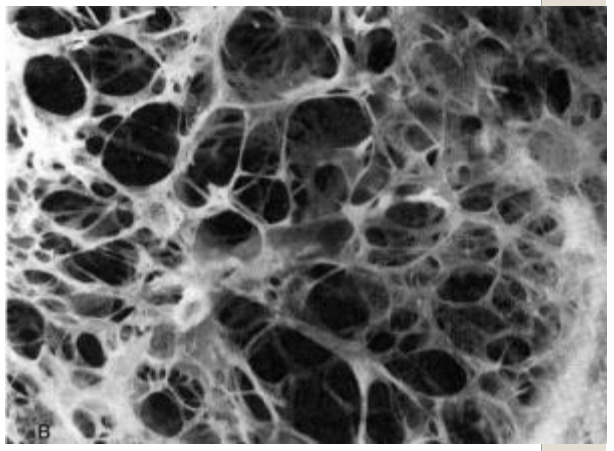
Combined Pulmonary Fibrosis Emphysema

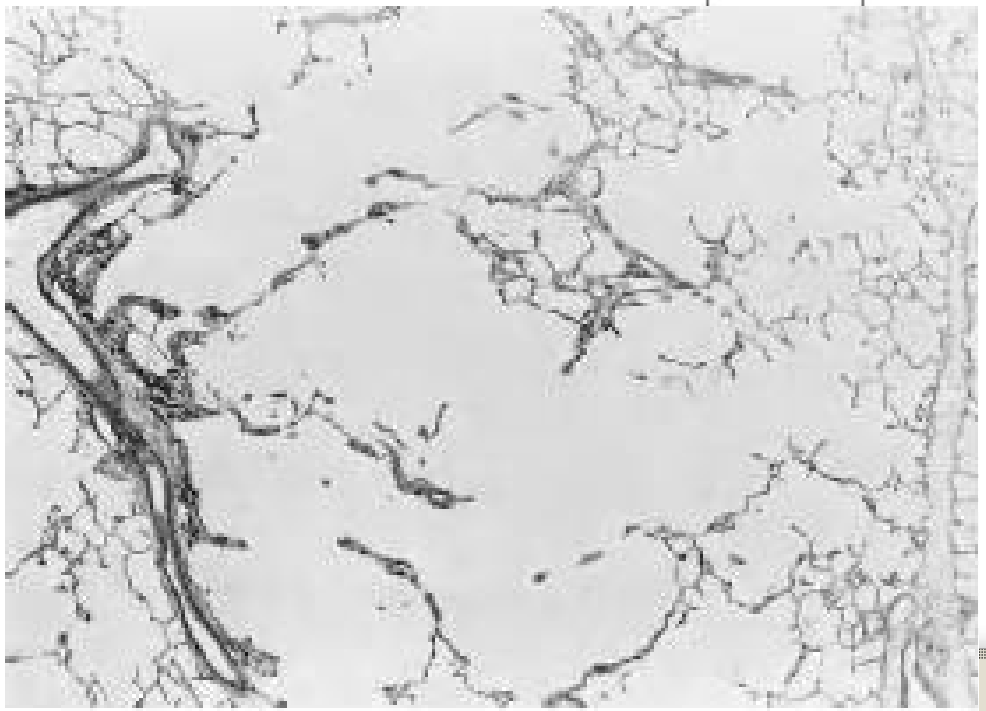
- tobacco smoking,
- severe dyspnea,
- *unexpected preserved spirometry measurements contrasting with severely low DLCO, and severely impaired gas exchange, and hypoxemia during exercise.*
- Characteristic imaging features, with centrilobular and/or paraseptal emphysema and diffuse infiltrative opacities suggestive of pulmonary fibrosis predominating in the lower lobes.

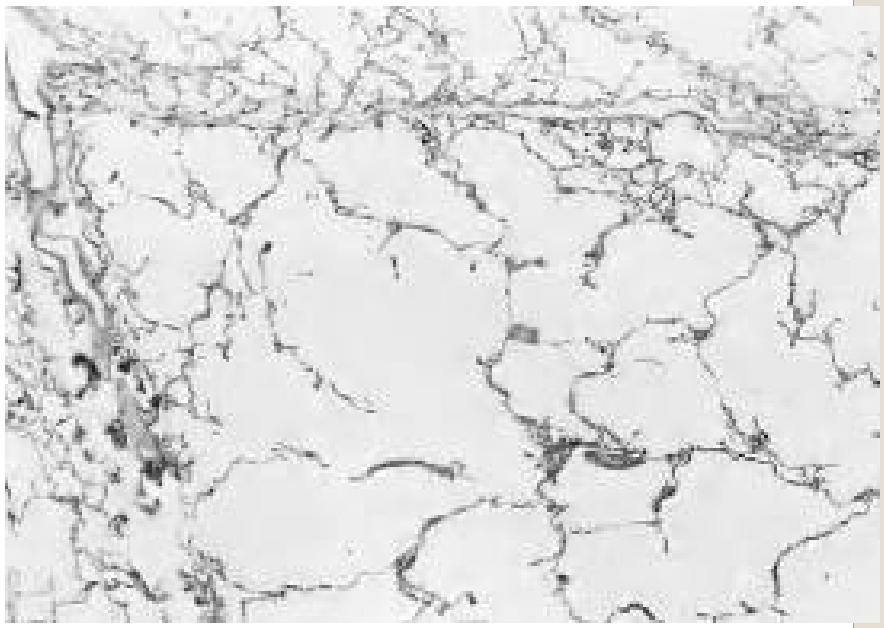


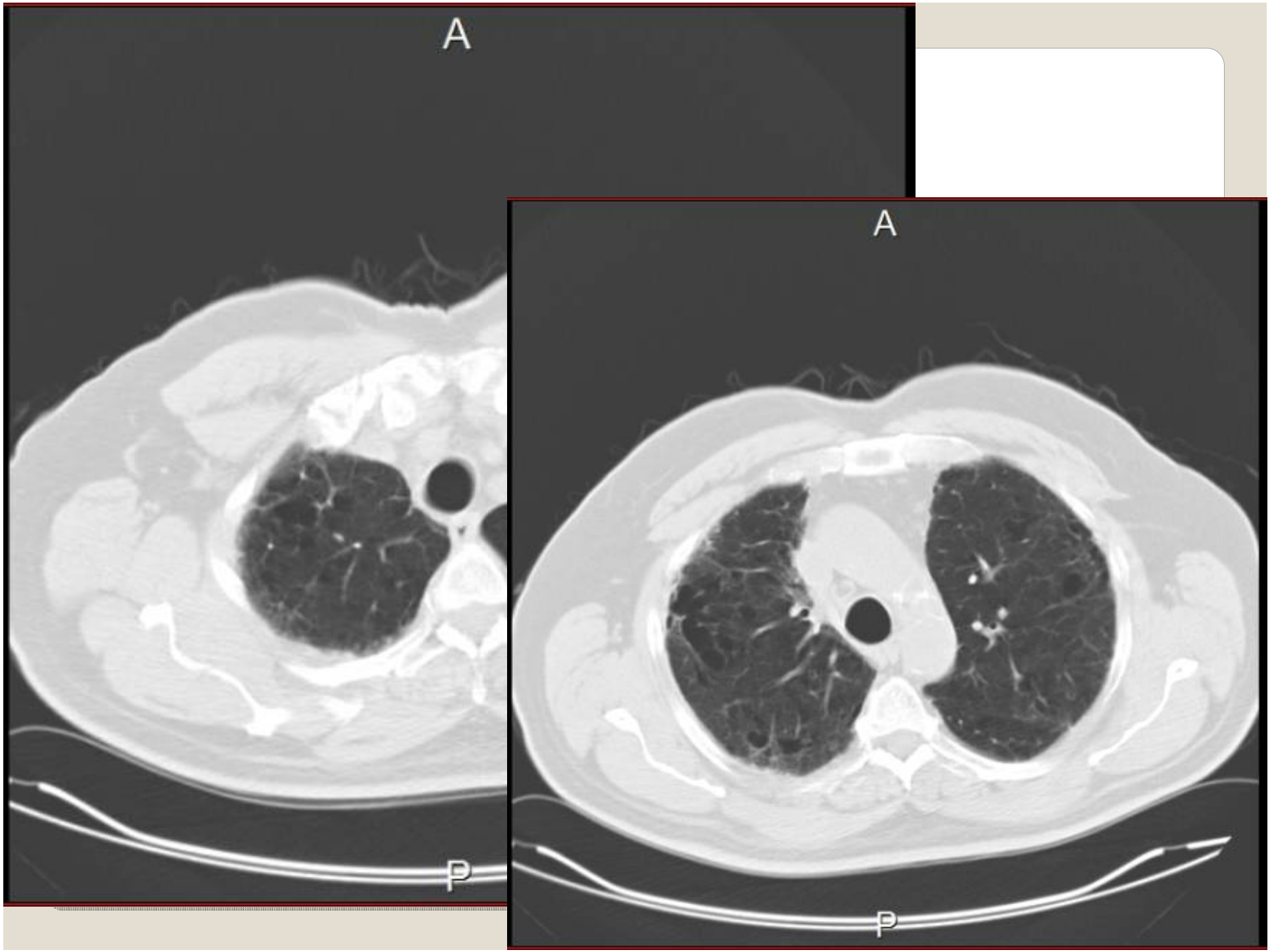



Lobular bronchiolus
D
C
Terminal bronchiolus
A
B
Respiratory bronchiolus
Septum





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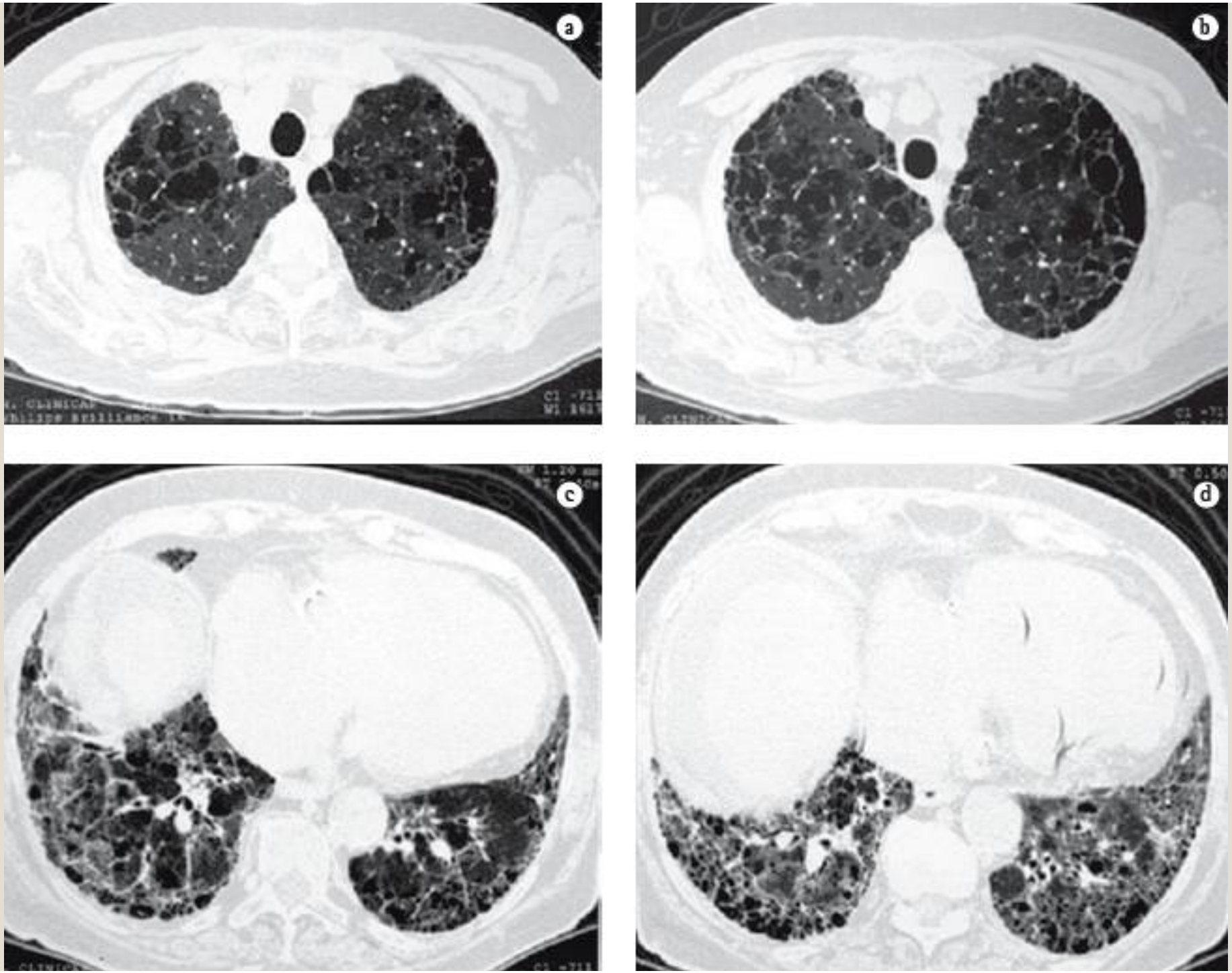
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Endoscopic Lung Volume Reduction: An Expert Panel Recommendation

Felix J.F. Herth[b] Dirk-Jan Slebos[a] Klaus F. Rabe[c, d] Pallav L. Shah[e, f]

COPD is a progressive disease with around half of the severe-stage patients developing severe hyperinflation [8]. In 1957, Brantigan and Mueller [9] performed the first lung volume reduction surgery (LVRS) procedure, in which tissue from one or both lungs is resected in order to treat the physiological consequences of emphysema. Despite the good long-term data in highly selected patients, LVRS is associated with significant mortality and morbidity, especially in high-risk patients.

Despite the demonstrated efficacy in the National Emphysema Treatment Trial (NETT) more than 10 years ago, LVRS is extremely scarcely used. Illustrative of this is the Medicare reported number of 93, 65 and 42 LVRS procedures performed in the USA in the years 2011–2013 [10]. Also the number of post-NETT LVRS published original scientific trial papers is very scarce. A number of new technical changes have been proposed to reduce adverse events, but hardly investigated and only reported as case series and a single RCT. Two interesting techniques, which should be further investigated, involve unilateral lobe resection by video-assisted thoracoscopic surgery [11] and nonresectional LVRS, which entails plication of the most severely emphysematous target areas [12].

Cochrane Library

Cochrane Database of Systematic Reviews

Cochrane Database of Systematic Reviews 2016, Issue 10. Art. No.: CD001001.

Lung volume reduction surgery for diffuse emphysema (Review)

van Agteren JEM, Carson KV, Tiong LU, Smith BJ

Patients with severe emphysema have limited treatment options as a result of extensive damage to the airways (Berger 2010; Russi 1997). One available treatment is lung volume reduction surgery (LVRS), in which unhealthy damaged parts of the lung are resected, leading to improved mechanical efficiency of healthy parts of the lung, and subsequently more efficient gas exchange. However, LVRS is a complicated procedure with significant associated risks. This review set out to determine the effectiveness of LVRS, to define the mortality and morbidity related to LVRS and to identify optimal surgical techniques.

- **Centrilobular emphysema:** most closely associated with smoking and results from dilation and destruction of respiratory bronchioles. Lesions associated with centrilobular emphysema are located predominantly in the upper lung.
- **Panlobular emphysema:** found mainly in the lower lobes and often associated with a genetic ($alpha_1$-anti-trypsin) deficiency.
- **Paraseptal emphysema:** occurs in the periphery of the lobules, specifically in the subpleural region.

How the intervention might work

Yusen 1996, in line with Cooper 1995, proposed that removal of diseased and functionless lung may improve the function of the remaining lung by:

- increasing elastic recoil pressure, thereby increasing expiratory airflow;
- decreasing the degree of hyperinflation, resulting in improved diaphragm and chest wall mechanics; and
- decreasing the inhomogeneity of regional ventilation and perfusion, leading to improved alveolar gas exchange and increased effectiveness of ventilation in maintaining blood gas levels.

Background

Lung volume reduction surgery (LVRS) performed to treat patients with severe diffuse emphysema was reintroduced in the nineties. Lung volume reduction surgery aims to resect damaged emphysematous lung tissue, thereby increasing elastic properties of the lung. This treatment is hypothesised to improve long-term daily functioning and quality of life, although it may be costly and may be associated with risks of morbidity and mortality. Ten years have passed since the last version of this review was prepared, prompting us to perform an update.

Objectives

The objective of this review was to gather all available evidence from randomised controlled trials comparing the effectiveness of lung volume reduction surgery (LVRS) versus non-surgical standard therapy in improving health outcomes for patients with severe diffuse emphysema. Secondary objectives included determining which subgroup of patients benefit from LVRS and for which patients LVRS is contraindicated, to establish the postoperative complications of LVRS and its morbidity and mortality, to determine which surgical approaches for LVRS are most effective and to calculate the cost-effectiveness of LVRS.

Types of participants

Participants with severe diffuse emphysema. We excluded studies that recruited participants with giant or bullous emphysema.

Types of interventions

We considered any of the variety of approaches and techniques used in LVRS for emphysema, including:

- median sternotomy with bilateral stapling of non-functional lung tissue with bovine reinforcement strips or pleural tenting technique;
- video-assisted thoracoscopic surgery (VATS) with neodymium: yttrium-aluminium-garnet (Nd: YAG) laser ablation to contract non-functional tissue;
- median sternotomy with unilateral stapling to resect approximately 20% of non-functional tissue; and
- Video-assisted thoracoscopic surgery with unilateral laser ablation of non-functional tissue.

Control groups consisted of usual follow-up or different surgical techniques. We did not include in this review studies that focused on bronchoscopic lung volume reduction (BLVR) procedures.

Types of outcome measures

Primary outcomes

- Short-term (90 days) and long-term (> 36 months) mortality
- Quality of life (e.g. St George Respiratory Questionnaire (SGRQ))

Secondary outcomes

- Lung function parameters (e.g. forced expiratory volume in one second (FEV_1))
- Exercise performance (e.g. six-minute walk distance (6MWD))
- Hospital utilisation (e.g. perioperative length of stay, re-admission rate (hospitalisations, emergency department visits))

- Adverse events (e.g. persistent air leaks, pneumothorax, dyspnoea)
- Cost-benefit analysis of LVRS

Main results

We identified two new studies (89 participants) in this updated review. A total of 11 studies (1760 participants) met the entry criteria of the review, one of which accounted for 68% of recruited participants. The quality of evidence ranged from low to moderate owing to an unclear risk of bias across many studies, lack of blinding and low participant numbers for some outcomes. Eight of the studies compared LVRS versus standard medical care, one compared two closure techniques (stapling vs laser ablation), one looked at the effect of buttressing the staple line on the effectiveness of LVRS and one compared traditional 'resectional' LVRS with a non-resectional surgical approach. Participants completed a mandatory course of pulmonary rehabilitation/physical training before the procedure commenced. Short-term mortality was higher for LVRS (odds ratio (OR) 6.16, 95% confidence interval (CI) 3.22 to 11.79; 1489 participants; five studies; moderate-quality evidence) than for control, but long-term mortality favoured LVRS (OR 0.76, 95% CI 0.61 to 0.95; 1280 participants; two studies; moderate-quality evidence). Participants identified post hoc as being at high risk of death from surgery were those with particularly impaired lung function, poor diffusing capacity and/or homogenous emphysema. Participants with upper lobe-predominant emphysema and low baseline exercise capacity showed the most favourable outcomes related to mortality, as investigators reported no significant differences in early mortality between participants treated with LVRS and those in the control group (OR 0.87, 95% CI 0.23 to 3.29; 290 participants; one study), as well as significantly lower mortality at the end of follow-up for LVRS compared with control (OR 0.45, 95% CI 0.26 to 0.78; 290 participants; one study). Trials in this review furthermore provided evidence of low to moderate quality showing that improvements in lung function parameters other than forced expiratory volume in one second (FEV_1), quality of life and exercise capacity were more likely with LVRS than with usual follow-up. Adverse events were more common with LVRS than with control, specifically the occurrence of (persistent) air leaks, pulmonary morbidity (e.g. pneumonia) and cardiovascular morbidity. Although LVRS leads to an increase in quality-adjusted life-years (QALYs), the procedure is relatively costly overall.

Authors' conclusions

Lung volume reduction surgery, an effective treatment for selected patients with severe emphysema, may lead to better health status and lung function outcomes, specifically for patients who have upper lobe-predominant emphysema with low exercise capacity, but the procedure is associated with risks of early mortality and adverse events.

Patient or population: patients with diffuse emphysema
Setting: hospitals
Intervention: lung volume reduction surgery
Comparison: standard medical care

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with control	Risk with surgery				
Early mortality (90 days)	13 per 1000	77 per 1000 (42 to 138)	OR 6.16 (3.22 to 11.79)	1489 (5 RCTs)	⊕⊕⊕◯ MODERATE[a]	
Long-term mortality (> 36 months)	547 per 1000	478 per 1000 (424 to 534)	OR 0.76 (0.61 to 0.95)	1280 (2 RCTs)	⊕⊕⊕◯ MODERATE[a]	Substantial differences in follow-up between the 2 trials measuring this construct
Change in total scores SGRQ (end of follow-up)	End of treatment control group mean SGRQ scores ranged from 57 units to 62.1 units	Mean SGRQ score in the LVRS group was -13.78 units lower (-15.75 to -11.78)	-	1326 (2 RCTs)	⊕⊕⊕◯ MODERATE[b]	Lower score indicates better quality of life. A difference of 4 units or more is thought to be clinically important
Walking distance (end of follow-up)	Control group walking distance ranged from 303 to 350 metres (in the 4 studies reporting 6MWD)	Standardised mean walking distance in the LVRS group was 0.70 standard deviations higher (0.42 to 0.98)	-	215 (5 RCTs)	⊕⊕◯◯ LOW[c,d]	Four studies reported 6MWD test and 1 shuttle walking test. 0.7 standard deviations equates to approximately 70 metres for 6MWD

Interventional pulmonology in chronic obstructive pulmonary disease

Daniela Gompelmann[a,b], *Nilab Sarmand*[a], *and Felix J.F. Herth*[a,b]

Recent findings

In the last 14 years, endoscopic therapeutic modalities emerged as a substantial part of severe COPD and emphysema treatment. Techniques of the endoscopic lung volume reduction (ELVR) aim at reduction of hyperinflation. Thereby, the reversible valve implantation of which the efficacy was confirmed in various randomized controlled trials (RCT) results in lobar volume reduction and clinical benefit in emphysema patients with absent interlobar collateral ventilation. Nonblocking ELVR methods that are independent of collateral ventilation include the partially irreversible coil implantation leading to parenchymal compression, the irreversible bronchoscopic thermal vapor ablation and polymeric lung volume reduction both inducing inflammatory reaction. The nonblocking methods have been examined in only a few RCTs. The targeted lung denervation as a novel bronchoscopic therapy for COPD patients aims at sustainable bronchodilation by ablation of parasympathetic pulmonary nerves.

Curr Opin Pulm Med 2017, 23:261–268

Table 1. Baseline characteristics of the endoscopic lung volume reduction trials compared to the initial NETT trial inclusion criteria

Inclusion criteria	NETT	EBV/VENT	IBV	Coils	Bio-LVR	BTVA
Age, years	40–74	63	65	60	64	63
Emphysema location	All	UL/LL	UL/LL	UL/LL	UL	UL
FEV_1, % predicted	20–45	30	31	29	31	31
RV, % predicted	>150	216	221	238	238	237
PaO_2, mm Hg	>45	69	68	64	65	64
$PaCO_2$, mm Hg	<50	41	41	42	41	40
6MWT distance, m	>140	333	337	306	293	300

Bio-LVR = Biological lung volume reduction (Aeriseal).

Patient selection

Table 2. Main inclusion and exclusion criteria for lung volume reduction therapies

Inclusion	Exclusion
COPD – emphysema phenotype	Clinically significant bronchiectasis
FEV_1 20–45% of predicted	Previous lung surgery: lobectomy, pneumonectomy, lung transplantation
RV >175% of predicted	Severe hypercapnia ($PaCO_2$ >8 kPa or 60 mm Hg) and/or hypoxia (PaO_2
RV/TLC >58%	<6.0 kPa or 45 mm Hg) both at room air at sea level
Optimal medical treatment	DLCO <20% of predicted
Nonsmoking	Significant pulmonary hypertension: right ventricular systolic pressure >50
Postrehabilitation	mm Hg on echocardiography
Symptomatic (mMRC >1)	Congestive heart failure (left ventricular ejection fraction <40%)
6MWT distance 100–500 m	Significant comorbidities significantly affecting performance and survival
	Maintenance anticoagulation: coumarines, low-molecular-weight heparin, clopidrogel or similar antiplatet agents, dabigatran or similar

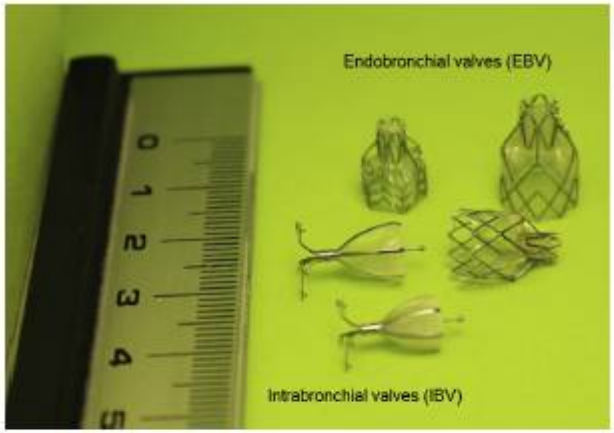

Fig. 1. Endobronchial (EBV; Zephyr, Pulmonx, Inc, Neuchatel, Schweiz) and intrabronchial (IBV; Spiration, Olympus, Tokyo, Japan) valves.

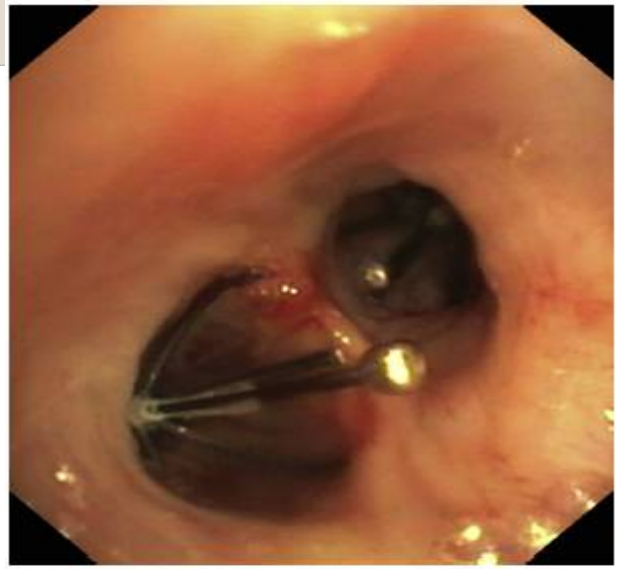

Fig. 3. Endoscopic image. Intrabronchial valves in the left upper lobe.

Table 1. Endoscopic therapeutic modalities for patients with severe chronic obstructive pulmonary disease and emphysema

Endoscopic technique	Aim	Mechanism of action	Degree of reversibility	Dependence of collateral ventilation
Endoscopic valve therapy	Lung volume reduction	Inducing lobar atelectasis	Reversible	Dependent
Endoscopic coil implantation	Lung volume reduction, Improvement of lung elastic recoil	Leading to parenchymal compression	Partial irreversible	Independent
Polymeric lung volume reduction	Lung volume reduction	Inducing inflammatory reaction	Irreversible	Independent
Bronchosopic thermal vapor ablation	Lung volume reduction	Inducing inflammatory reaction	Irreversible	Independent
Targeted lung denervation	Sustainable bronchodilation	Ablation of parasympathetic pulmonary nerves	Irreversible	Independent

Table 1
Overview of the different endoscopic techniques available in management for chronic obstructive pulmonary disease and emphysema

	Endoscopic Lung Volume Reduction (ELVR)			
Endoscopic Technique	Valve Implantation	Lung Volume Reduction Coil (LVRC) Implantation	Bronchoscopic Thermal Vapor Ablation (BTVA)	Targeted Lung Denervation (TLD)
Primary objective		Target lobe volume reduction		Bronchodilation
Mechanism of action	Lobar atelectasis	Parenchymal compression	Local inflammatory reaction	Ablation of parasympathetic nerves
Reversibility	Reversible	Partially irreversible	Irreversible	Irreversible
Prerequisite	• FEV_1 <45–50% • RV >150% • Heterogeneous emphysema with upper or lower lobe predominance	• FEV_1 <45% • RV >175% • Heterogeneous emphysema with upper or lower lobe predominance • Homogeneous emphysema	• FEV_1 <45% • RV >150% • Heterogeneous emphysema with upper lobe predominance	Positive response (FEV_1 >15%) to spirometry to inhaled ipratropium bromide
Dependence of CV	Dependent	Independent	Independent	Independent
Predictors for success	• Low CV • Lobar occlusion • High amount of low attenuation clusters • High small vessel percent vascular volume	Not available at present. Predictive factors have to be evaluated in currently ongoing trials.	Heterogeneity index >1.2	Not available at present. Predictive factors have to be evaluated in currently ongoing trials.
Frequent complications	Pneumothorax	• Hemoptysis • Inflammatory reaction	Inflammatory reaction	• COPD exacerbation • Device-related events
Availability	Commercially available in European countries.			Under investigation, RCT ongoing

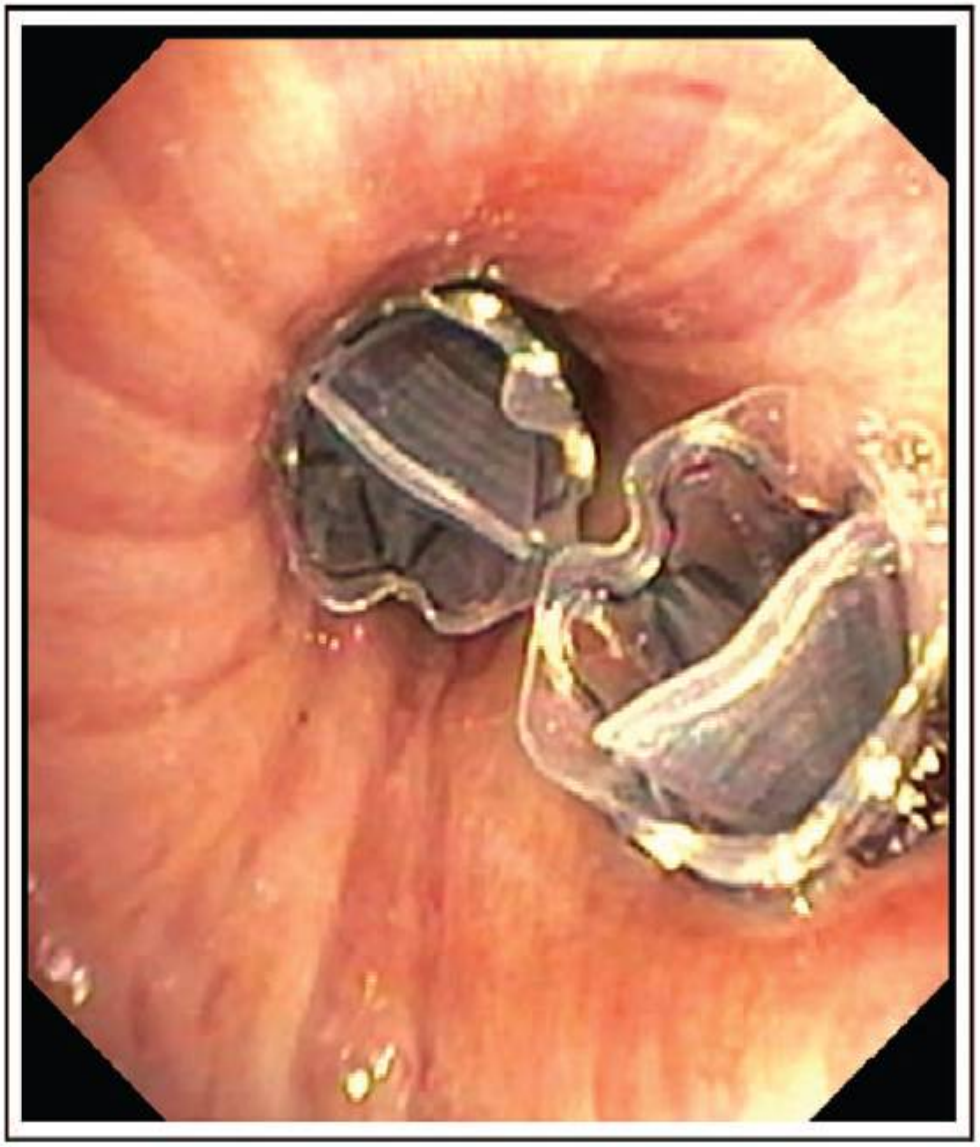

FIGURE 2. Bronchoscopic image. Endobronchial valves (EBV) in the left lower lobe.

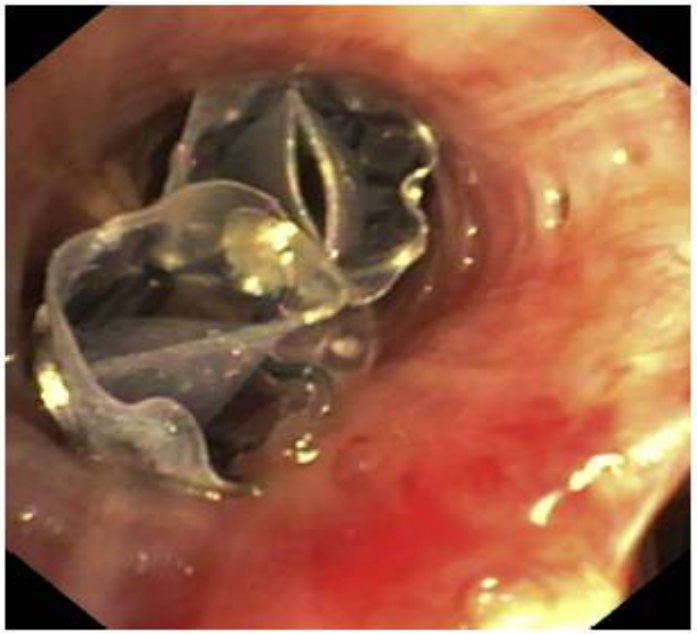

Fig. 2. Endoscopic image. Endobronchial valves in the left lower lobe.

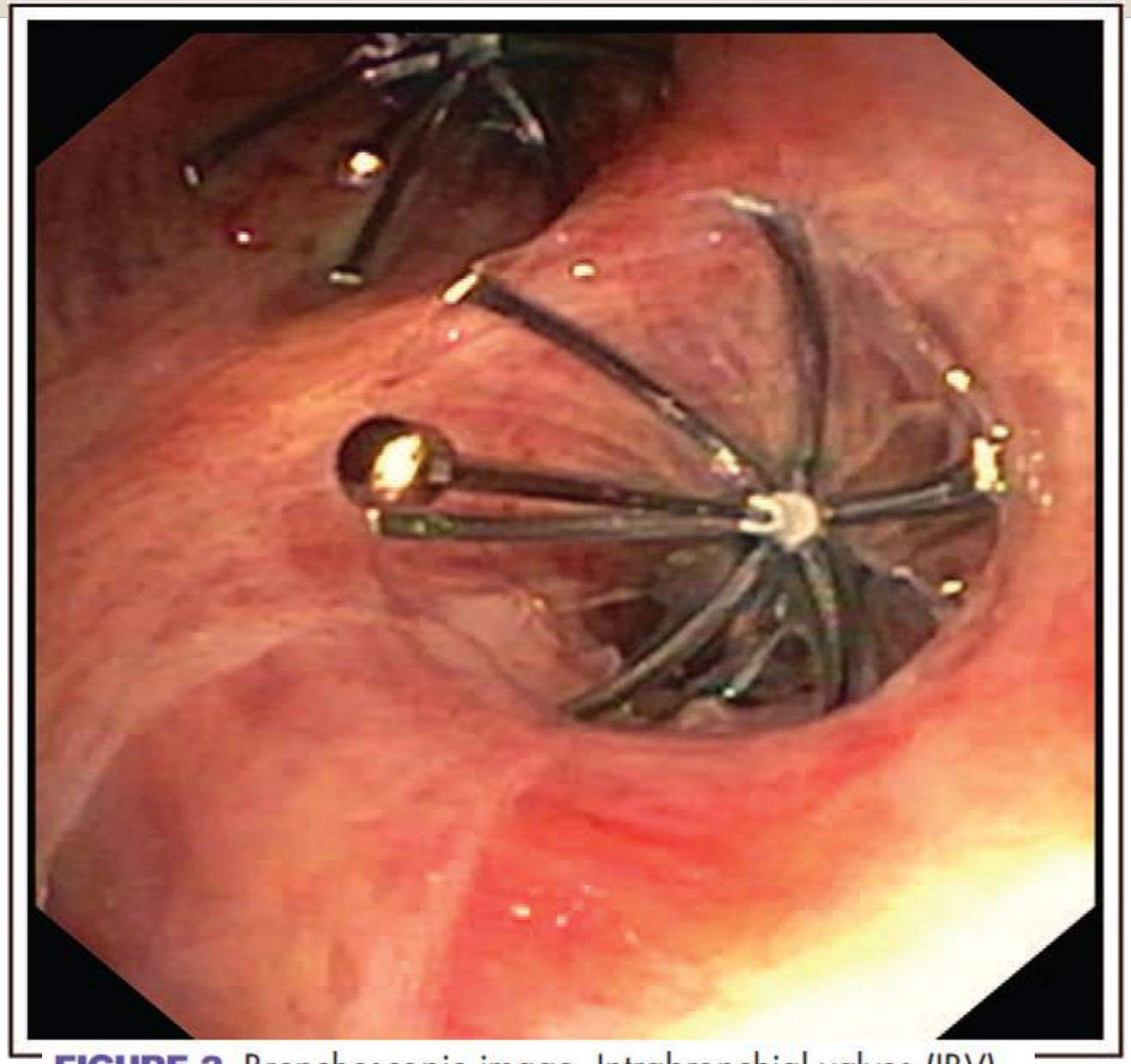

FIGURE 3. Bronchoscopic image. Intrabronchial valves (IBV) in the left upper lobe.

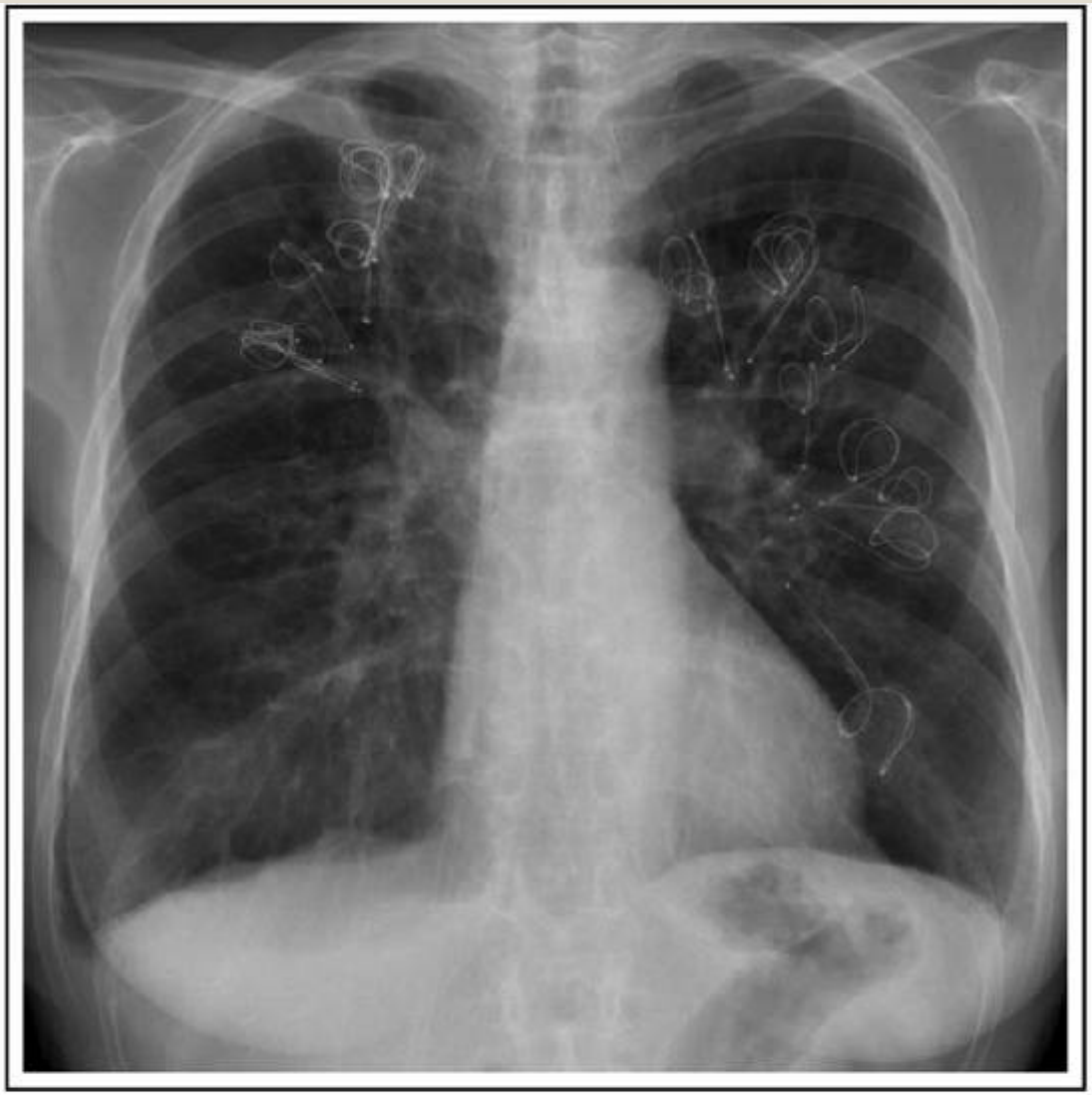

FIGURE 4. Chest X-ray. Implantation of lung volume reduction coils in the right upper lobe (90 days ago) and in the left upper lobe (1 day ago). In courtesy of Prof. Dr med. Heussel, Diagnostic and Interventional Radiology, Thoraxklinik at the University of Heidelberg.

The Technologies

Table 3. Summary of trial design, number of patients, follow-up duration and the main efficacy parameters (FEV_1, RV, 6MWT distance and SGRQ) for the endoscopic lung volume reduction trials published

Device/first author, year [Ref.]	Trial design	Patients treated, n	Follow-up duration	ΔFEV_1	ΔRV	Δ6MWT distance	ΔSGRQ, total score
EBV							
Davey, 2015 [26]	Double-blind sham-controlled RCT Single center	25	3 months	0.06 L (0.02–0.38) 8.77% (2.27–35.85)	–0.26 liters (–1.07 to –0.16) –6.58% (–18.60 to 2.94)	25 (7–64)	–4.40 (–16.93 to 6.76)
Klooster, 2015 [30]	Prospective RCT Single center	34	6 months	216 (128–304) ml		92 (64–120) m	–17.4 (–24.8 to –10.0)
Park, 2015 [53]	Prospective open-label single-arm trial	43	3 months (n = 35)	0.68±0.26 to 0.89±0.37 liters	4.98±1.15 to 3.91±1.15 liters	233.5±114.8 to 283.7±121.6 m	65.59±13.07 to 55.70±13.79
	Single center		6 months (n = 27)	0.68±0.26 to 0.92±0.40 liters	4.98±1.15 to 3.67±0.95 liters	233.5±114.8 to 299.6±87.5 m	65.59±13.07 to 53.76±11.40
Herth, 2013 [29]	Nonrandomized prospective trial Multicenter	51 (CV negative patients)	30 days	0.14±0.20 liters 16±22%	4.49±1.22	24±57	–10±13
Herth, 2012 [23]	Prospective RCT Multicenter	44 (intact fissures)	6 months 12 months	16±21% 15±29%		11±34% 13±35%	–6±15 0±15
Sciurba, 2010 [22]	Prospective RCT	220	6 months	4.3% (95% CI: 1.4–7.2) 34.5 ml (10.8–58.3)		2.5% (95% CI: –1.1 to 6.1) 9.3 m (95% CI: –0.5 to 19.1)	–2.8 (–4.7 to –1.0)

IBV							
Szlubowska, 2015 [54]	Prospective observational study Single center	20	3 months				−12.8±11.9
Ninane, 2012 [24]	Single-blinded sham-controlled RCT Multicenter	37	3 months 6 months	0.99±0.35 to 0.90±0.34 liters	4.65±1.30 to 4.86±1.35 liters	337±106 to 344±18 m	−4.3±16.2 −10.9±18.2
Eberhardt, 2012 [36]	RCT Single center	11 (unilateral) 11 (bilateral)	30 days 30 days	267±154 ml 13±140 ml	−546±1307 ml 61± 990 ml	47.8±55.7 m −25.0±81.5 m	−12.2±13.4 −0.3±9.8
Sterman, 2010 [55]	Prospective, open enrollment, consecutive case series Multicenter	91	6 months 12 months	0.87±0.25 to 0.83±0.29 0.87±0.25 to 0.85±0.33	4.74±1.06 to 4.89±1.17 4.74±1.06 to 4.71±1.27	338±95 to 351±102 338±95 to 358±92	−8.2±16.2 −9.5±14.4
Coil							
Gulsen, 2015 [56]	Retrospective analysis Single center	40	6 months	+0.15 liters (+24.7%)	−0.82 liters (−14.5%)	+ 48 m	−10.4
Deslee, 2015 [41]	Prospective randomized controlled superiority trial Multicenter	50	1 year			36% improvement ≥54 m	
Kontogianni, 2014 [57]	Retrospective analysis Single center	26	90 days 180 days	0.10±0.13 liters 0.04±0.12 liters	−0.6 liters −0.42 liters	47±54 m 32±60 m	−7 −6
Klooster, 2014 [42]	Prospective, open-label, cohort trial Single center	10	3–4 months	16.6% (−16 to 55)	−0.79 liters (−1.20 to 0.04)	42 m (15±141)	−11 (−25±6)
Deslee, 2014 [43]	Prospective open-label feasibility study Multicenter	60	6 months 12 months	15.4±26.7% 16.0±35.5%	−11.3±15.3% −13.8±12.7%	29.7±74.1 m 51.4±76.1 m	−12.1±12.9 −11.1±13.3
Shah, 2013 [40]	Prospective RCT Multicenter	23	90 days	14.2% (6.8–21.6)	−0.51 liters (−0.73 to −0.30)	51.2 m (27.7–74.7)	−8.1 (−13.8 to 2.4)
Slebos, 2012 [39]	Prospective cohort pilot study Single center	16	3 months 6 months	19.9±20.0% 14.9±17%	−11.1±9.9% −11.4±9%	62.2±76.6 m 84.4±73.4 m	−12.6±10.8 −14.9±12.1

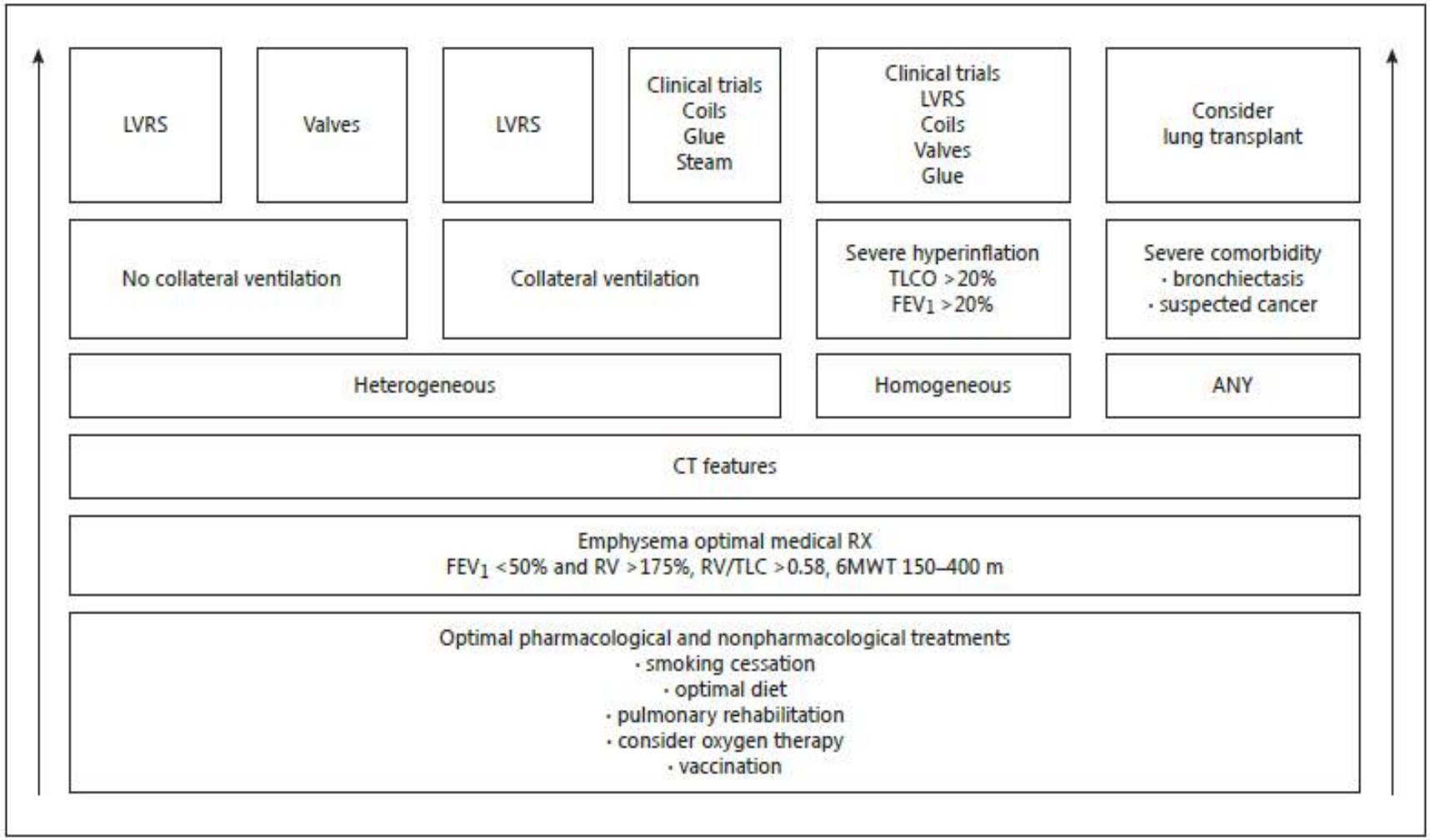

Fig. 1. Algorithm for the advanced treatment of severe emphysema patients.

SUMMARY

Endoscopic treatments are emerging as a substantial part of severe COPD and emphysema management. There are currently five different endoscopic therapeutic modalities available of which some of them are currently still under investigation: endoscopic valve therapy, endoscopic coils implantation, PLVR, BTVA, and TLD. The best-examined method is the valve therapy; its efficacy was demonstrated in seven RCTs. The data for the other techniques are still limited, so that these techniques can or should only be used within clinical trials.

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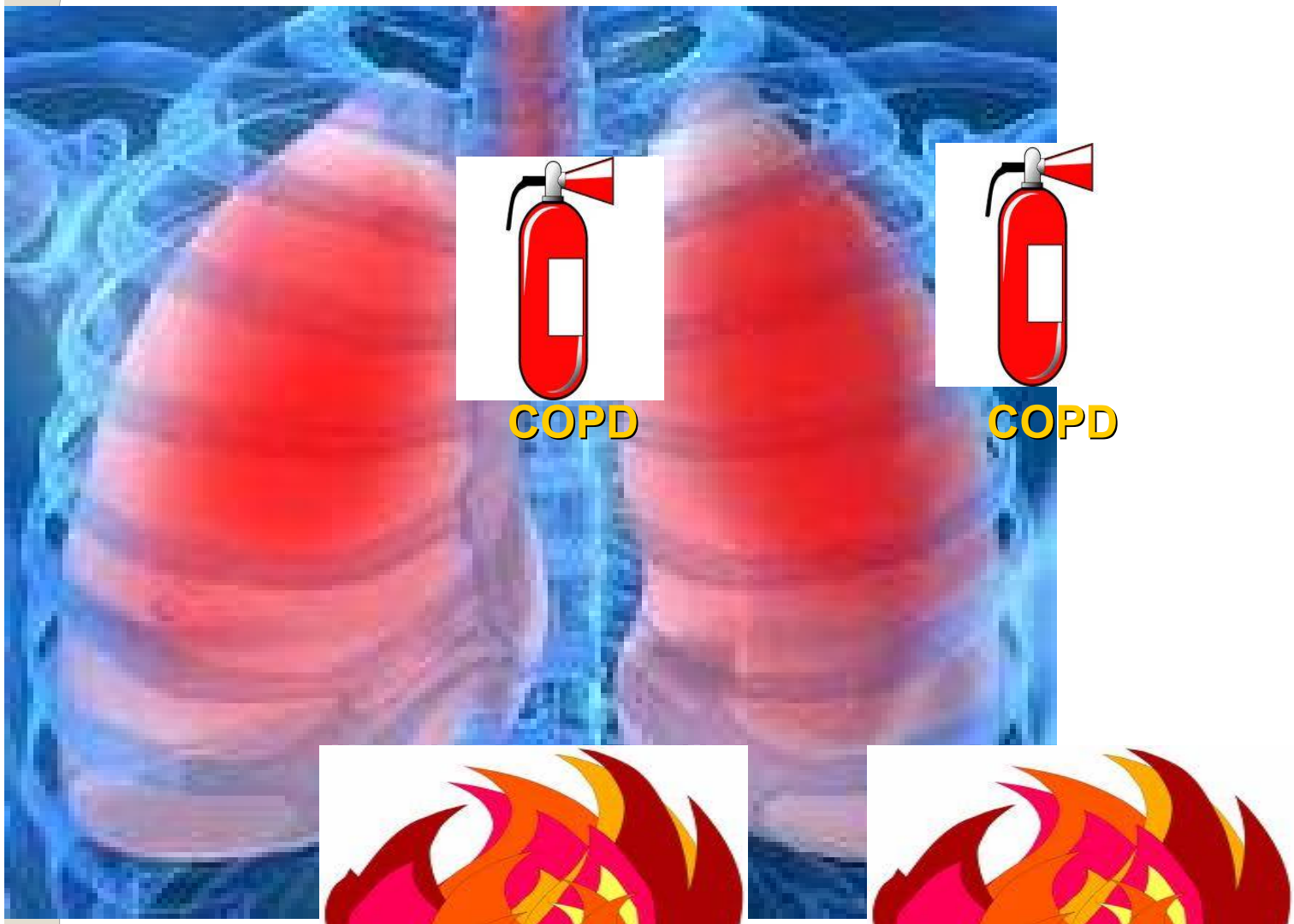
Bronchoscopic lung volume reduction procedures for chronic obstructive pulmonary disease (Review)

van Agteren JEM, Hnin K, Grosser D, Carson KV, Smith BJ

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.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