Pneumo Update Europe 2017

9-10 June, Vienna

Pulmonary Endoscopy

Felix Herth, Germany

Presented papers

- **Diagnostic**
- **Cryo-Biopsy**
- **Solitary pulmonary nodules (SPN)**
- **Endosonography**
- **Interventions in obstructive lung diseases**

Diagnostic

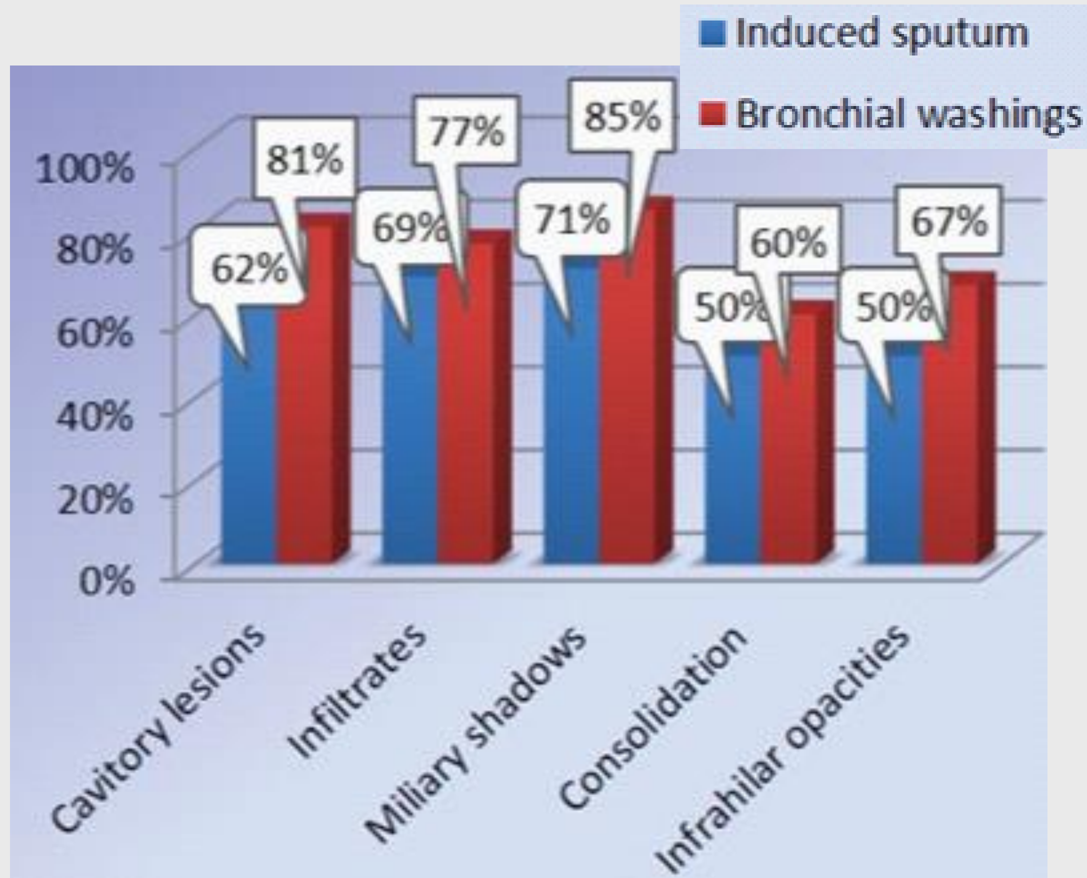
Images courtesy: F. Herth

Gopathi, N.R., et al., A Comparative Study of Induced Sputum and Bronchial Washings in Diagnosing Sputum Smear Negative Pulmonary Tuberculosis.
J Clin Diagn Res, 2016. 10(3):OC07-10

120 patients with
TBc typical X-ray
Symptoms
sputum smear
samples negative

Induced sputum
(5-10 ml of 3% hypertonic NaCl)
And
bronch with BL

compare the results of induced sputum and bronchial washings smear



Allover: 63.3% vs 78.3%

Jhun B.W., et al., Preoperative flexible bronchoscopy in patients with persistent ground-glass nodule.
PLoS One, 2015. 10(3):e0121250.

264 patients
persistent/progressiv
e GGO
Surgical candidates

BRSK
with
BL
TBB (partial)

diagnostic value of preoperative flexible bronchoscopy

Jhun, B.W., et al., Preoperative flexible bronchoscopy in patients with persistent ground-glass nodule.
PLoS One, 2015. 10(3):e0121250.

Characteristics	Pure GGN	Part-solid GGN	*p*-value
Number of GGNs	135	161	
Size (mm)	13 (10–18)	20 (16–25)	<0.001
Bronchoscopic inspection			0.420
Anthracofibrosis	4/135 (3)	9/161 (5)	
Narrowing or stricture	2/135 (1)	2/161 (1)	
Mucosal irregularity	0/135 (0)	3/161 (2)	
Nodular lesion	2/135 (1)	1/161 (1)	
No endobronchial lesion	127/135 (95)	146/161 (91)	
Bronchial washing cytology			0.269
Positive for malignancy	0/86 (0)	3/122 (2)	
Bronchoscopic mucosal biopsy			NA
Positive for malignancy	0/2 (0)	0/3 (0)	
Transbronchial lung biopsy			NA
Positive for malignancy	0 (0)	0/3 (0)	
Malignancy	120/135 (89)	151/161 (94)	

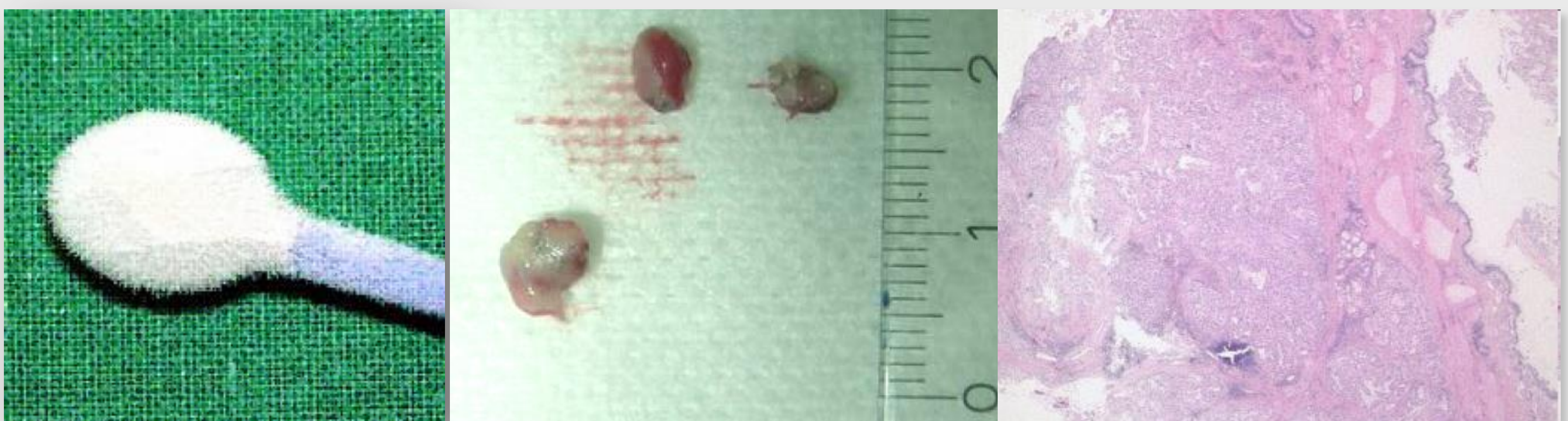
Take-Home Message

- Suspiciuos Tbc and negative sputum

⇒ direct BRSK and BL

- GGO and high cancer probability
- direct surgery
- no need for bronchoscopy

Cryo-biopsy



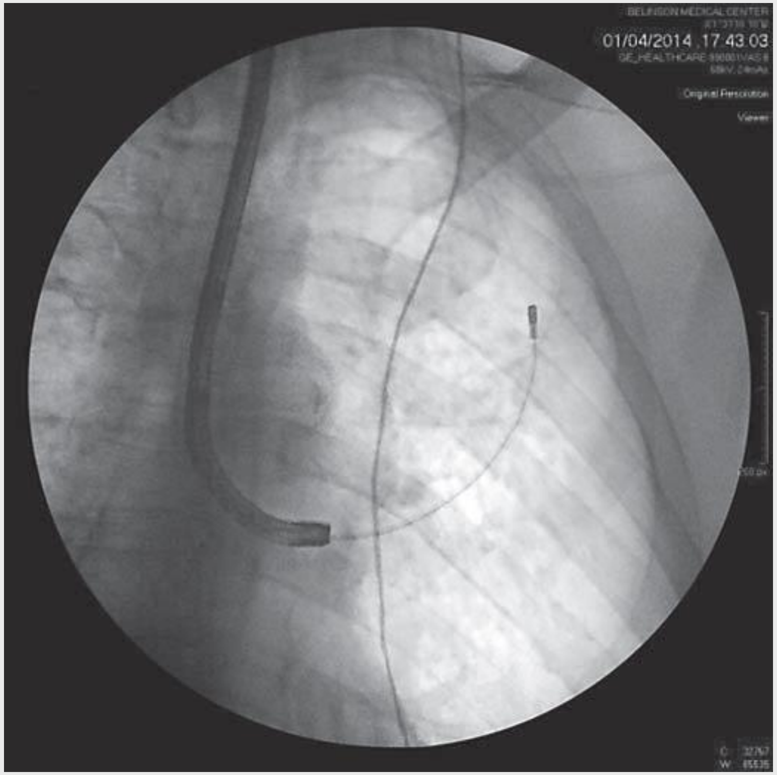
Images courtesy: F. Herth

Tomassetti S, et al., Bronchoscopic lung cryobiopsy increases diagnostic confidence in the multidisciplinary diagnosis of idiopathic pulmonary fibrosis..
Am J Respir Crit Car Med 2016; 193(7):745-52.

117 patients with fibrotic ILDs MDT decision cross-sectional study

58 Cryo biopsy
59 SLB
2 clinicians, 2 radiologists, 2 pathologists sequentially reviewed clinical-radiological findings and biopsy results

process their diagnostic impressions and confidence levels



Tomassetti S, et al., Bronchoscopic lung cryobiopsy increases diagnostic confidence in the multidisciplinary diagnosis of idiopathic pulmonary fibrosis.
Am J Respir Crit Car Med 2016; 193(7):745-52.

STEP	DATA	PARTICIPANTS	DISCUSSION
1	Clinical-Radiological data	C + R	Individual
2			Group
3	BAL	C + R + P	Individual
4			Group
5	BIOPSY	C + R + P	Individual
6			Group
7	FOLLOW-UP data	C + R + P	Individual
8			Group

Tomassetti S, et al., Bronchoscopic lung cryobiopsy increases diagnostic confidence in the multidisciplinary diagnosis of idiopathic pulmonary fibrosis.
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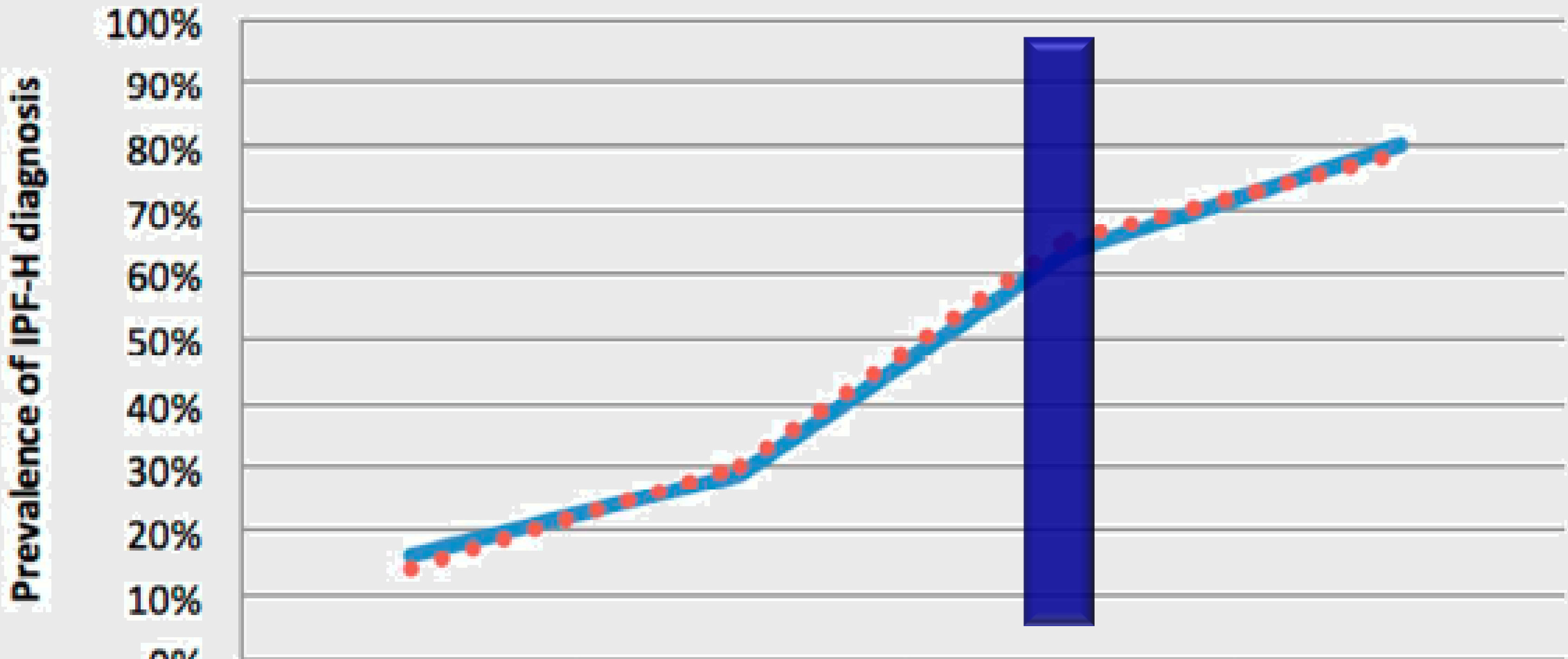
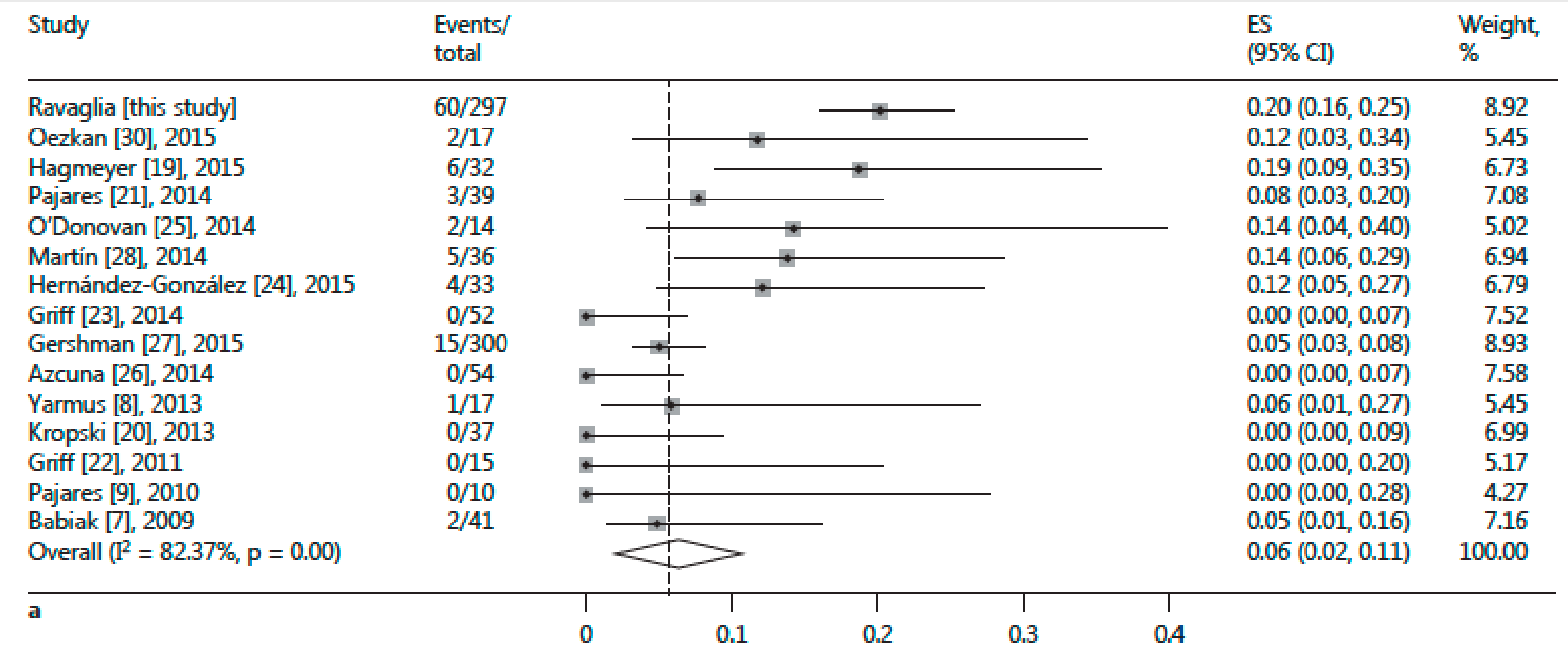


	step 2	step 4	step 6	step 8
BLC	16%	29%	63%	80%
SLB	14%	30%	65%	79%

Ravaglia C., et al., Safety and Diagnostic Yield of Transbronchial Lung Cryobiopsy in Diffuse Parenchymal Lung Diseases: A Comparative Study versus Video-Assisted Thoracoscopic Lung Biopsy and a Systematic Review of the Literature.

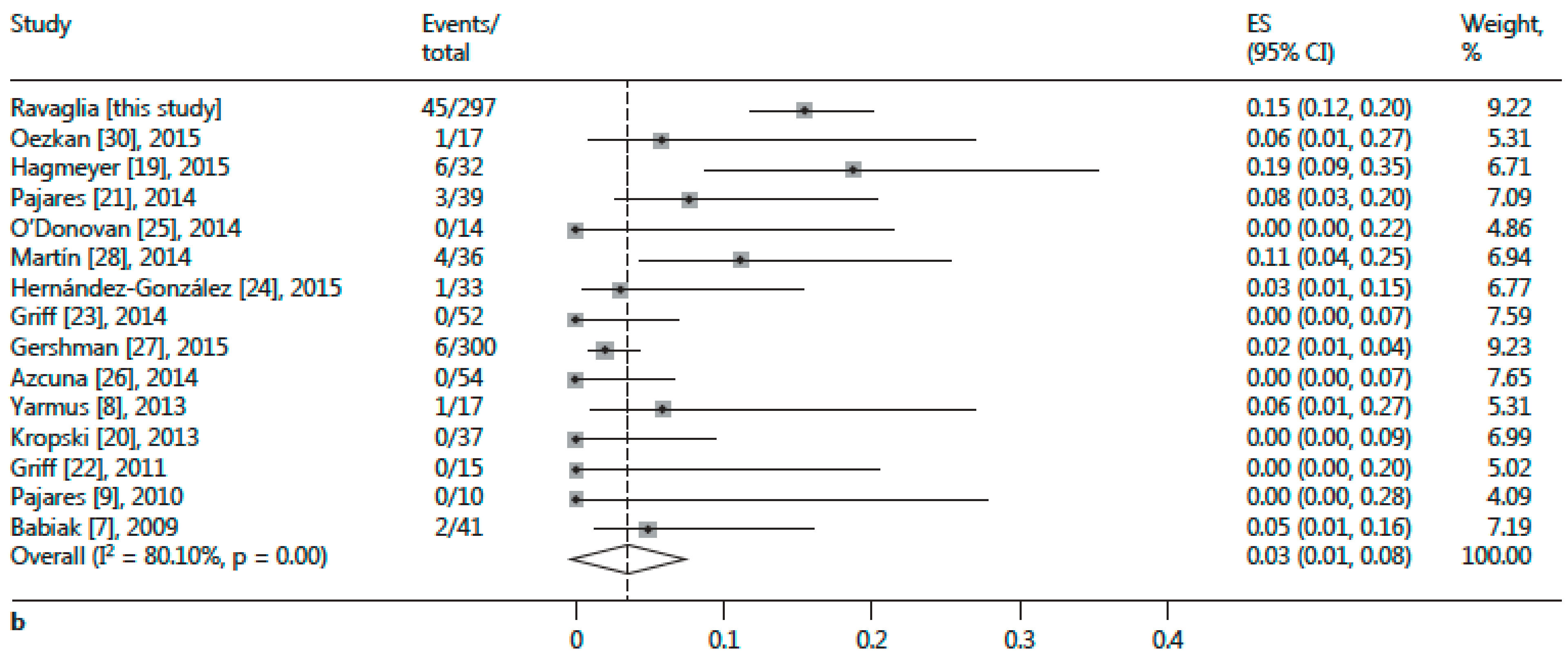
Respiration, 2016;91:215–227

Pneumo



Ravaglia C., et al., Safety and Diagnostic Yield of Transbronchial Lung Cryobiopsy in Diffuse Parenchymal Lung Diseases: A Comparative Study versus Video-Assisted Thoracoscopic Lung Biopsy and a Systematic Review of the Literature.
Respiration, 2016;91:215–227

Bleeding



Additional Cryo-biopsy - papers

- Thin cryo-probe (1,1 mm) is effective

KJ Franke et al. Respiration 2016

- Need for a standardization of Cryo-biopsy

Poletti et al, Respiration 2015

- Complication depends on freezing time and placement of the probe

M Ing et al. Respiration 2016

Take-Home Message

- Cryo-PE in ILD increasing
- Diagnostic in 70-80 % of the cases
- Depended on ILD subtyoe

Main complication

- Pneumothorax

Main limitation

- Need of Intubation

- European Multicenter RT will be presented in Milano

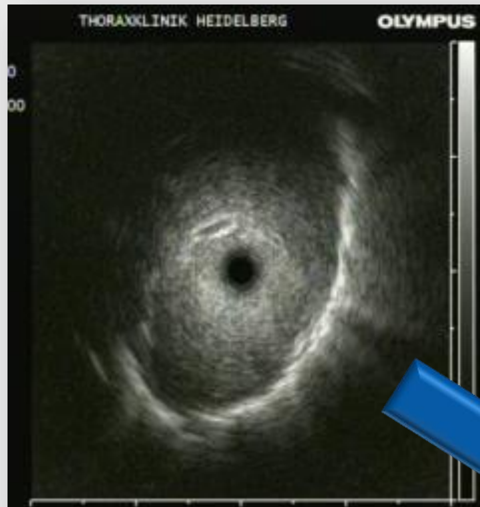
Solitary Pulmonary Nodule

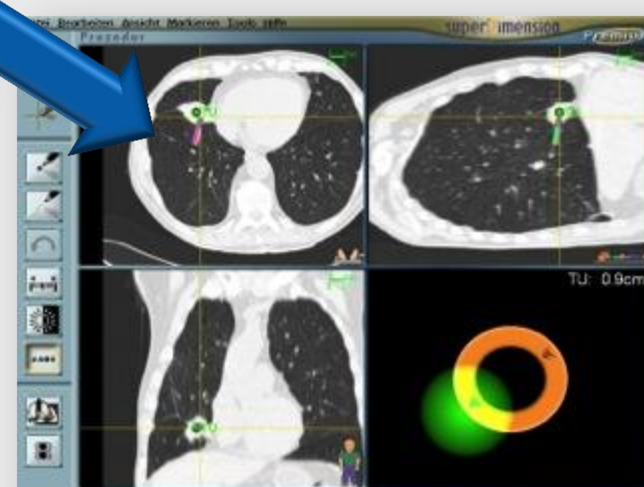
Steinfort, D.P. et al., Sequential multimodality bronchoscopic investigation of peripheral pulmonary lesions
Eur Respir J 2016; 47: 607–614

236patients
237 SPNS < 30 mm

EBUS with virtual bronchoscopy EMN only where EBUS was unable to locate SPN

Yield
complications





Steinfort, D.P. et al., Sequential multimodality bronchoscopic investigation of peripheral pulmonary lesions
Eur Respir J 2016; 47: 607–614

- **236 patients**
- **mean SPN size 22.8±12.4 mm (mean±SD).**
- **188 (77%) pts EBUS localisation successful and diagnostic in 134 of these (71.3%)**
- **<u>Allover yield of EBUS+VB alone was 54.7%</u>**
- **EMN in 57 patients**
- **9 of these 57 procedures achieved a definitive diagnosis (16%)**
- **<u>Overall diagnostic yield to 58.4%</u>**

Godbout K. etal., Evaluation of Pulmonary Nodules Using the Spyglass Direct Visualization System Combined With Radial Endobronchial Ultrasound: A Clinical Feasibility Study
The Open Respiratory Medicine Journal, 2016, 10, 79-85

15 patients
SPN < 30mm

radial EBUS, spygalss, Biopsy

yield
complications

Godbout K. etal., Evaluation of Pulmonary Nodules Using the Spyglass Direct Visualization System Combined With Radial Endobronchial Ultrasound: A Clinical Feasibility Study
The Open Respiratory Medicine Journal, 2016, 10, 79-85

ID	Sex	Age	Lesion size (mm)	Localisation	p-EBUS position	SpyGlass appearance	Sampling results	Final diagnosis
1	M	77	38	RUL	Central	Abnormal (infiltrated)	Adenocarcinoma	Adenocarcinoma
2	M	53	18	LLL	Central	Abnormal (mucus)	Non-diagnostic	Infection
3	F	50	32	LLL	Adjacent	Abnormal (granulation)	Non-diagnostic	Adenocarcinoma
4	F	48	52	RUL	Central	Normal	Granuloma	Fungal infection
5	F	66	35	RLL	Central	Normal	Adenocarcinoma	Adenocarcinoma
6	F	63	18	RUL	Adjacent	Normal	Non-diagnostic	Fibrosis
7	M	79	42	RML	Adjacent	Normal	Non-diagnostic	Squamous cell carcinoma
8	F	50	21	LUL	Adjacent	Technically impossible	Non-diagnostic	Metastatic melanoma
9	F	68	54	RUL	Central	Normal	Non-diagnostic	Bronchioloalveolar carcinoma
10	M	65	25	RUL	Adjacent	Normal	Adenocarcinoma	Adenocarcinoma
11	M	63	27	RUL	Adjacent	Abnormal (hemorrhagic)	Adenocarcinoma	Adenocarcinoma
12	F	59	46	LUL	Central	Abnormal (infiltrated)	Adenocarcinoma	Adenocarcinoma
13	M	68	26	RUL	Central	Abnormal (granulation)	Non-diagnostic	Squamous cell carcinoma
14	M	68	23	RUL	Central	Normal	Adenocarcinoma	Adenocarcinoma
15	M	61	74	RUL	Central	Abnormal (infiltrated)	NSCLC	NSCLC

- **All lesions could be radial EBUS (100%)**
- **Distal mucosa could be imaged with SpyGlass in 14/15 patients (93.3%)**
- **Final diagnosis in 12 patients (80%):**

Additional SPN - papers

- EBUS probe should be placed within the lesion

Okachi et al, Intern Med, 2016

- Radial EBUS and ROSE improving efficacy

Hayama et al, BMC Pulm Med, 2016

- Radial EBUS also in TBC Endemic areas with a high diagnostic yield

Franzen et al, BMC Pulm Med, 2016

Take-Home Message

- Radial EBUS shows high diagnostic yield
- Additional use of EMN increases the yield only minimal
- Spyglas as new option

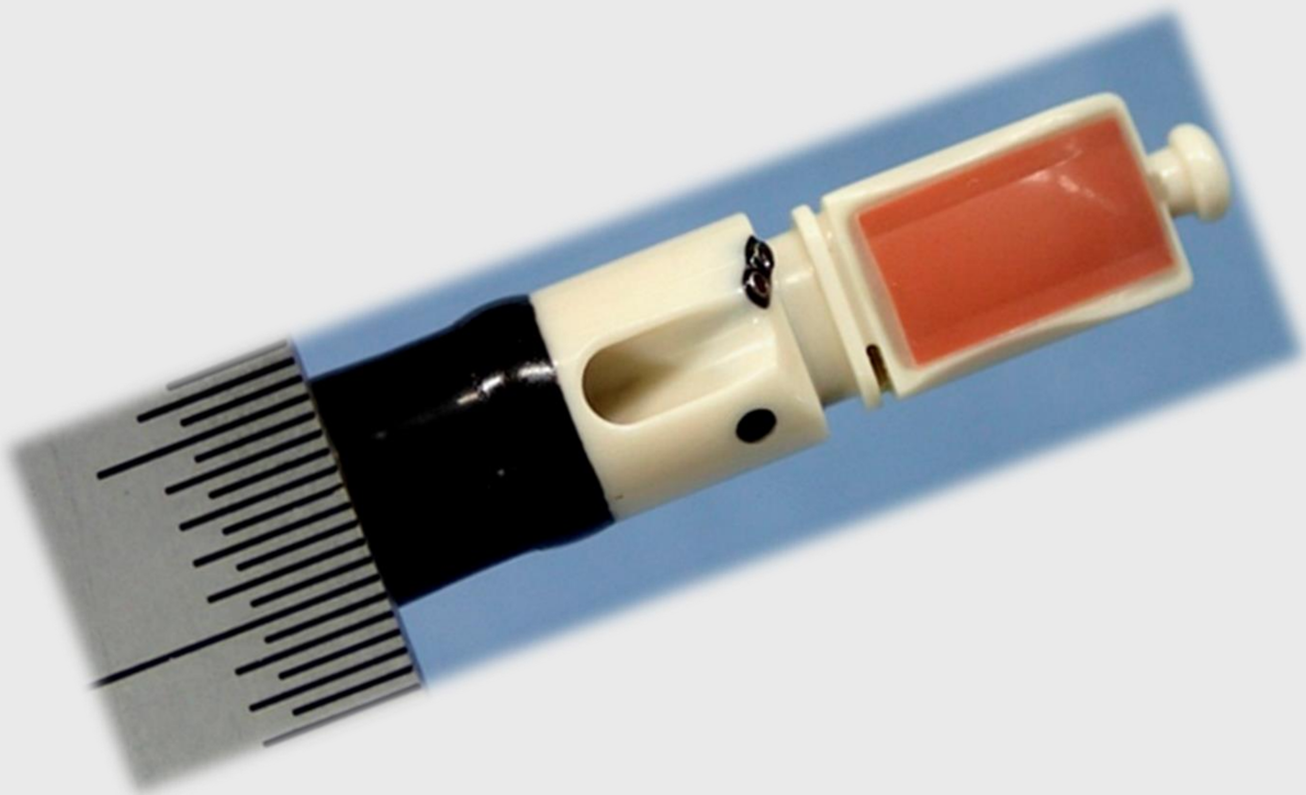
Endosonography

Beaudoin, S., et al., Randomized Trial Comparing Patient Comfort Between the Oral and Nasal Insertion Routes for Linear Endobronchial Ultrasound.
J Bronchology Interv Pulmonol, 2016. 23(1): p. 39-45

220 Patients with enlarged LN conscious sedation

RCT
nasal or oral intubation

Patient comfort
complications
diagnostic yield



Beaudoin, S., et al., Randomized Trial Comparing Patient Comfort Between the Oral and Nasal Insertion Routes for Linear Endobronchial Ultrasound.
J Bronchology Interv Pulmonol, 2016. 23(1): p. 39-45

	oral	nasal
N	110	
insertion possible	100 %	75,5 %
Duration	no difference	
dose of sedation	no difference	
patient satisfaction	9.1 pts	8.7 pts
patient stisfaction	8.3 pts	8.3 pts
adaequate specimens	no difference	
diagnostic yield	no difference	

Izumo, T., et al., Re-biopsy by endobronchial ultrasound procedures for mutation analysis of non-small cell lung cancer after EGFR tyrosine kinase inhibitor treatment. BMC Pulm Med, 2016. 16(1):106

53 consecutive patients progressive NSCLC after EGFR-TKI

EBUS-guided re-biopsy

evaluate the utility of EBUS-guided re-biopsy

Table 3 Adequacy of re-biopsy samples for molecular analysis (*N* = 53)

		Detection rate of re-biopsy for malignant cells		
		Cytology	Histology	Overall
ALL	53	41 (77.4)	41 (77.4)	42 (79.2)
EBUS-TBNA	9	9 (100)	8 (88.9)	9 (100)
EBUS-GS	44	32 (72.7)	33 (75.0)	33 (75.0)

Izumo, T., et al., Re-biopsy by endobronchial ultrasound procedures for mutation analysis of non-small cell lung cancer after EGFR tyrosine kinase inhibitor treatment. BMC Pulm Med, 2016. 16(1):106

Initial EGFR mutation profile		EGFR mutation profile on re-biopsy	
Del19	30	Del19 alone	8
		Del19 + T790M	16
		Re-biopsy failure	6
L858R	22	L858R alone	11
		L858R + T790M	6
		Re-biopsy failure	5
L816Q	1	L816Q alone	1

No complications
age 65 (35–85)
mean ECOG 1

Additional EBUS - papers

- **EBUS-TBNA allows puncture of the left adrenals**

  Crombag et al., Respiration 2016

- **EBUS-TBNA possible on ventilated patients without complications**

  Decavele et al., Intensive Care Med, 2016

- **Yield of EBUS TBNA confirmed by real life registry**

  Steinhauser Motta et al., BMC Pulm Med, 2016

- **EBUS TBNA better than classical TBNA in sarcoidosis**

  Hu et al., Chin Med J (Engl), 2016

Take-Home Message

EBUS

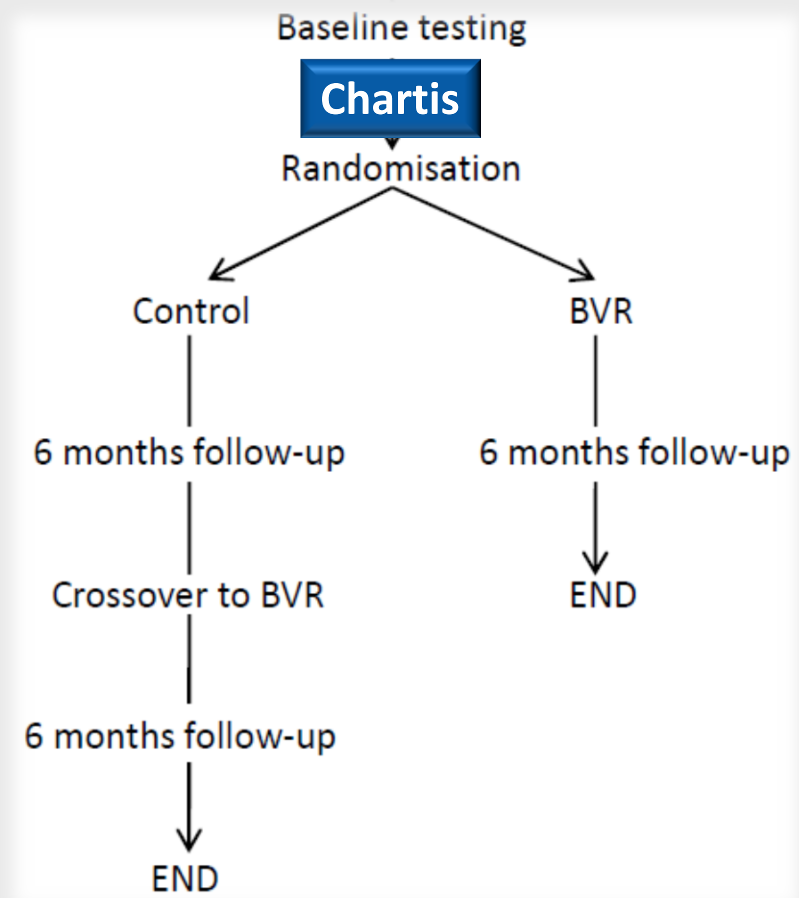
- **Oral Intubation seems a alternative**
- **Re-Biopsy is feasible and useful**
- **Not only possible for lymph nodes**

Interventions in Obstructive Lung Diseases

Klooster K et al., Endobronchial Valve Treatment Versus Standard Medical Care in Patients with Emphysema Without Interlobar Collateral Ventilation (The STELVIO-Trial)
N Engl J Med 2015;373:2325-35.

- UMC-Groningen, NL
- RCT, 1:1
- n=68
- 6 month follow-up
- Crossover for control

	EBV (n=34)	CONTROL (n=34)
Age, years	58±10	59±8
FEV_1, % predicted	29±7	29±8
FVC, % predicted	78±16	77±20
RV, % predicted	216±36	220±32
6MWD, meters	372±90	377±84



Klooster, K., et al., Endobronchial Valves for Emphysema without Interlobar Collateral Ventilation- 12 months results

Respiration, 2017; 93:112-121

	FEV_1		FVC		RV		6MWD		SGRQ	
	6 Months	1 Year	6 Months	1 Year	6 months	1 Year	6 months	1 Year	6 months	1 Year
All patients N=40	25.7% (18 to 33)	17.2%[b] (11 to 24)	23.4% (15 to 32)	23.1% (15 to 31)	-815 ml (-1003 to -599)	-687 ml[b] (-918 to -456)	74 m (56 to 93)	61 m (42 to 80)	-17 pts (-23 to -12)	-11 pts[b] (-17 to -6)
Heterogeneous distribution N=19	33.1% (24 to 42)	25.6%[b] (19 to 32)	27.4% (17 to 38)	24.2% (14 to 35)	-786 ml (-1069 to -504)	-672 ml (-957 to -389)	77 m (49 to 104)	70 m[b] (41 to 98)	-20 pts (-27 to -12)	-13 pts[b] (-19 to -7)
Homogeneous distribution N=21	18.9% (7 to 31)	9.6%[a,b] (-1 to 20)	19.8% (6 to 33)	22.2% (10 to 34)	-841 ml (-1189 to -493)	-699 ml (-1072 to -326)	72 m (44 to 100)	54 m (27 to 81)	-16 pts (-23 to -8)	-10 pts[b] (-19 to -0.4)
Upper lobe treatment N=22	31.0% (21 to 41)	22.3%[b] (14 to 31)	25.2% (14 to 36)	21.8% (11 to 32)	-770 ml (-1001 to -539)	-634 ml (-821 to -447)	67 m (43 to 91)	55 m (30 to 81)	-19 pts (-25 to -12)	-11 pts[b] (-16 to -6)
Lower lobe treatment N=18	19.2% (7 to 31)	11.0%[b] (0.2 to 22)	21.3% (7 to 35)	24.7% (12 to 38)	-870 ml (-1289 to -451)	-752 ml (-1247 to -258)	84 m (52 to 116)	69 m (38 to 100)	-16 pts (-25 to -7)	-12 pts[b] (-22 to -1)

FEV_1 +110 ml   VC +310 ml   RV – 687 ml   6MWT +61 m   SGRQ 11 pt

HOT TOPIC
ERS 2016

Li et al., A randomized controlled trial assessing the safety and effectiveness of the Spiration® Valve System for severe emphysema (REACH trial)

ERS 2016 | Session 148, Abstract OA3013

101 COPD patients
2:1 randomisation
RV > 175%
QCT fissure complete

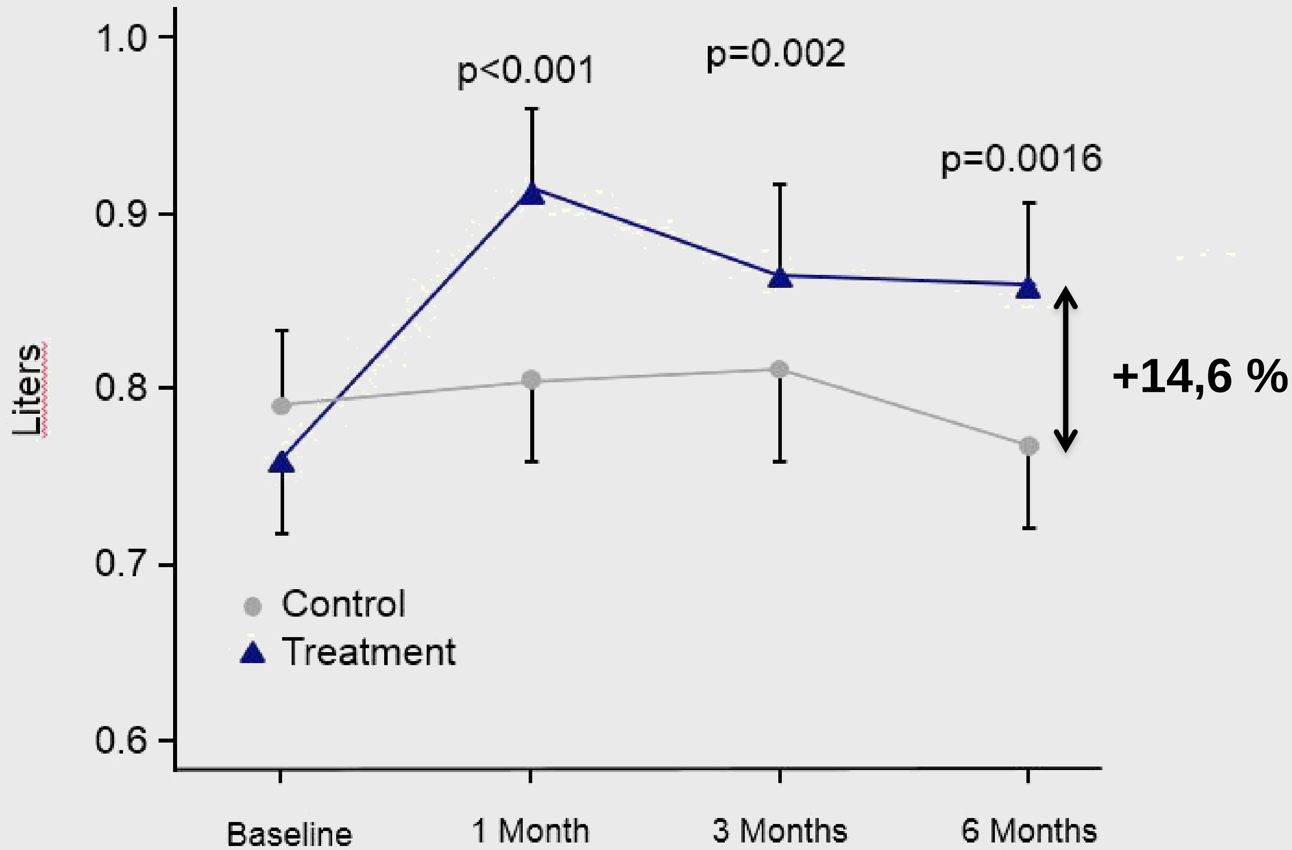
Valve placement
FU

Mean change in FEV1 at 3 months

	Treatment Group	Control Group
Age	63.7± 6.5	62.5 ± 7.1
Males, n (%)	66 (100)	34 (97)
FEV_1 % predicted	27.2 ± 6.8	28.4 ± 8.0
FVC % predicted	61.2 ± 16.1	61.9 ± 17.7
TLC % predicted	135.9 ± 23.3	137.8 ± 23.2
RV % predicted	261.2 ± 75.0	266.4 ± 72.7
6MWT (meters)	335.2 ± 92.8	318.8 ± 86.2

Li et al., A randomized controlled trial assessing the safety and effectiveness of the Spiration® Valve System for severe emphysema (REACH trial)
ERS 2016 | Session 148, Abstract OA3013

HOT TOPIC ERS 2016



% improvement from baseline		1 Month	3 Months	6 Months
	Treatment	20.4	15.4	12.9
	Control	3.9	1.7	-1.7

Li et al., A randomized controlled trial assessing the safety and effectiveness of the Spiration® Valve System for severe emphysema (REACH trial)
ERS 2016 | Session 148, Abstract OA3013

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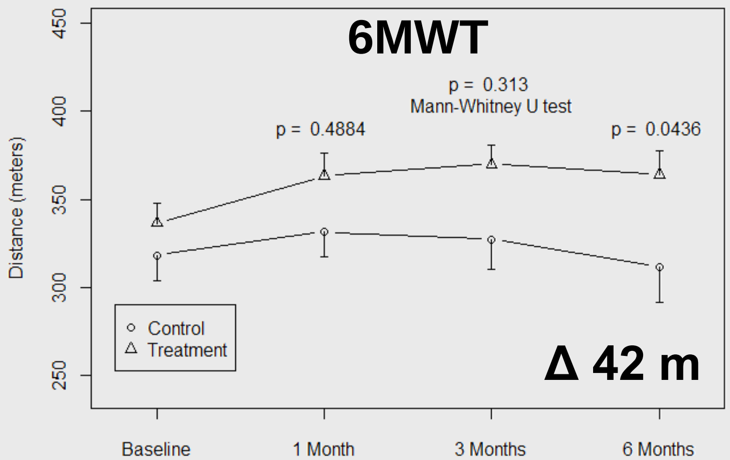
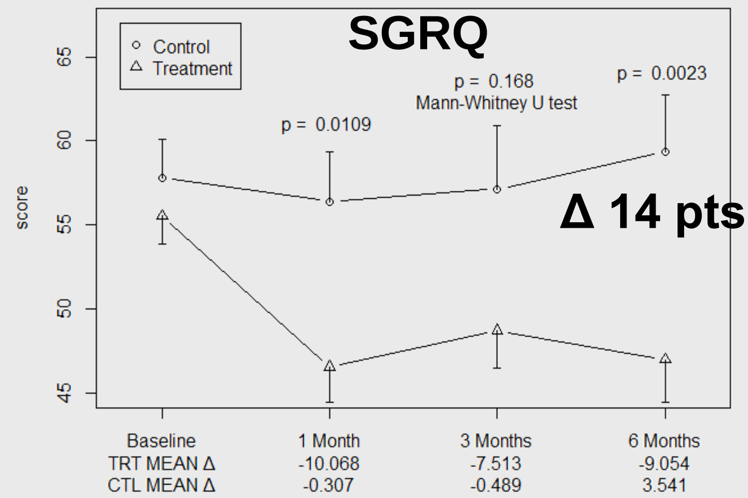
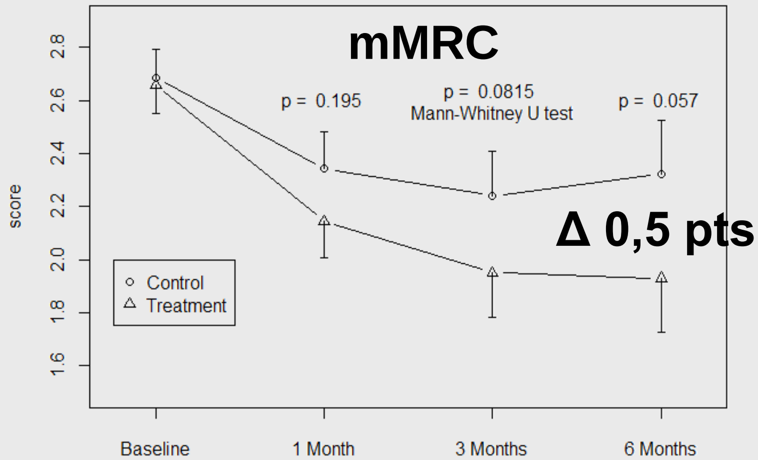
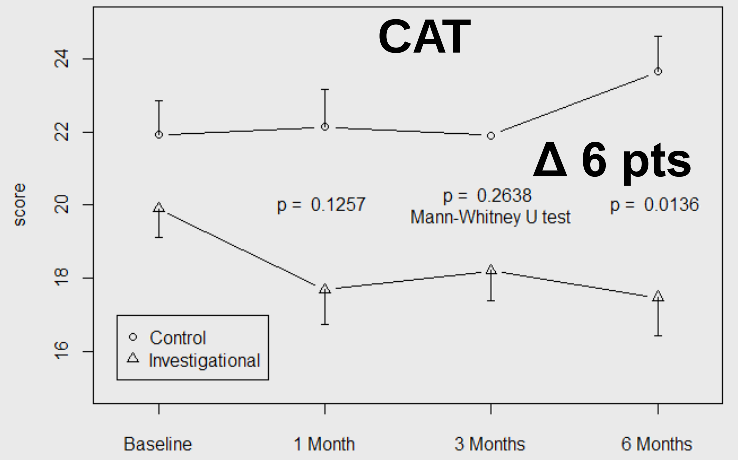








Valipour, A., et al., Endobronchial Valve Therapy in Patients with Homogeneous Emphysema: Results from the IMPACT Study.
Am J Respir Crit Care Med, 2016; 194(9):1073-1082

Variable	EBV Group (n=43)	SoC Group (n=50)
Gender	20 Males / 23 Females	16 Males / 34 Females
Age (years)	64.3 ± 6.3	63.2 ± 6.0
BMI (kg/m^2)	23.8 ± 4.4	22.6 ± 3.7
Pack Year smoking history	41.5 ± 19.6	42.5 ± 22.0
Clinical Characteristics		
GOLD Stage	16 Stage III 27 Stage IV	22 Stage III 28 Stage IV
Emphysema score of the target lobe at -910 HU*	68.0 ± 7.22	65.42 ± 7.06
Volume weighted Heterogeneity Index between target and ipsilateral lobe(s) †	6.88 ± 6.83	4.56 ± 6.30
Forced Expiratory Volume in 1 sec. (% predicted)	28.4 ± 6.3	29.9 ± 6.6
Residual Volume (% predicted)	277.3 ± 55.2	273.7 ± 63.4
Total Lung Capacity (% predicted)	144.9 ± 21.2	144.2 ± 17.6
6 Minute Walk Distance (m)	308 ± 91	328 ± 93
SGRQ Total score ‡	63.2 ± 13.7	59.34 ± 15.6
mMRC score §	2.67 ± 0.75	2.42 ± 0.97
CAT Total score ‖	23.4 ± 6.8	22.8 ± 5.9
BODE Index score **	5.69 ± 1.4	5.22 ± 1.7

- **Homogeneous emphysema (<15% difference in emphysema destruction)**
- **RCT, 1:1,n=93**
- **3 month follow-up**

Valipour, A., et al., Endobronchial Valve Therapy in Patients with Homogeneous Emphysema: Results from the IMPACT Study.
Am J Respir Crit Care Med, 2016 194(9):1073-1082

Variable	EBV Group (*n*)	SoC Group (*n*)	ΔEBV − SoC [*Mean (95% CI)*]	*P* Value
FEV_1, L	0.10 ± 0.18 (43)	−0.02 ± 0.10 (50)	0.12 (0.06 to 0.18)	<0.0001
Residual volume, L	−0.42 ± 0.90 (43)	0.05 ± 0.87 (50)	−0.48 (−0.84 to −0.11)	0.0113*
6MWD, m	22.6 ± 66.6 (40)	−17.3 ± 52.8 (50)	40.0 (15.0 to 65.0)	0.002*
SGRQ total score, points	−8.63 ± 11.2 (37)	1.01 ± 9.3 (48)	−9.64 (−14.09 to −5.20)	<0.0001*
mMRC grade, points	−0.39 ± 1.00 (41)	0.18 ± 0.98 (50)	−0.57 (−0.98 to −0.16)	0.007*
CAT total score, points	−1.5 ± 5.6 (41)	−0.7 ± 3.7 (49)	−0.9 (−2.9 to 1.1)	0.374*
BODE index score	−0.7 ± 1.5 (39)	0.4 ± 1.1 (50)	−1.16 (−1.7 to −0.6)	<0.0001†

Definition of abbreviations: 6MWD = 6-minute-walk distance; BODE = body mass index, airflow obstruction, dyspnea, and exercise capacity; CAT = COPD Assessment Test; CI = confidence interval; COPD = chronic obstructive pulmonary disease; EBV = endobronchial valve; mMRC = modified Medical Research Council; SGRQ = St. George's Respiratory Questionnaire; SoC = standard of care.
Values represent means ± SD.
*Two-sample *t* test.
†Wilcoxon signed-rank test.

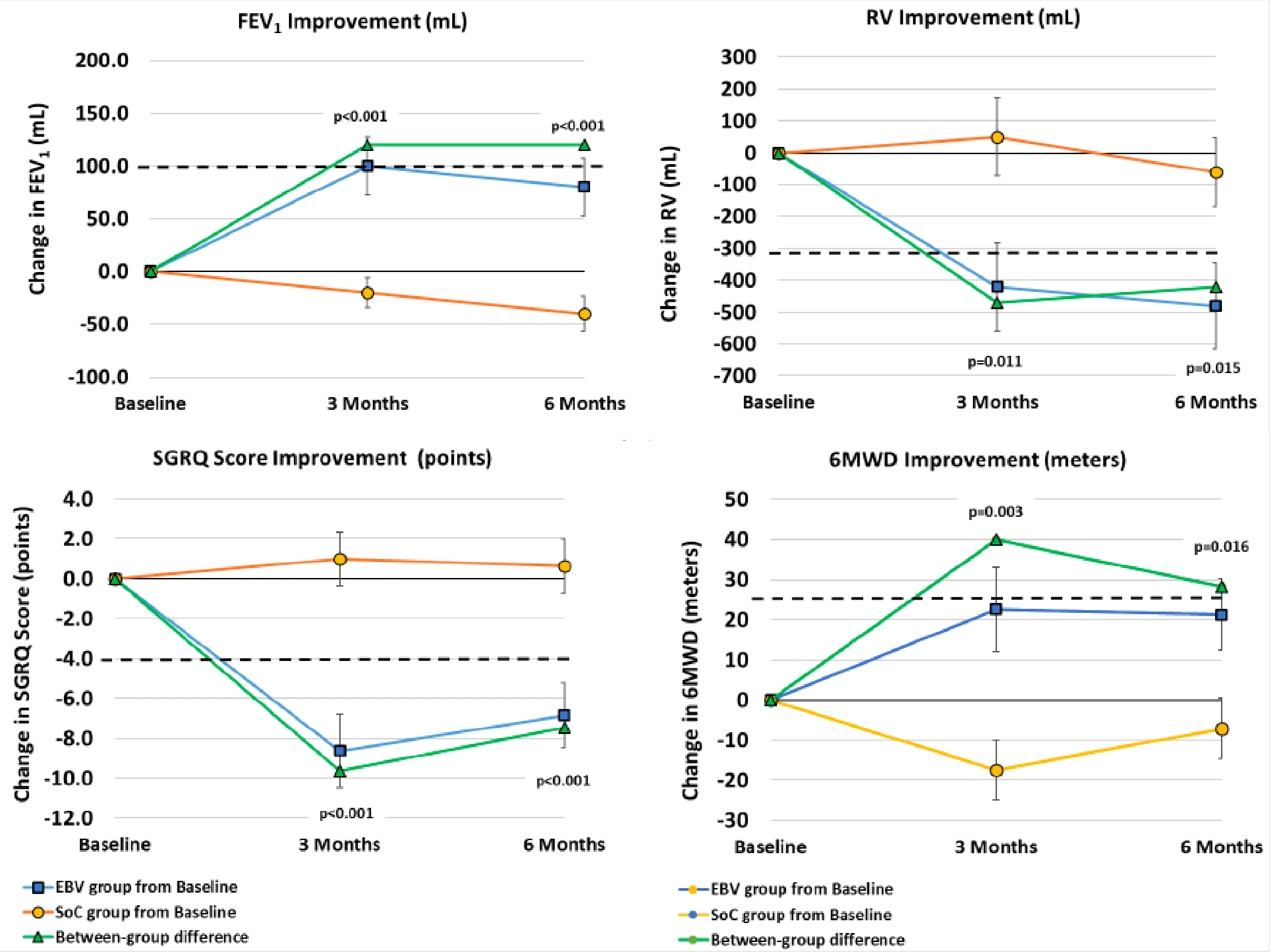
Valipour, A., et al., Endobronchial Valve Therapy in Patients with Homogeneous Emphysema: Results from the IMPACT Study.
Am J Respir Crit Care Med, 2016 194(9):1073-1082

Adverse Event	EBV Group (N=43) Events (% subjects)	SoC Group (N=50) Events (% subjects)	P-value†
Total no of respiratory SAEs	**26 (44.2%)**	**8 (12.0%)**	**<0.001**
Pulmonary events			
Death	0	1 (2.0%) ‡	
COPD Exacerbation with hospitalization	10 (16.3%)	6 (12.0%)	NS
Dyspnoea	1 (2.3%)	0	
Pneumonia	0	1 (2.0%)	
Respiratory distress	1 (2.3%)	0	
Pneumothorax	**12 (25.6%)**	**0**	**<0.001**
Resolved ≤ 14 days after onset, with drainage§	8 (16.3%)	0	
Required temporary valve removal	2 (4.6%)	NA	
Required permanent valve removal because of recurrent pneumothorax	1 (2.3%)	NA	
Required permanent valve removal, after temporary removal and re-implantation, because of recurrent pneumothorax	2 (4.6%)	NA	
Other EBV-related events requiring valve replacement	**3 (7.0%)**	**NA**	
Valve migration	2 (4.6%)	NA	
Paralysis of the nervus recurrens	1 (2.3%) ‖	NA	

Slebos DJ., et al., EBV Treatment In Homogeneous Emphysema: 6-Month Follow-Up In The Impact RCT

ATS 2017 A101 ADVANCES IN INTERVENTIONAL PULMONARY

HOT TOPIC ATS 2017



Gompelmann D et al., Survival after endoscopic valve therapy in patients with severe emphysema

ERS 2016 | Session 148, Abstract OA472

HOT TOPIC ERS 2016

449 COPD patients
RV > 175%
01/2005-12/2013
mean FU 37.3 ± 21 ms

Valve placement
FU

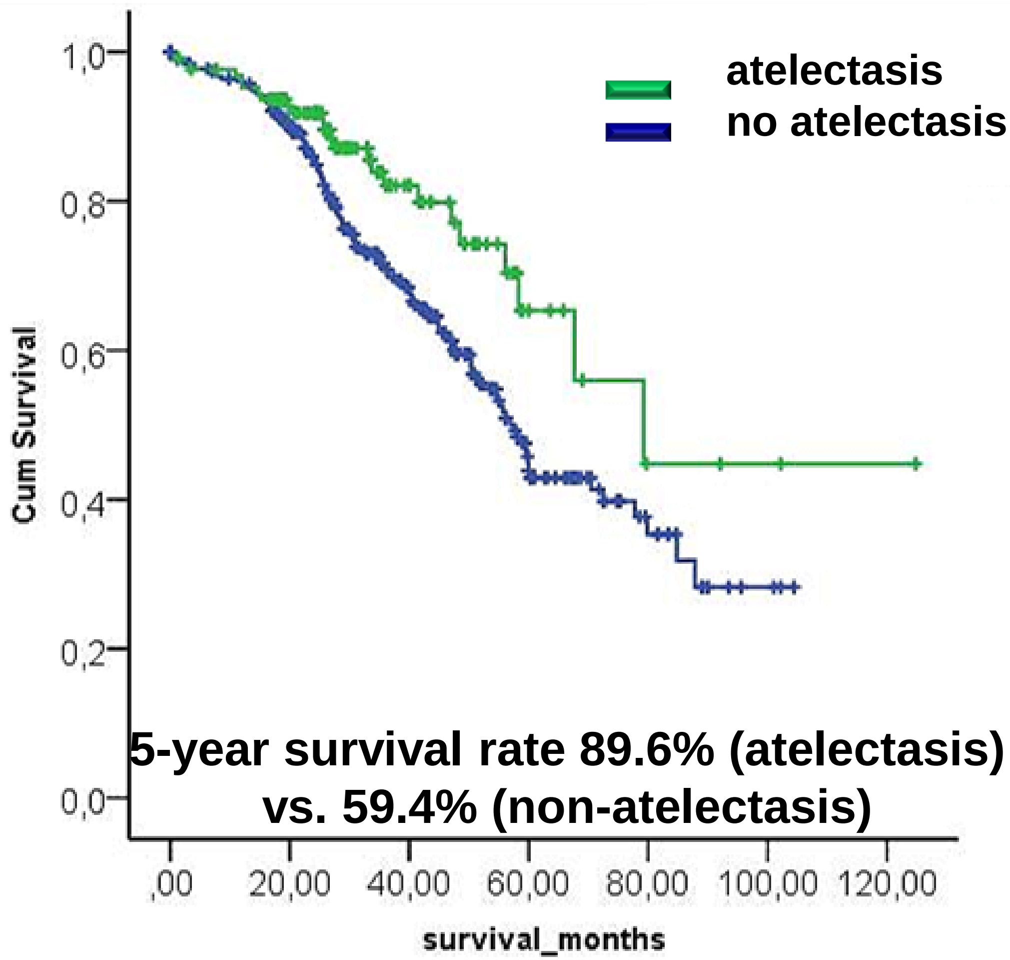
Survival

VC (L)	2.43 ± 0.81
VC (%)	70.33 ± 18.01
FEV_1 (L)	0.82 ± 0.27
FEV_1 (%)	30.53 ± 8.29
RV (L)	5.68 ± 1.37
RV (%)	259.27 ± 59.63
TLC (L)	8.14 ± 1.67
TLC (%)	139.12 ± 21.32
6-MWD (m)	274.83 ± 101.50
mMRC	2.85 ± 1.05

Gompelmann D et al., Survival after endoscopic valve therapy in patients with severe emphysema

ERS 2016 | Session 148, Abstract OA472

HOT TOPIC ERS 2016



5-year survival rate 89.6% (atelectasis) vs. 59.4% (non-atelectasis)

p=0.009
Log-rank test

Age-adjusted p=0.019

Sciurba, F.C. et al., Effect of Endobronchial Coils vs Usual Care on Exercise Tolerance in Patients With Severe Emphysema: The RENEW Randomized Clinical Trial.
JAMA, 2016. 315(20):2178-89.

315 COPD patients
RV > 175%
1:1 random

bilateral Coils placement
vs.
standard of care

Effectiveness: Difference in 6-MWT
Safety

secondary outcome
6 MWT responder rate difference
SGRQ, FEV_1

- **MC-RCT**
- **158 coil pts., 157 SOC**
- **bilateral**
- **12 month follow-up**

	Coil	SoC
Age, years	63 ± 8	64 ± 7
FEV_1, % predicted	26 ± 6	26 ± 7
RV, % predicted	250 ± 40	245 ± 38
6MWD, meters	312 ± 79	303 ± 79
Homogen distribution	77 %	77 %

Sciurba, F.C. et al., Effect of Endobronchial Coils vs Usual Care on Exercise Tolerance in Patients With Severe Emphysema: The RENEW Randomized Clinical Trial.
JAMA, 2016. 315(20):2178-89.

End Point	Coil (N=158)	Usual Care (N=157)	Between-Group Difference	p-value
Δ 6-MWT(m)	10.3 (-33.0, 45.0)	-7.6 (-40.0, 26.0)	14.6* (0.4, ∞)	0.015**
6-MWT Responder Rate	40.0% [31.0, 49.0]	26.9% [18.9,35.0]	11.8% (1.0, ∞) OR 1.8 (1.1, ∞)	0.01
Percent Δ in FEV1 (%)	3.8 (-6.3, 16.1)	-2.5 (-8.9, 4.4)	7.0* (3.4, ∞)	<0.001**
Δ SGRQ	-8.1 (-10.2, -6.0)	0.8 (-1.2, 2.9)	-8.9 (-∞, -6.3)	<0.001
SGRQ Responder Rate%	61.2% [50.9, 71.4]	27.7% [18.6, 36.8]	31.6% (20.5, ∞) OR 4.1 (2.4, ∞)	<0.001
Δ Residual Volume (L)	-0.41 (0.57, -0.25)	-0.10 (-0.26, 0.06)	-0.31 (-∞, -0.11)	0.001
Δ RV/TLC (%)	-4.0 (-5.1, -2.9)	-0.5 (-1.6, 0.6)	-3.5 (-∞, -2.1)	<0.001

Sciurba, F.C. et al., Effect of Endobronchial Coils vs Usual Care on Exercise Tolerance in Patients With Severe Emphysema: The RENEW Randomized Clinical Trial.
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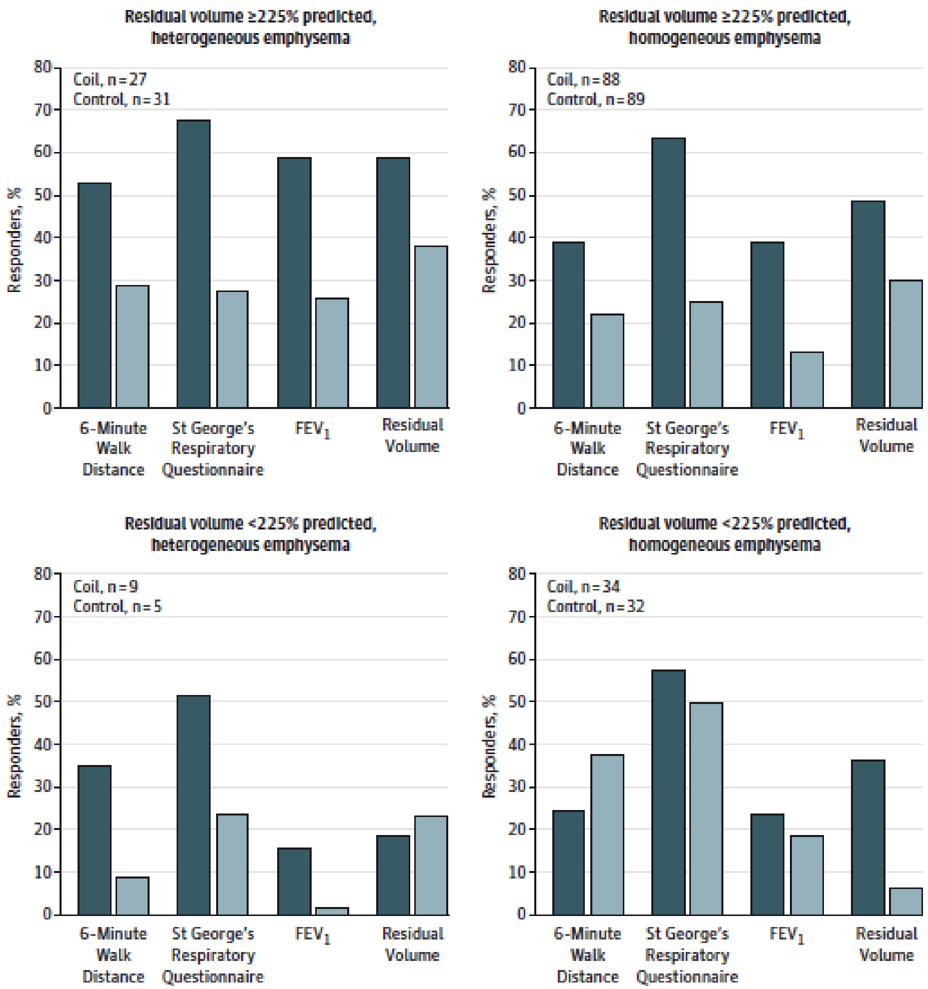


Sciurba, F.C. et al., Effect of Endobronchial Coils vs Usual Care on Exercise Tolerance in Patients With Severe Emphysema: The RENEW Randomized Clinical Trial.
JAMA, 2016. 315(20):2178-89.

	No. (%) of Patients[a]			
	Coil Treatment (n = 155)	Usual Care (n = 157)	Difference, % (95% CI)[b]	P Value[c]
Major complications				
Any	54 (34.8)	30 (19.1)	15.7 (5.9 to 25.2)	.002
Death	10 (6.5)	8 (5.1)	1.4 (−4.1 to 7.0)	.64
Pneumothorax requiring extended chest tube drainage >7 d	1 (0.6)	1 (0.6)	0.0 (−2.9 to 3.0)	>.99
Hemoptysis requiring intervention	2 (1.3)	0	1.3 (−1.3 to 4.6)	.25
COPD exacerbation requiring extended hospitalization >7 d	18 (11.6)	13 (8.3)	3.3 (−3.4 to 10.2)	.35
Lower respiratory tract infection, including pneumonia, requiring intravenous antibiotics and/or corticosteroids	29 (18.7)	7 (4.5)	14.3 (7.3 to 21.5)	<.001
Respiratory failure requiring mechanical ventilation	6 (3.9)	6 (3.8)	0.0 (−4.7 to 4.8)	>.99
Unanticipated bronchoscopy	0	0	NA	
Other important serious adverse events[d]				
Pneumonia[e]	31 (20.0)	7 (4.5)	15.5 (8.4 to 22.9)	<.001
COPD exacerbation	43 (27.7)	32 (20.4)	7.4 (−2.1 to 16.7)	.15
Hemoptysis	4 (2.6)	0	2.6 (−0.3 to 6.4)	
Pneumothorax[f]	15 (9.7)[f]	1 (0.6)	9.0 (4.3 to 14.7)	<.001

Herth, F.J., et al., Endoscopic Lung Volume Reduction: An Expert Panel Recommendation.
Respiration, 2016. 91(3): p. 241-50

<table>
<tr><td>LVRS</td><td>Valves</td><td>Valves</td><td>Coils (RV>225%)</td><td rowspan="2">Coils (RV>225%) LVRS Steam Foam</td><td rowspan="2">Trial Steam (LL)/Foam</td><td rowspan="2">Coils (RV> 225%)</td><td rowspan="2">Trial Steam/ Foam/ LVRS</td><td rowspan="2">Consider lung transplant</td></tr>
<tr><td></td><td></td><td></td><td>Trial Steam/Foam</td></tr>
<tr><td colspan="2">Heterogeneous</td><td colspan="2">Homogenous</td><td colspan="2">Heterogeneous</td><td colspan="2">Homogenous</td><td></td></tr>
<tr><td colspan="4">FI complete/ Chartis negative</td><td colspan="4">FI incomplete/ Chartis positive</td><td></td></tr>
<tr><td colspan="8">Fissure integrity/ Chartis</td><td></td></tr>
<tr><td colspan="9">Emphysema optimal medical RX
FEV1<50% and RV>175%, RV/TLC>0.58, 6MWD 150-400m</td></tr>
<tr><td colspan="9">Optimal pharmacological and non pharmacological treatments
- Smoking cessation, optimal diet, vaccination
- Pulmonary rehabilitation
- Consider oxygen therapy</td></tr>
</table>

Take-Home Message

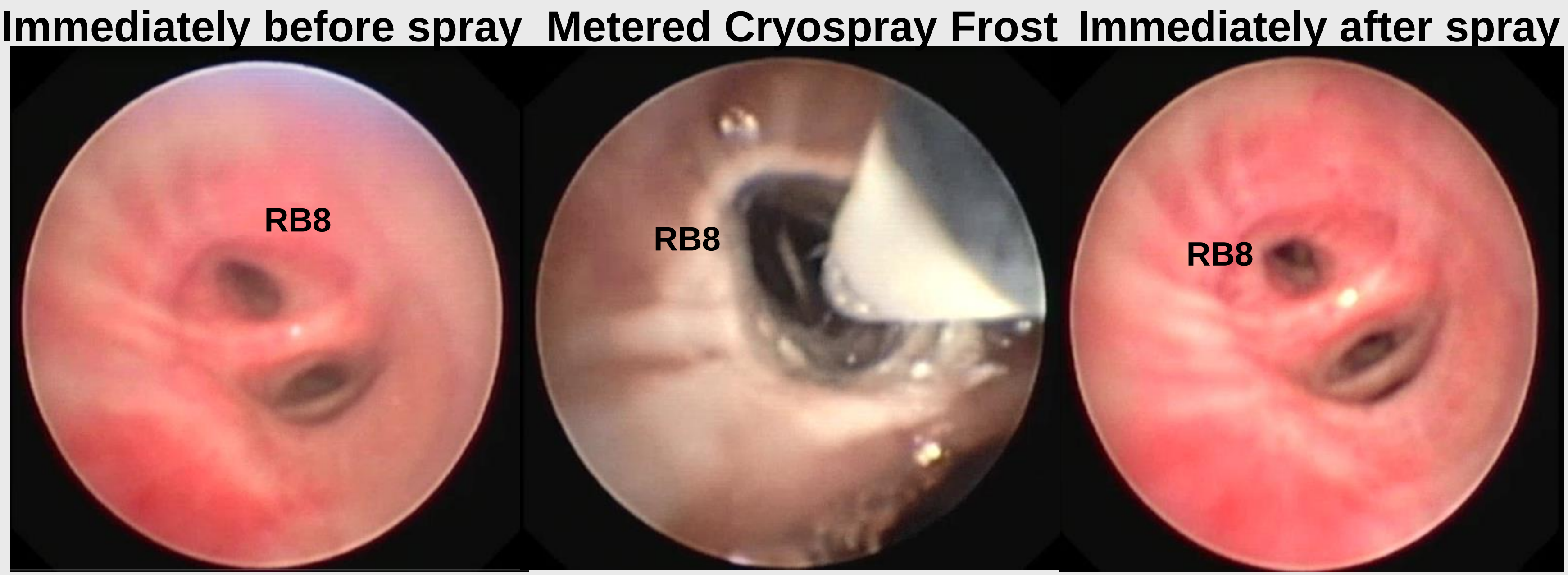
- Valve hypothesis confirmed
- Correct patient selection > 80% success rate

- Coil trial disappointing
- Patient selection still not clear

- Vapor as step up technique effective and safe

- Patient selection is the
- „imaging based phenotyping“

Chronic bronchitis – Cryo-spray



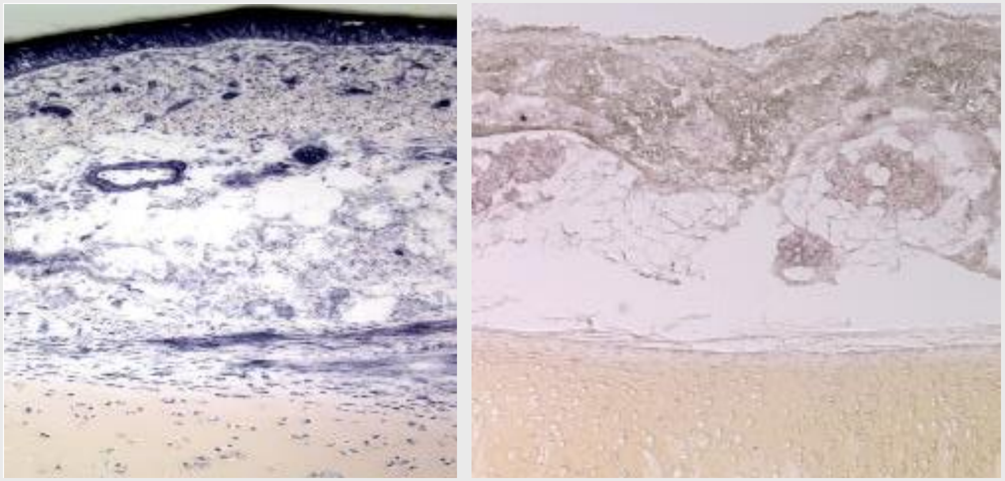


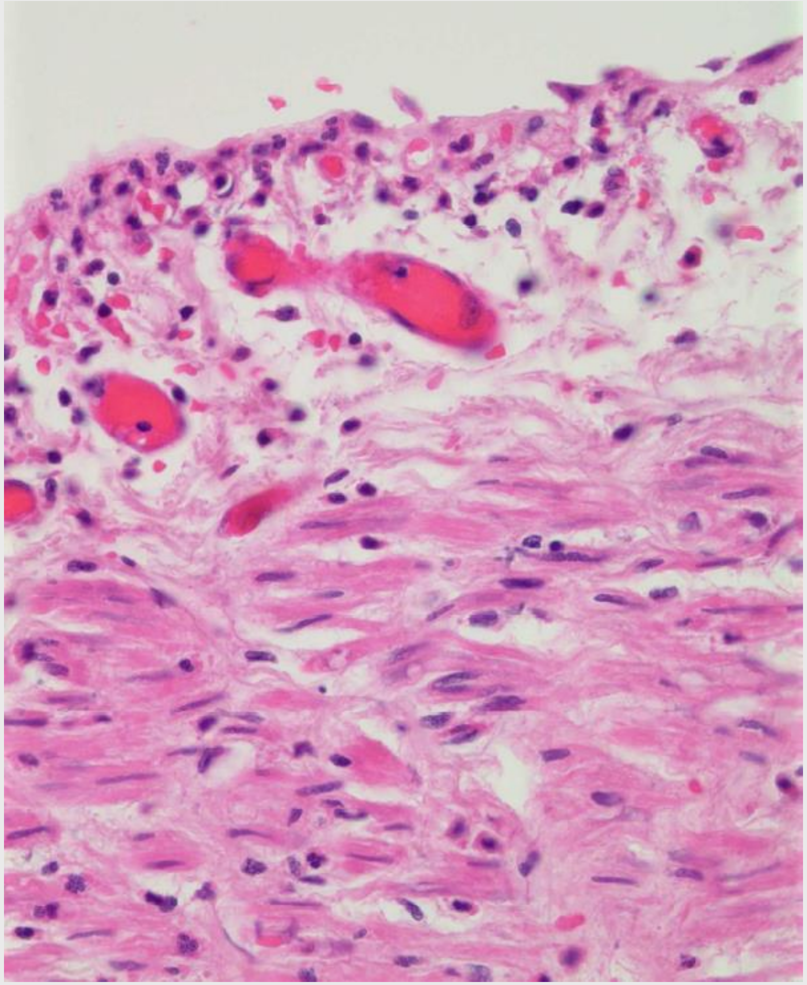
Image courtesy: F. Herth

Slebos DJ et al., Safety and histological effect of liquid nitrogen metered spray cryotherapy in the lung.. AJRCCM, 2017; epub ahead

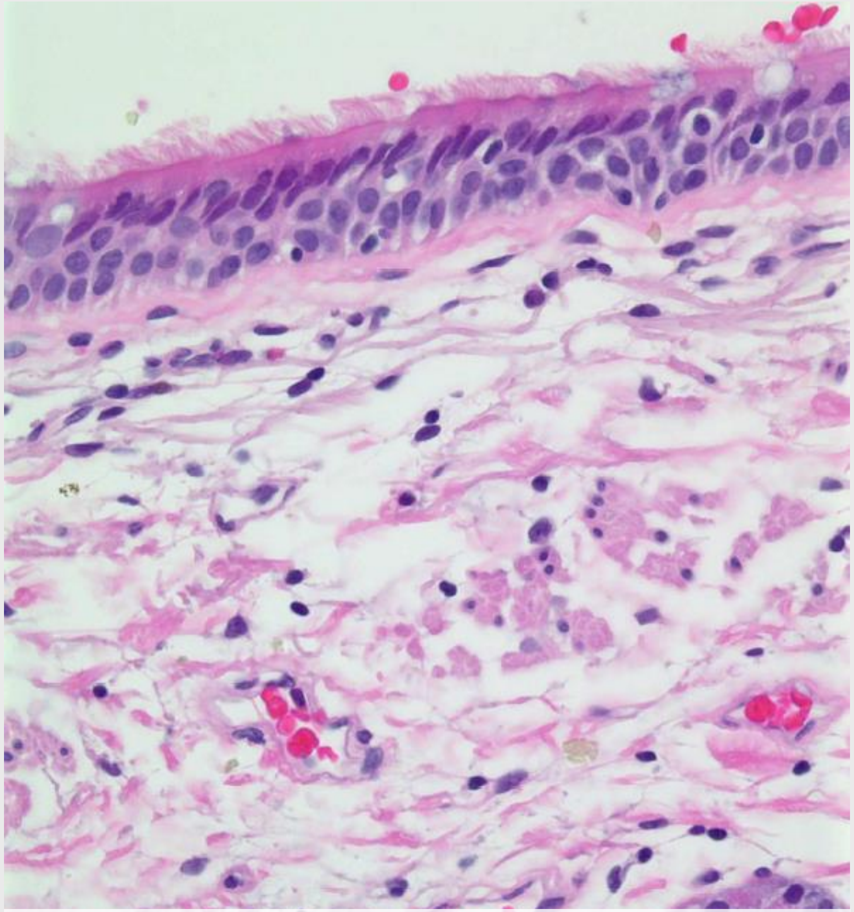
16 patients
Lobar spray cryo
Lobectomy for cancer

11 patients with immediate lobectomy
5 patients with delayed resection (14d)

Safety
Hitological effects



Slebos DJ et al., Safety and histological effect of liquid nitrogen metered spray cryotherapy (MCS) in the lung..
AJRCCM, 2017; epub ahead



respiratory epithelium with occasional goblet cells, preservation of the submucosa and cartilage

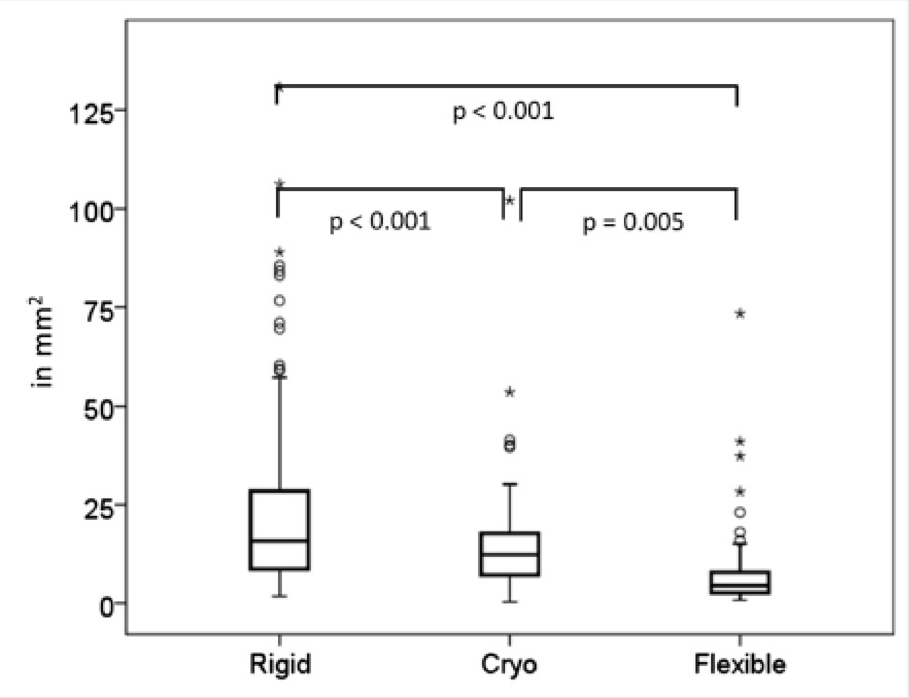
- MCS was feasible and safe with no device related
- No intra-operative complications
- Histology findings were consistent with complete re-epithelialization at the treatment site

=> European RCT in choronic bronchitis patients already started

Wurps, H., et al., Intra-patient comparison of parietal pleural biopsies by rigid forceps, flexible forceps and cryoprobe obtained during medical thoracoscopy: a prospective series of 80 cases with pleural effusion.
BMC Pulm Med, 2016. 16(1): p. 98.

- **Rigid biopsy 79/80 cases**
- **Cryo biopsy 73/80 cases**
- **Flexible biopsy: 74/80 cases**

- **Diagnostic yield achieved with cryobiopsies was inferior**



Take-Home Message

- **Spray Cryo as new option for chronic bronchitis under investigation**

- **Cryo-biopsy in medical thoracosopy inferior to rigid biopsies**

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