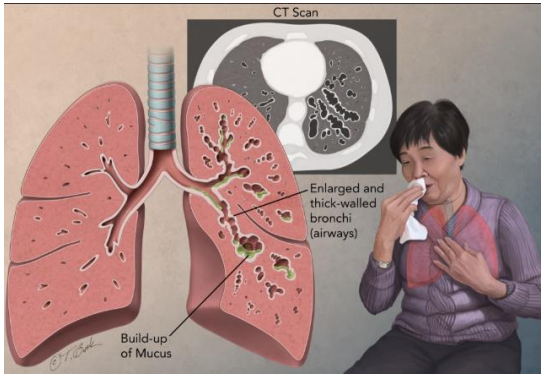
Pulmonary Rehabilitation and Non-Pharmacologic Treatment For Bronchiectasis



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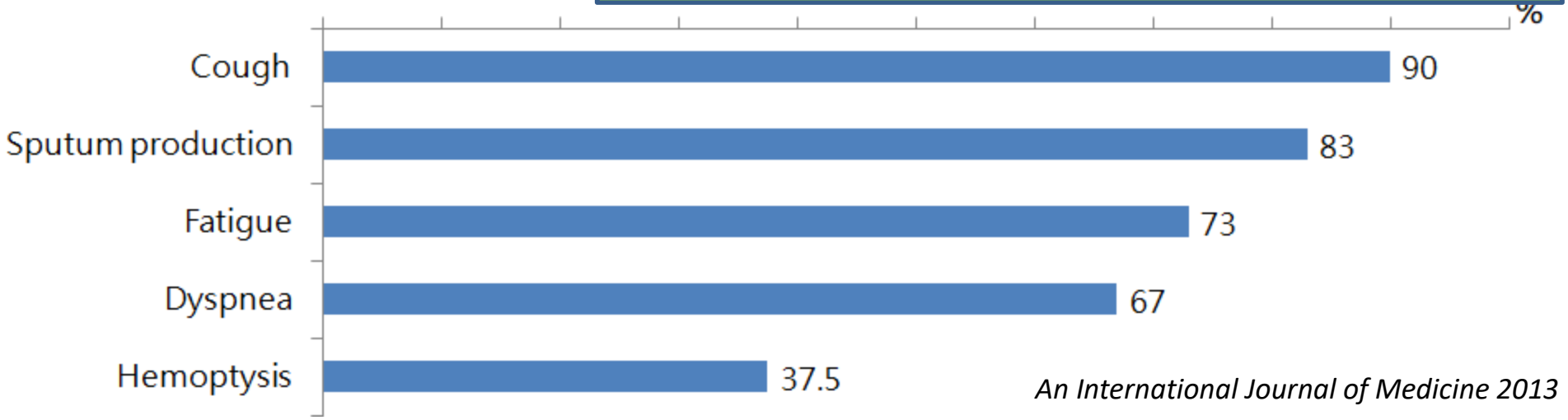
•School of Medicine, Tzu-Chi University, Hualien

Common symptoms and signs

ERS guidelines for the management of adult bronchiectasis

1. Structural lung disease
- Long-term bronchodilator
- Surgery
- Pulmonary rehabilitation

2. Chronic bronchial infection
- Long-term inhaled or oral antibiotic therapy
- Eradication of new pathogenic microorganisms
- Antibiotic treatment of exacerbations



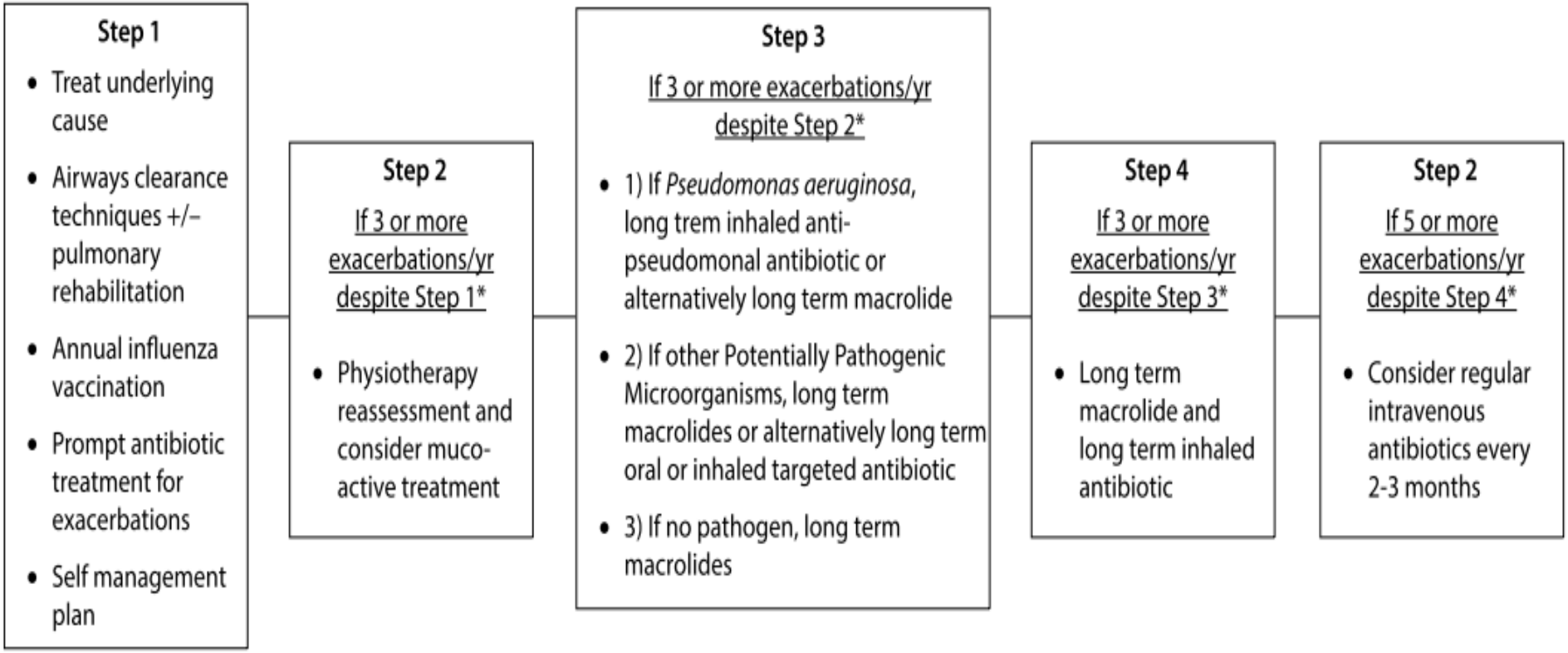
An International Journal of Medicine 2013

3. Inflammation
- Long-term anti-inflammatory therapies

4. Impaired mucociliary clearance
- Long-term mucoactive treatments
- Airway clearance

British Thoracic Society Guideline for bronchiectasis in adults

Thorax 2019



Airway clearance techniques for Bronchiectasis

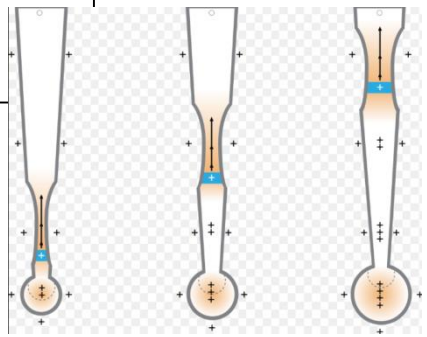
Airway clearance techniques

- Active cycle of breathing techniques (ACBT)
- Autogenic drainage (AD)
- Forced expiration technique (FET)
- Manual techniques (MTs)
- Postural drainage (PD) or modified PD
- Positive expiratory pressure (PEP)
- Oscillating positive expiratory pressure (OPEP)

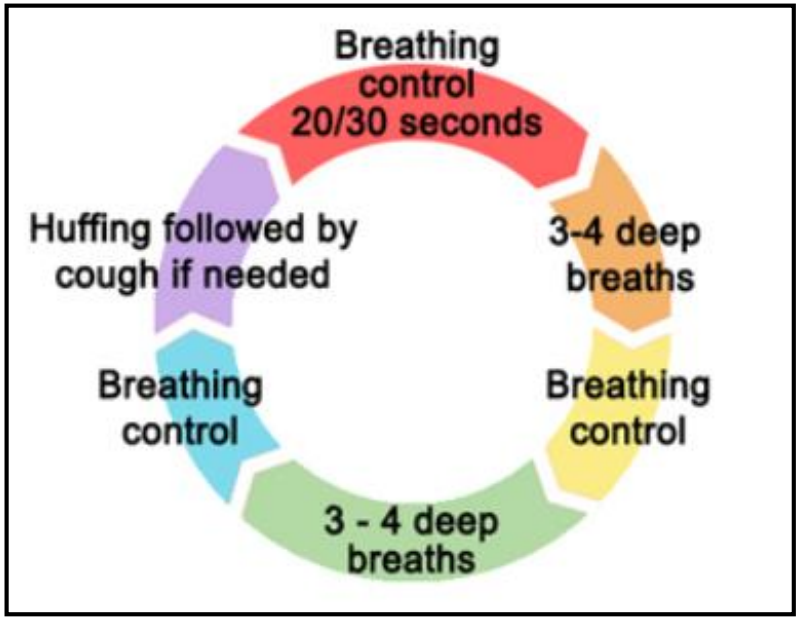
Active cycle of breathing techniques (ACBT)

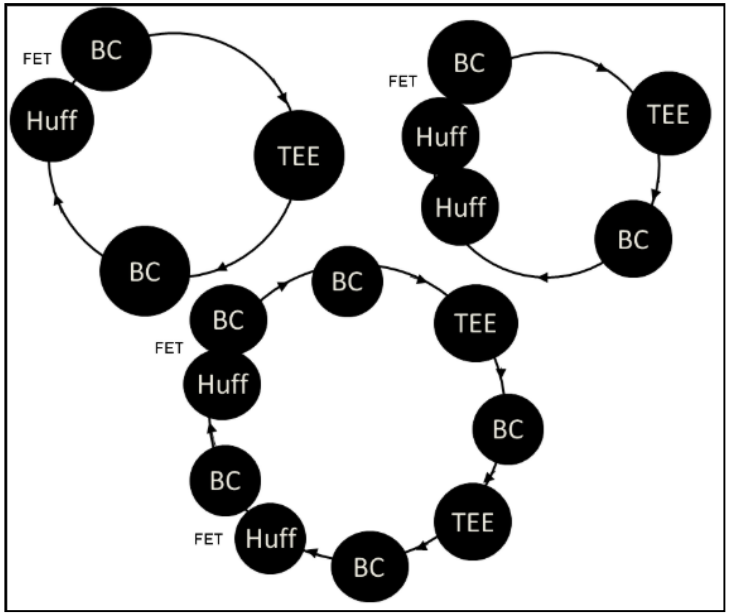
1. **Breathing control**
2. **Thoracic expansion exercises**
3. **Forced expiration technique (FET)**

Secretions: peripheral ➔ central

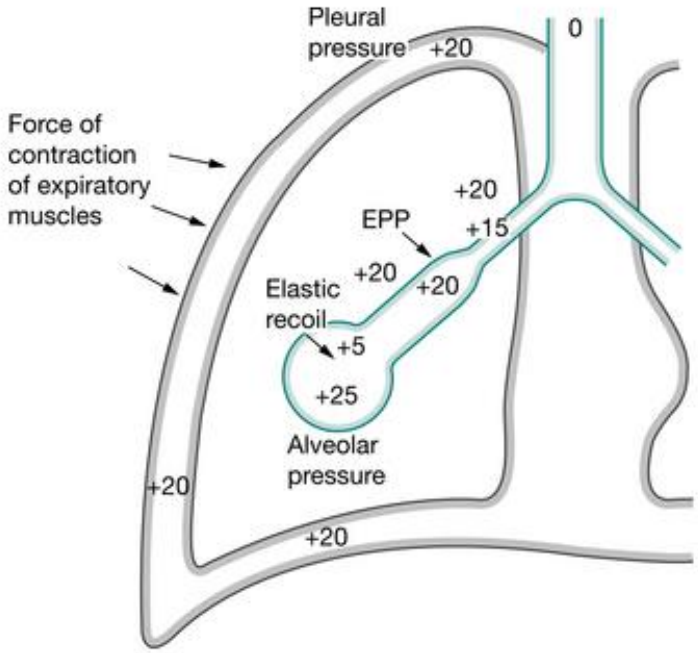


Huff or cough (high lung volume) ➔ clear secretion

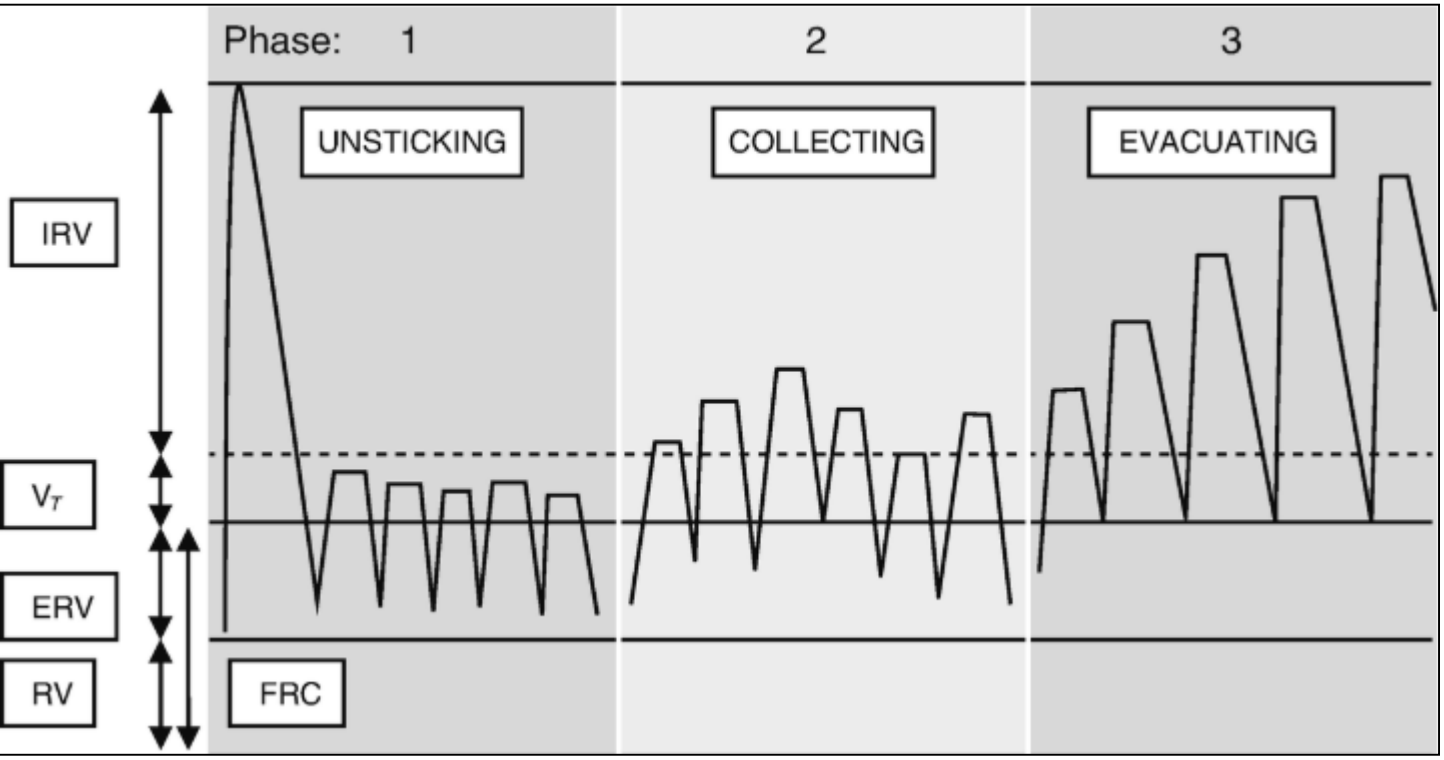


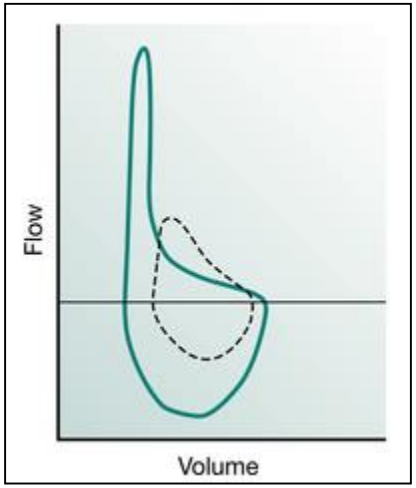


Forced expiration technique (FET)

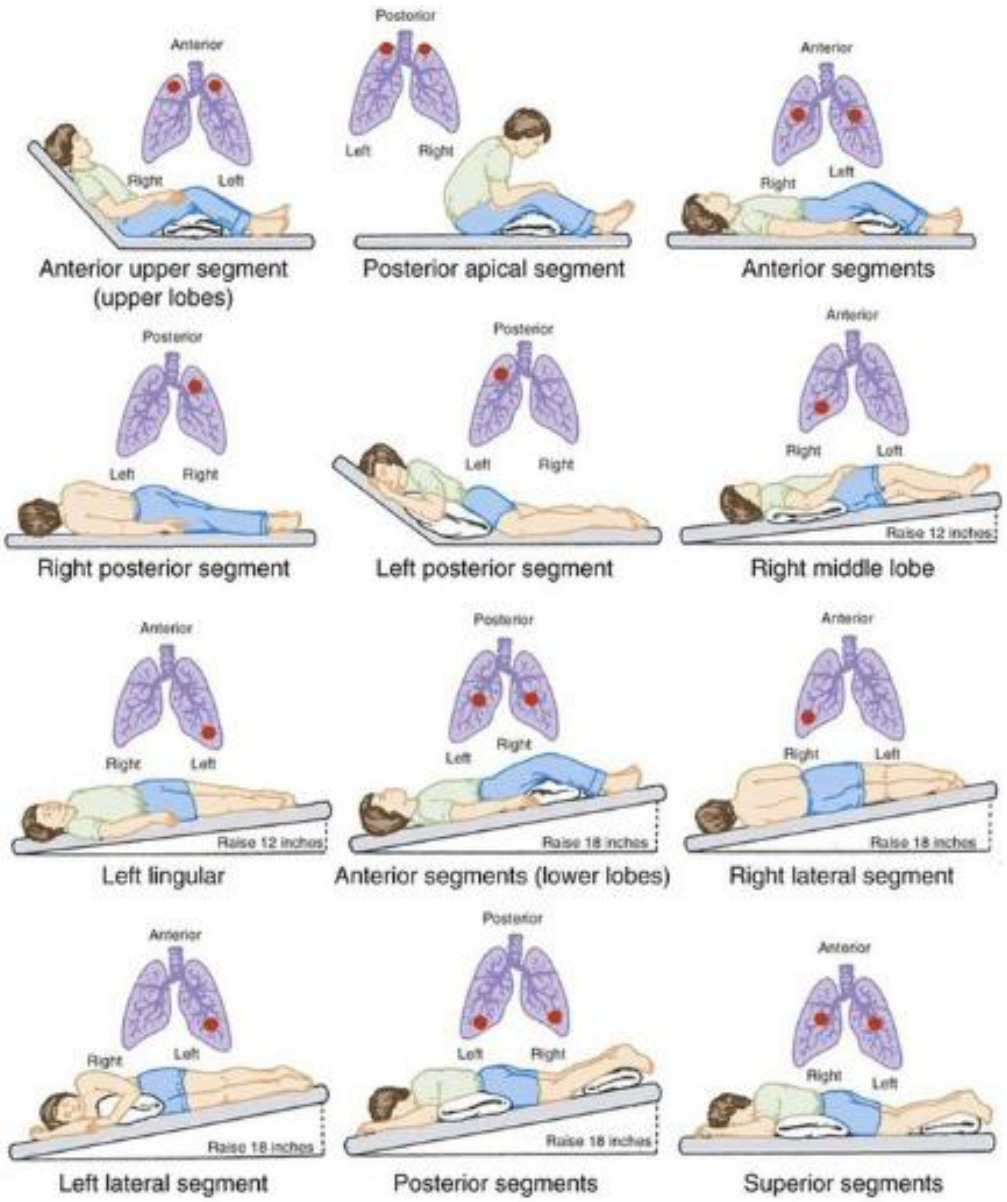


Autogenic drainage (AD)

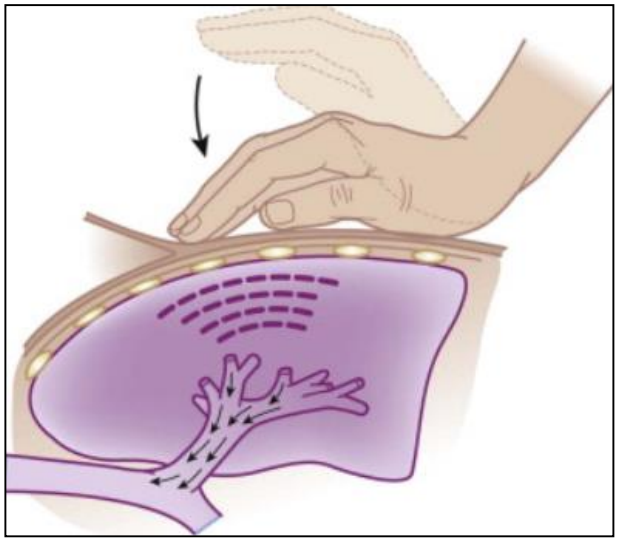




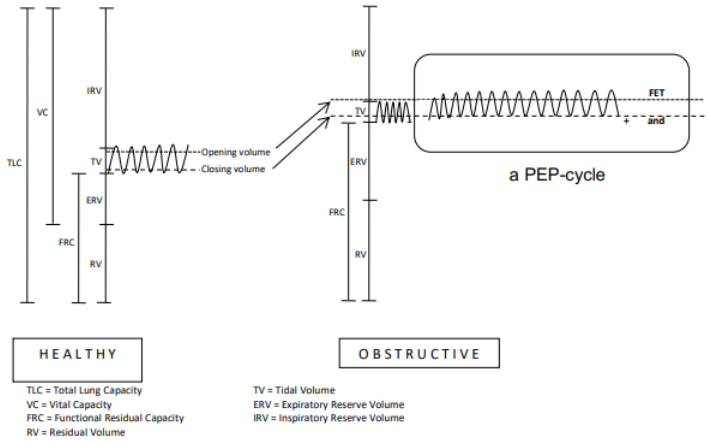
Postural drainage

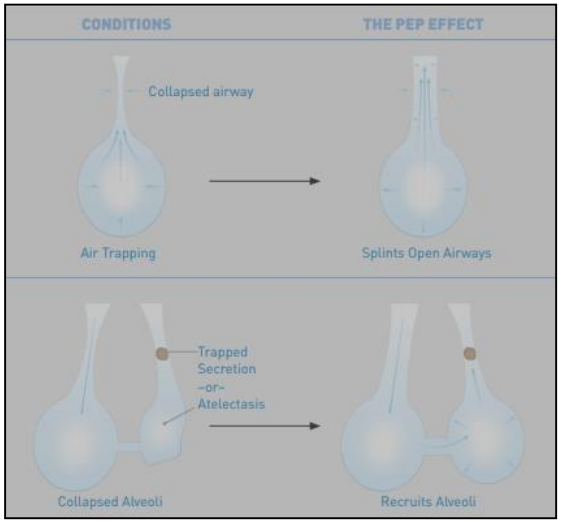


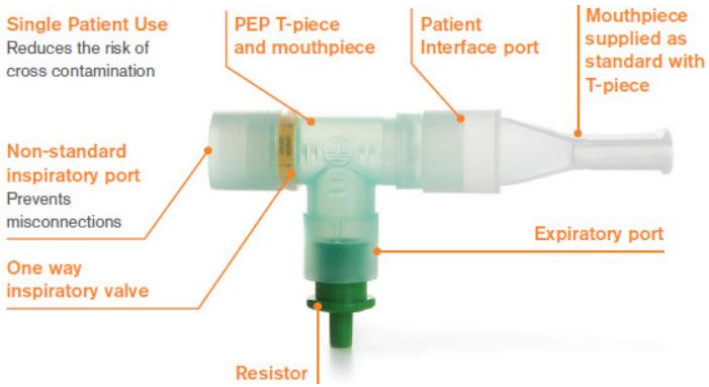
Manual techniques (MTs)



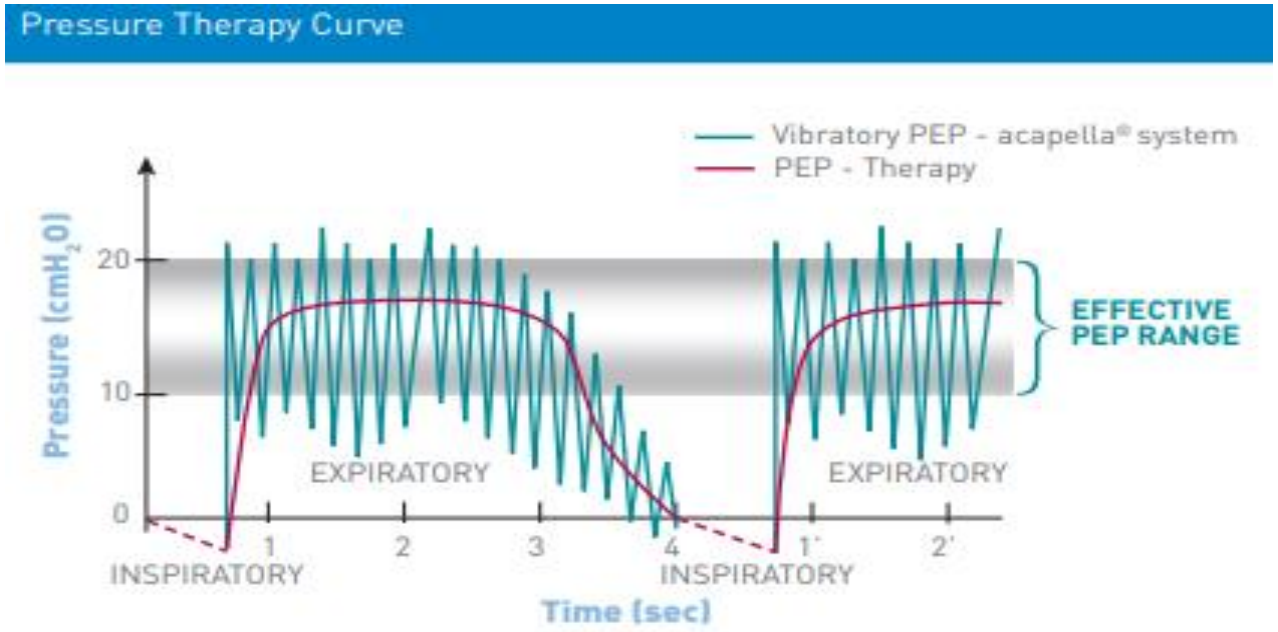
Positive Expiratory Pressure (PEP)

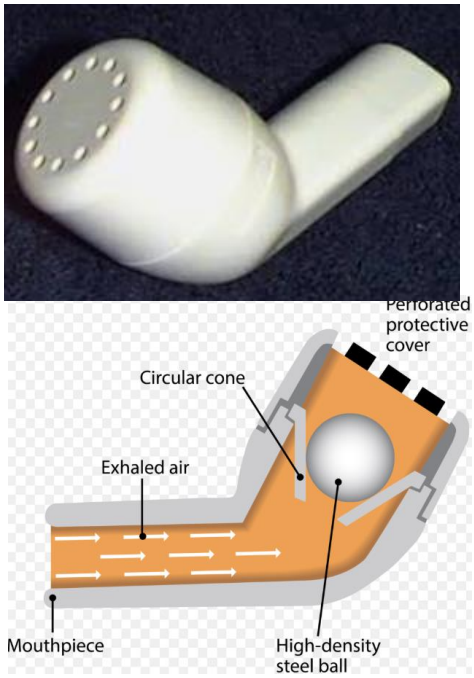


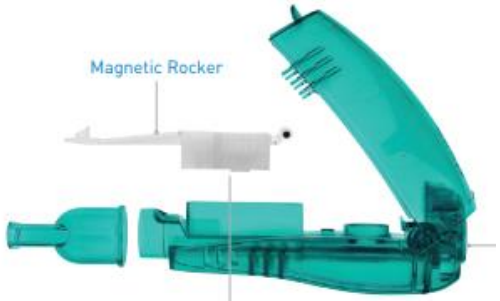


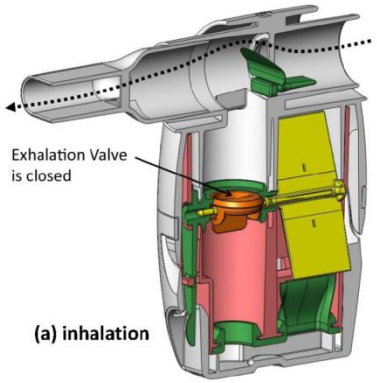


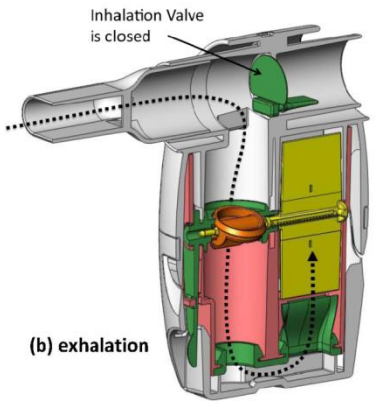
Oscillating Positive Expiratory Pressure (OPEP)



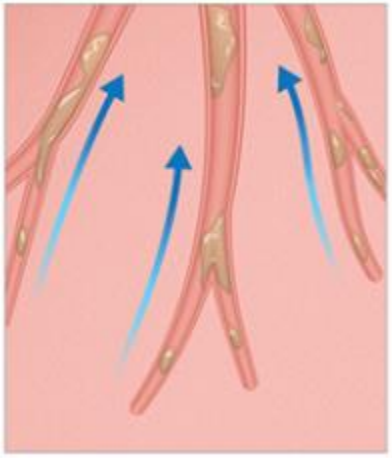


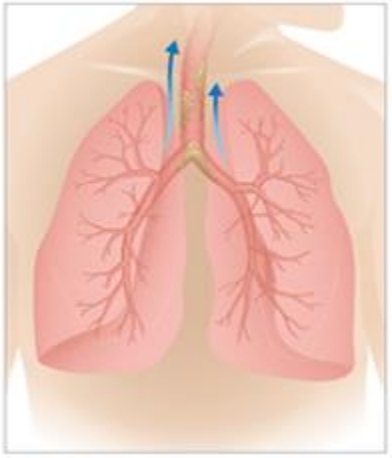






High-frequency chest wall oscillation





Mucociliary clearance techniques for treating non-cystic fibrosis bronchiectasis: Is there evidence?

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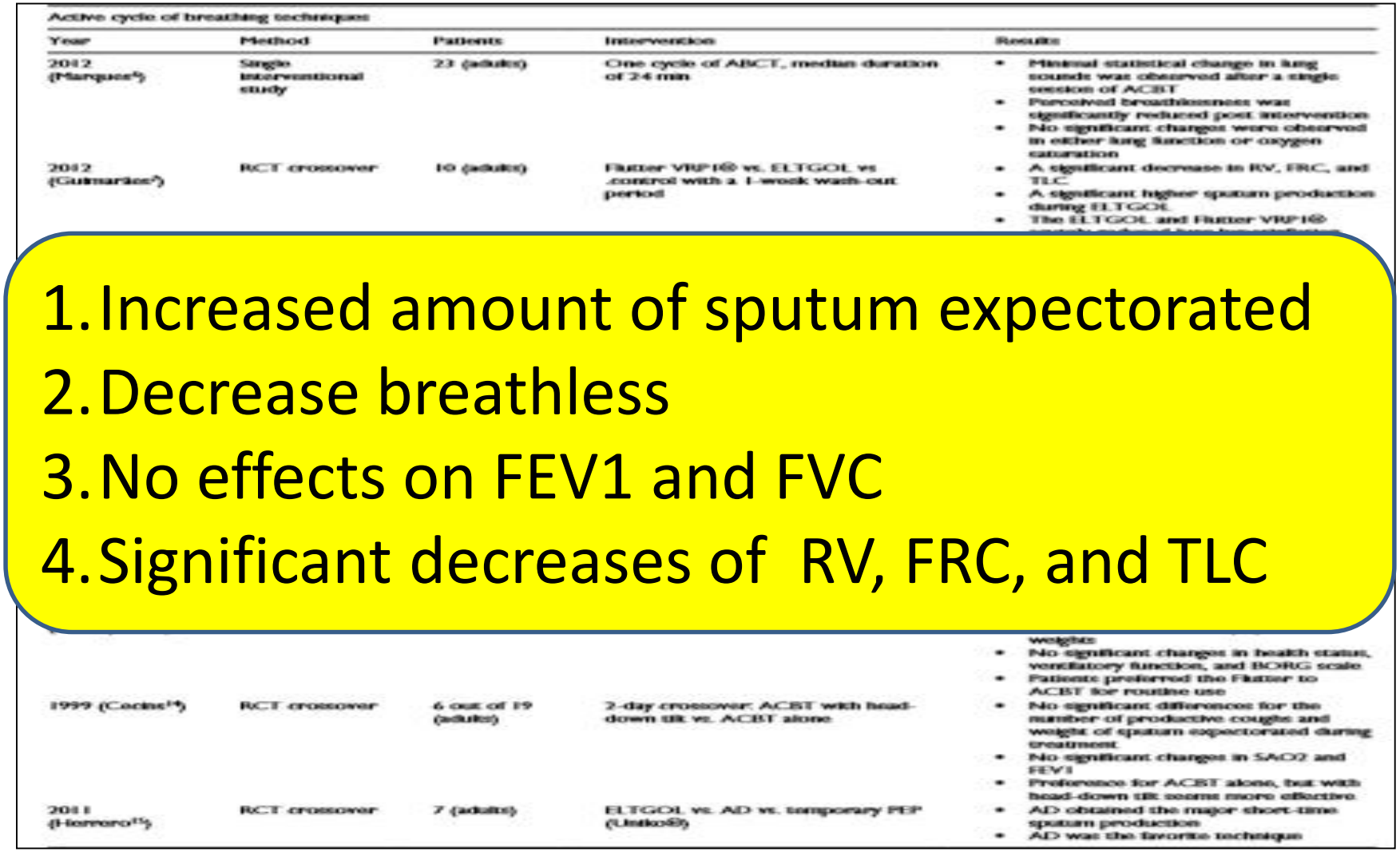
A Escribano Montaner,[2] G Perilongo[1] and A Barbato[1]

Reviewed

- Active cycle of breathing techniques (ACBT)
- Forced expiration techniques (FET)
- Autogenic drainage(AD)
- Postural drainage(PD)
- Oscillating positive expiratory pressure (OPEP)
- High frequency chest wall oscillation (HFCWO)

Studies on the effect of **ACBTs** on bronchiectasis



Active cycle of breathing techniques

Year	Method	Patients	Intervention	Results
2012 (Marques[5])	Single interventional study	23 (adults)	One cycle of ABCT, median duration of 24 min	• Minimal statistical change in lung sounds was observed after a single session of ACBT • Perceived breathlessness was significantly reduced post intervention • No significant changes were observed in either lung function or oxygen saturation
2012 (Guimarães[7])	RCT crossover	10 (adults)	Flutter VRP1® vs. ELTGOL vs. control with a 1-week wash-out period	• A significant decrease in RV, FRC, and TLC • A significant higher sputum production during ELTGOL • The ELTGOL and Flutter VRP1®
				weights • No significant changes in health status, ventilatory function, and BORG scale • Patients preferred the Flutter to ACBT for routine use
1999 (Cecins[14])	RCT crossover	6 out of 19 (adults)	2-day crossover: ACBT with head-down tilt vs. ACBT alone	• No significant differences for the number of productive coughs and weight of sputum expectorated during treatment • No significant changes in SAO2 and FEV1 • Preference for ACBT alone, but with head-down tilt seems more effective
2011 (Herrero[15])	RCT crossover	7 (adults)	ELTGOL vs. AD vs. temporary PEP (Linkos®)	• AD obtained the major short-time sputum production • AD was the favorite technique

1. Increased amount of sputum expectorated
2. Decrease breathless
3. No effects on FEV1 and FVC
4. Significant decreases of RV, FRC, and TLC

International Journal of Immunopathology and Pharmacology 2015

Studies on the effect of **forced expiration techniques (FET)** on bronchiectasis

Forced expiration technique (FET)

Year	Method	Patients	Intervention	Results
1994 (Hasani[16])	RCT crossover	19 (adults)	1 day FET vs. 1 day Cough vs. 1 day Control intervention	• No change in pulmonary function • FET and cough increased clearance of the lung and amount of sputum
			wash-out period	• A significant higher sputum production during ELTGOL • The ELTGOL and Flutter VRP1® acutely reduced lung hyperinflation, but only the ELTGOL increased the removal of pulmonary secretions
2011 (Herrero[15])	RCT crossover	7 (adults)	ELTGOL vs. AD vs. temporary PEP (Uniko®)	• ELTGOL showed a higher sputum production at 24 h • ELTGOL was effective at long-term

1. Increased amount of sputum expectorated
2. Significant decreases of RV, FRC, and TLC

International Journal of Immunopathology and Pharmacology 2015

Studies on the effect of **postural drainage (PD)** on bronchiectasis

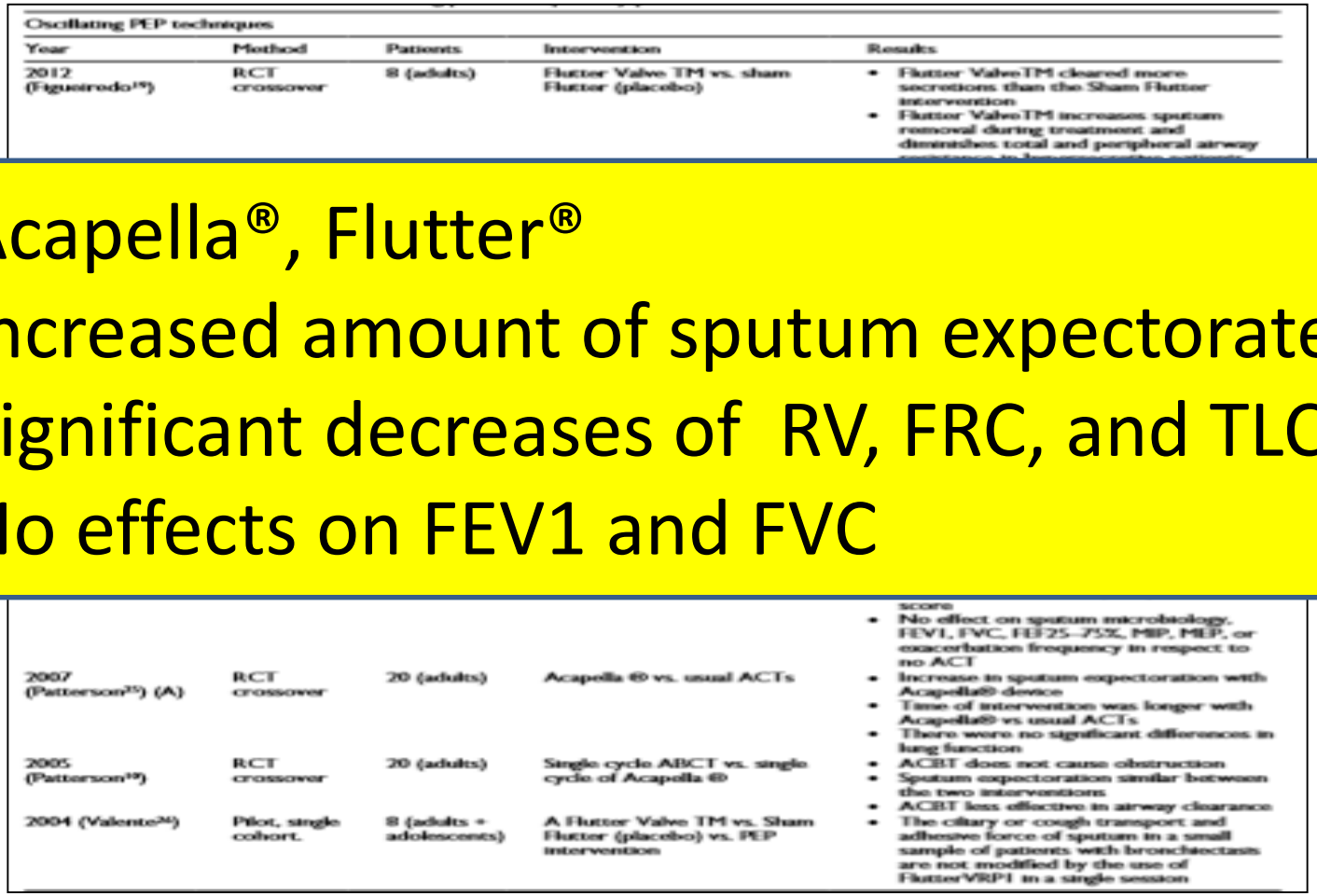
Postural drainage (PD)

Year	Method	Patients	Intervention	Results
2008 (Mutalithas[8])	RCT	53 (adults)	Two weeks of ACTs (combination of	• Reduction of cough symptoms and health-related quality of life
2004 (Patterson[10])	RCT crossover	20 (adults)	ACBT (plus PD and vibration) vs. TIRE	terms of acute efficacy • Significant higher sputum expectoration with ACBT
1999 (Cecins[14])	RCT crossover	6 out of 19 (adults)	2-day crossover: ACBT with head-down tilt vs. ACBT alone	• ACBT with head-down tilt was considered more effective • Horizontal position was better tolerated
1995 (Ambrosino[18])	RCT	14 (adults)	OPep vs. PD combined with chest percussion	• No differences in tolerance or amount of sputum produced

1. Significant higher sputum expectoration with ACBT
2. Reduction of cough symptoms and HRQL

International Journal of Immunopathology and Pharmacology 2015

Studies on the effect of **OPEP** on bronchiectasis



Oscillating PEP techniques

Year	Method	Patients	Intervention	Results
2012 (Figueiredo[19])	RCT crossover	8 (adults)	Flutter Valve TM vs. sham Flutter (placebo)	• Flutter ValveTM cleared more secretions than the Sham Flutter intervention • Flutter ValveTM increases sputum removal during treatment and diminishes total and peripheral airway
				score • No effect on sputum microbiology, FEV1, FVC, RF25–75%, MIP, MEP, or exacerbation frequency in respect to no ACT
2007 (Patterson[35]) (A)	RCT crossover	20 (adults)	Acapella ® vs. usual ACTs	• Increase in sputum expectoration with Acapella® device • Time of intervention was longer with Acapella® vs usual ACTs • There were no significant differences in lung function
2005 (Patterson[19])	RCT crossover	20 (adults)	Single cycle ABCT vs. single cycle of Acapella ®	• ACBT does not cause obstruction • Sputum expectoration similar between the two interventions • ACBT less effective in airway clearance
2004 (Valente[36])	Pilot, single cohort.	8 (adults + adolescents)	A Flutter Valve TM vs. Sham Flutter (placebo) vs. PEP intervention	• The ciliary or cough transport and adhesive force of sputum in a small sample of patients with bronchiectasis are not modified by the use of FlutterVRP1 in a single session

1. Acapella®, Flutter®
2. Increased amount of sputum expectorated
3. Significant decreases of RV, FRC, and TLC
4. No effects on FEV1 and FVC

International Journal of Immunopathology and Pharmacology 2015

Studies on the effect of **high frequency chest wall oscillation (HFCWO)** on bronchiectasis

HFCWO

Year	Method	Patients	Intervention	Results
2011 (Chakravorty[28])	RCT crossover	22 (adults)	4 weeks HFCWO device vs. 4 weeks conventional ACTs	• A trend in reduction of sputum expectoration with HFCWO • Improvement in quality of life
20				
2013 (Gokdemir[30])	RCT crossover	24 (children)	5 day Vest vs. 5 day conventional PR	in sputum • PFT values of patients increased significantly after both interventions. There was no significant difference in PFT values between the two groups • HFCWO was found more comfortable by the patients

1. Improve sputum clearance
2. Improve HRQL
3. Improve lung function
4. More comfortable

International Journal of Immunopathology and Pharmacology 2015

A randomized evaluation of OPEP (Flutter) and ACBT with and without PD in bronchiectasis

- First RCT compare flutter vs ACBT vs ACBT-PD (random order)
- 36 patients (mean age 62 years, range 33–83); FEV1 57%,

Table 2 (a) Comparison of acute sputum clearance measures with Flutter and ACBT with and without PD

Results expressed as mean (SD)	*Flutter*	*ACBT*	*ACBT-PD*
Sputum wet wt (g) clearance	4.4 (6.1)	4.1 (5.7)	10.0 (12.4)
Sputum wet wt (g) post-30-min	1.2 (1.8)	1.5 (2.1)	1.2 (1.3)
Total wet wt (g)	5.6 (7.5)	5.6 (6.7)	11.2 (13.3)
Sputum vol (mL) clearance	6.0 (8.5)	5.4 (8.0)	11.1 (15.1)
Sputum vol (mL) post-30-min	1.9 (3.1)	1.9 (2.4)	1.4 (1.5)
Total vol (mL)	7.9 (11.4)	7.3 (9.6)	12.6 (15.9)
Duration (min)	15.0 (7.8)	15.8 (7.6)	17.8 (9.6)

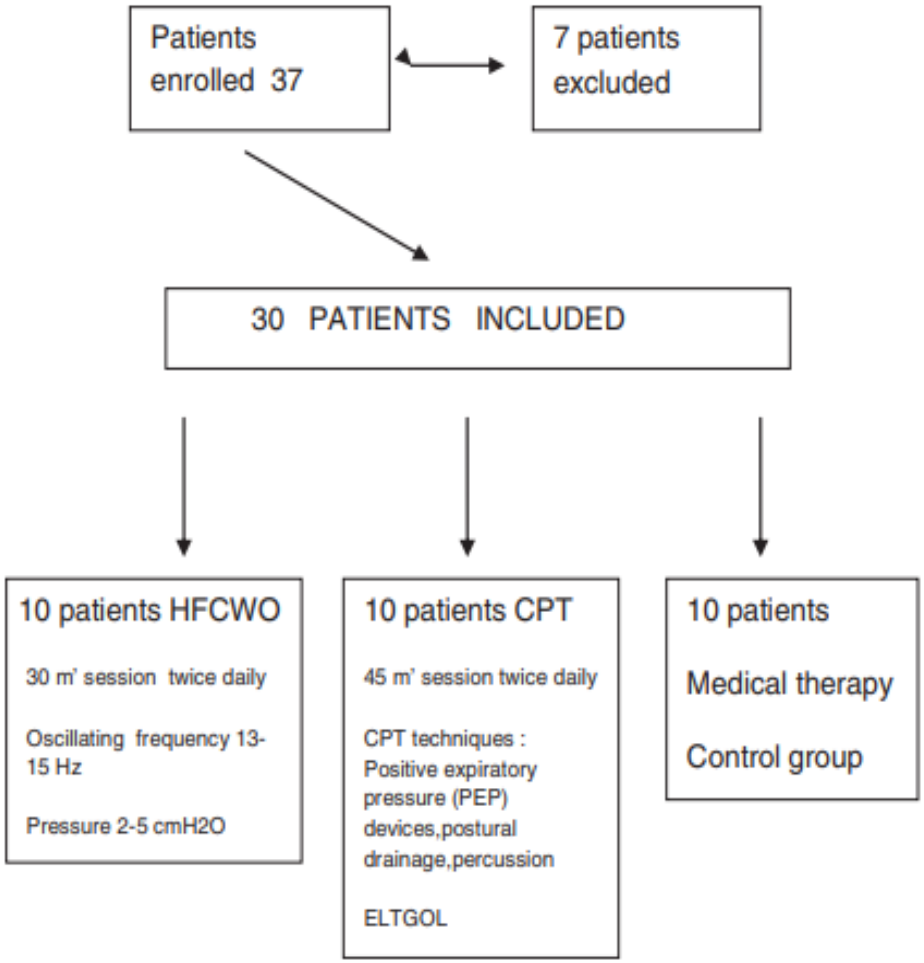
Total sputum weight for ACBT-PD was twice that of either ACBT alone or Flutter

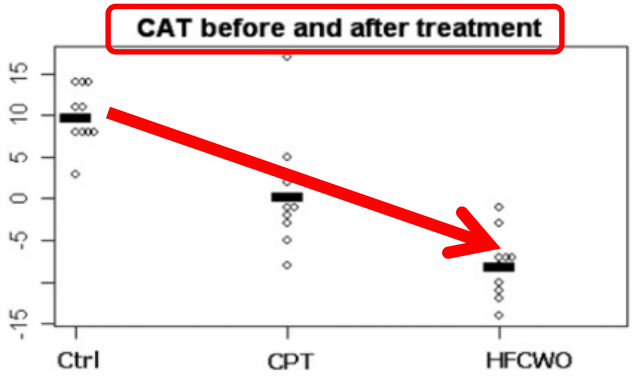
Results expressed as mean difference (SD)	*Flutter versus ACBT*	*Flutter versus ACBT-PD*	*ACBT versus ACBT-PD*
Sputum wet wt (g)	0.3 (3.4)	−5.6 (8.2)*	−5.9 (9.6)*
Sputum wet wt (g) post-30-min	−0.3 (2.0)	0.01 (1.6)	0.3 (1.6)
Total wet wt (g)	0.0 (3.7)	−5.6 (8.5)**	−5.6 (9.2)**
Sputum wet vol (mL)	0.6 (3.9)	−5.1 (8.8)*	−5.7 (10.5)*
Sputum wet vol (mL) post-30-min	0.1 (2.2)	0.5 (2.5)	0.4 (1.8)
Total vol (mL)	0.9 (4.7)	−4.9 (8.2)**	−5.3 (9.9)**
Duration	−0.7 (7.0)	−1.7 (7.3)	−1.4 (9.5)

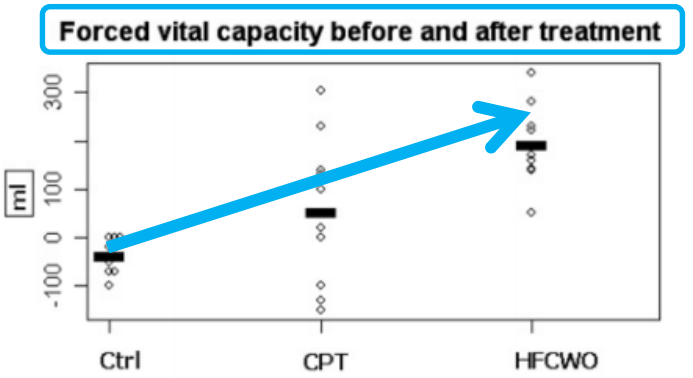
All three techniques were well accepted and tolerated. Patient preference was 16 (44%) for Flutter, eight (22%) ACBT and 12 (33%) for ACBT-PD

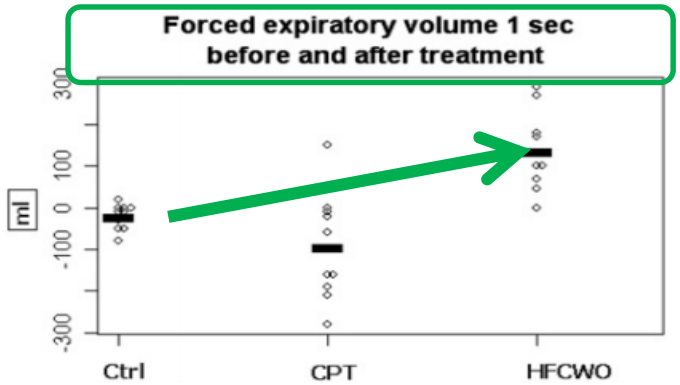
Chronic Respiratory Disease 2007

Effectiveness of treatment with high-frequency chest wall oscillation in patients with bronchiectasis









BMC Pulm Med. 2013

Effect of airway clearance (ACT) techniques in patients experiencing an acute exacerbation of bronchiectasis: a systematic review

- Six studies, total of 120 participants.
- ACTs include ACBT, AD, PD, MT, PEP, OPEP
- Results:
- 1) Safe, no adverse reactions
- 2) ACBT may be more effective than PD and percussion (at improving gas exchange, sputum volume, and health-related quality)
- 3) Two studies prefer OPEP over the ACBT or PD

Physiother Theory Pract. 2019

How to select airway clearance technique for patients

Table 21-1 Considerations When Selecting an Airway Clearance Technique

Technique	Age of Patient	Assistant Needed	Equipment Needed	During Acute Exacerbation	Concurrent Nebulizer	Precautions	Cost
PD, percussio vibration/ shaking							pensive if rformed by regiver over ng term
			infants			motion injuries	
ACBT	Begin to teach at 3-4 years of age	Until 8-10 years of age	Positioning aids; percussor/ vibrator	Yes	Only in upright or side-lying	Precautions for head-down positions	Inexpensive if done independently
AD							cost
HFCWO			appropriately sized vest			catheter, or other device in chest area	ry pensive
IPV	Adolescents	While in	Home unit or	May not be	Yes	Titrate for	Moderately pensive
Acoustic Airway Clearance			generator and appropriate size transducer	further studies are needed		are needed	ry expensive
Exercise	Children, adolescents, and adults	For young children	Variable	No	Premedicate before exercise	Exercise-induced bronchospasm; oxygen desaturation; adjunct to ACT	Depends on type of exercise

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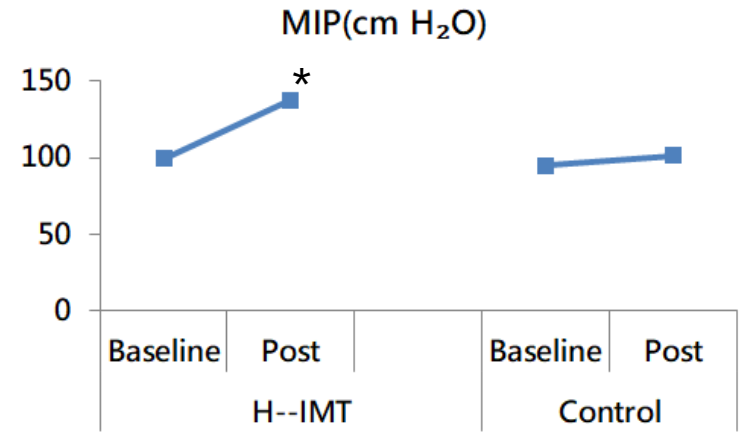
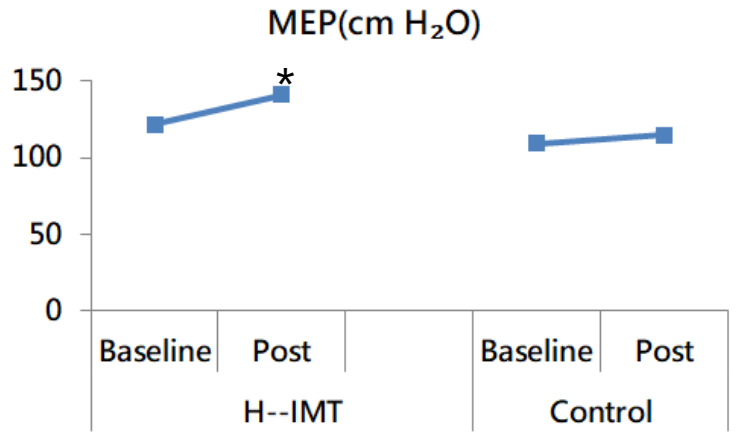
Inspiratory muscle training for Bronchiectasis

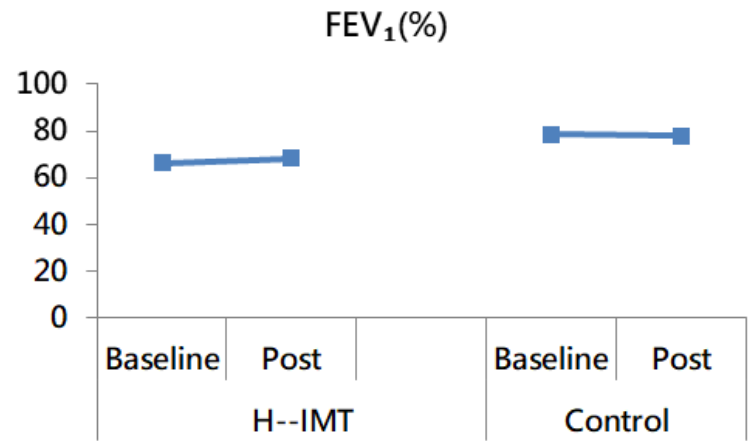
Inspiratory muscle training in bronchiectasis

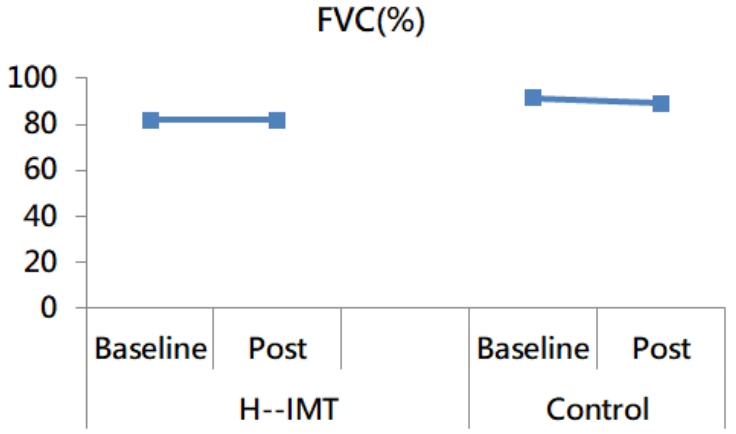
- Forty-five patients
- H-IMT for 8 weeks vs control
  - Threshold loading with a target workload of MIP 70%
  - 3-min cycles (2-min training: 1-min rest)
  - Total 21 min

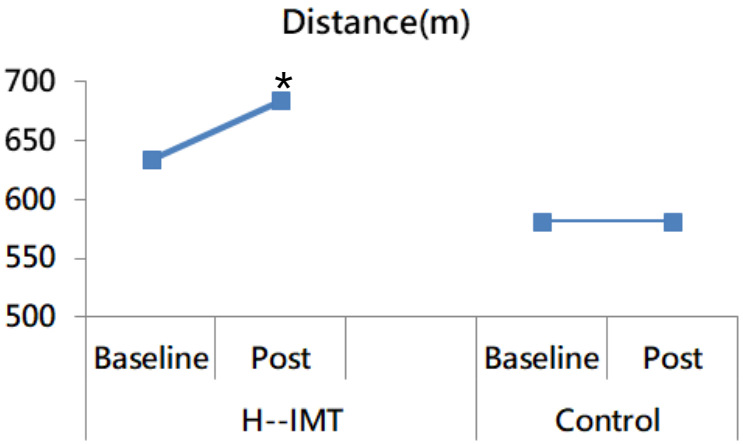
Respirology. 2019 Mar;24(3):246-253

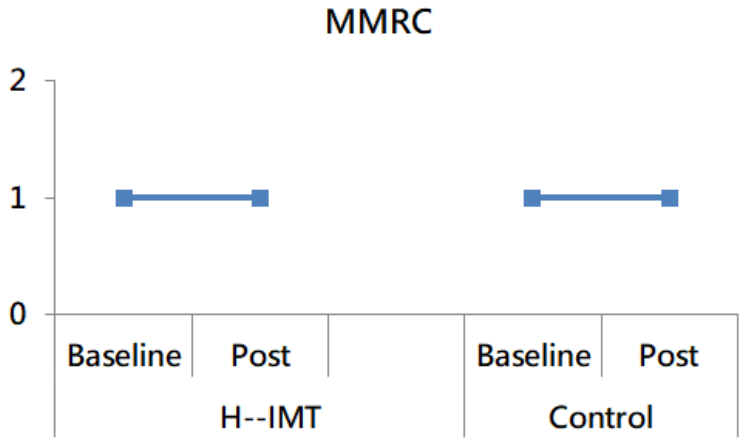

MIP(cm H_2O)
150
100
50
0
*
Baseline
Post
Baseline
Post
H--IMT
Control

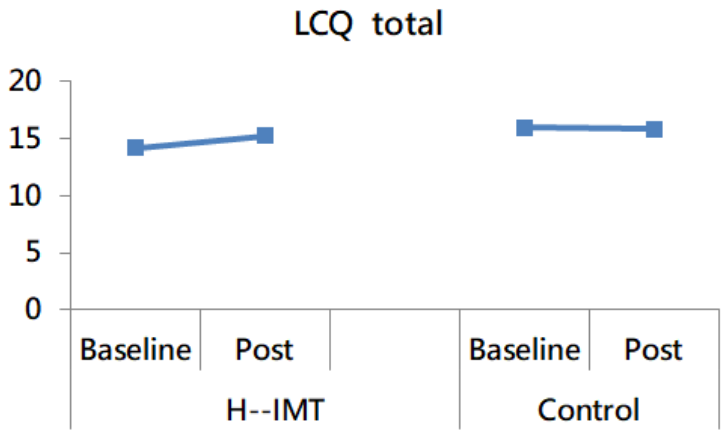

MEP(cm H_2O)
150
100
50
0
*
Baseline
Post
Baseline
Post
H--IMT
Control

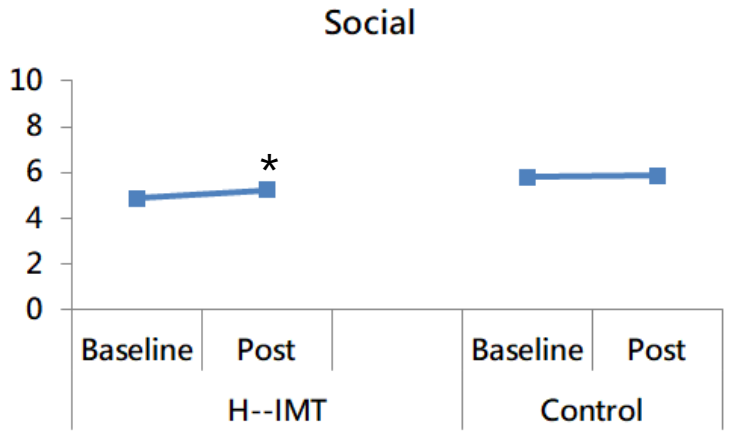

FEV_1(%)
100
80
60
40
20
0
Baseline
Post
Baseline
Post
H--IMT
Control

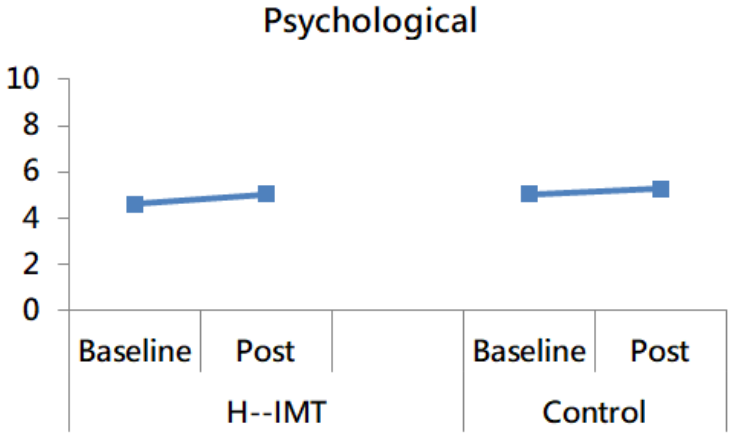

FVC(%)
100
80
60
40
20
0
Baseline
Post
Baseline
Post
H--IMT
Control

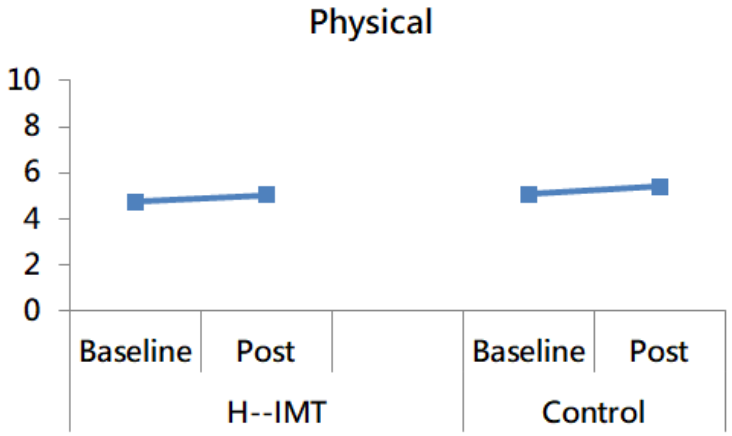

Distance(m)
700
650
600
550
500
*
Baseline
Post
Baseline
Post
H--IMT
Control


MMRC
2
1
0
Baseline
Post
Baseline
Post
H--IMT
Control









The H-IMT increased exercise capacity , respiratory muscle strength, and social aspects of QOL.

British Thoracic Society Guideline - Role of IMT for bronchiectasis

Consider the use of inspiratory muscle training in conjunction with conventional pulmonary rehabilitation to enhance the maintenance of the training effect. (B)

Thorax 2019

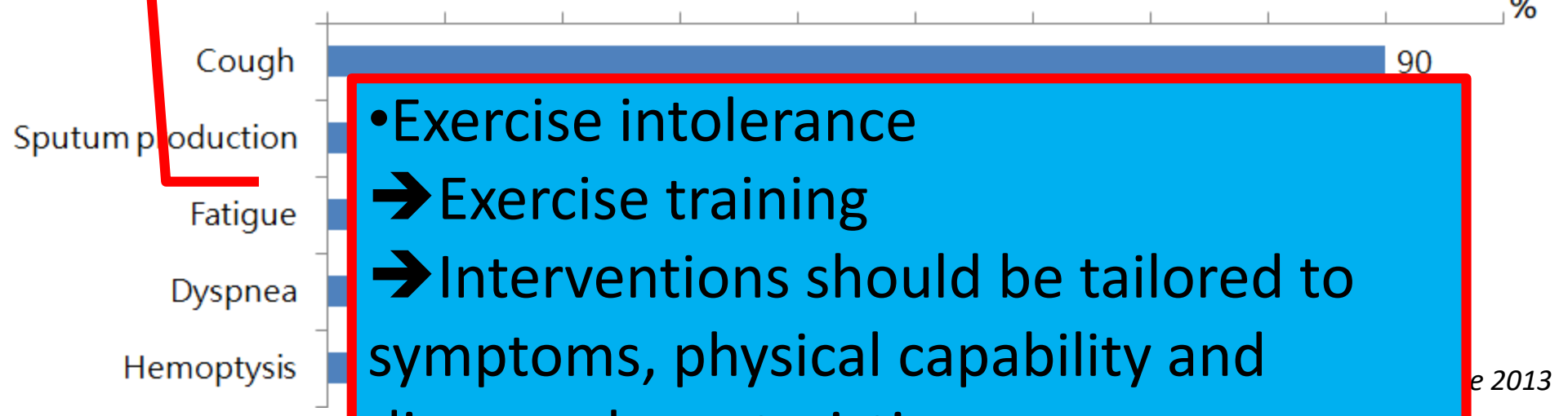
Pulmonary rehabilitation for Bronchiectasis

Common symptoms and signs

ERS guidelines for the management of adult bronchiectasis

1. Structural lung disease
- Long-term bronchodilator
- Surgery
- Pulmonary rehabilitation

2. Chronic bronchial infection
- Long-term inhaled or oral antibiotic therapy
- Eradication of new pathogenic microorganisms
- Antibiotic treatment of exacerbations



- Exercise intolerance
- ➔ Exercise training
- ➔ Interventions should be tailored to symptoms, physical capability and disease characteristics

(**strong** recommendation, **high** quality of evidence).

3. Inflammation
- Long-term anti-inflammatory th

Bronchiectasis: new therapies and new perspectives

	Strength of recommendation	Quality of evidence
Do a minimum bundle of tests, including differential blood count, serum immunoglobulins, and testing for ABPA in newly diagnosed patients	Conditional	Very low
Treat acute exacerbations of bronchiectasis with 14 days of antibiotics	Conditional	Very low
Patients with a new isolation of *Pseudomonas aeruginosa* should be offered eradication antibiotic treatment	Conditional	Very low
Do not offer eradication antibiotic treatment to patients after new isolation of pathogens other than *P aeruginosa*	Conditional	Very low
Do not offer inhaled corticosteroids for the treatment of bronchiectasis	Conditional	Low
Do not offer statins for the treatment of bronchiectasis	Strong	Low
Offer long-term antibiotic treatment for patients with three or more exacerbations per year*	Conditional	Moderate
Offer mucoactive treatment for patients with difficulty expectorating sputum and poor quality of life when standard airway clearance techniques have failed to control symptoms	Conditional	Low
Do not offer recombinant DNase for the treatment of bronchiectasis	Strong	Moderate
Do not routinely offer long-acting bronchodilators for patients with bronchiectasis	Conditional	Very low
Offer long-acting bronchodilators for patients with clinically significant breathlessness on an individual basis	Conditional	Very low
Do not offer surgical treatments, except to patients with localised disease and high exacerbation frequency despite optimum medical care	Conditional	Very low
Patients with chronic productive cough or difficulty expectorating should be taught airway clearance techniques	Conditional	Low
Patients with impaired exercise capacity should participate in pulmonary rehabilitation and take regular exercise	Strong	High

Lancet Respir Med 2018

British Thoracic Society Guideline - Role of PR for bronchiectasis

Offer pulmonary rehabilitation to individuals who are functionally limited by shortness of breath (MMRC Dyspnea Scale ≥1). (B)

Consider the use of inspiratory muscle training in conjunction with conventional pulmonary rehabilitation to enhance the maintenance of the training effect. (B)

Thorax 2019

Pulmonary rehabilitation in bronchiectasis -a propensity-matched study

Eur Respir J 2019; 53

EUROPEAN RESPIRATORY *journal*
FLAGSHIP SCIENTIFIC JOURNAL OF ERS

Patients referred for PR with a diagnosis of bronchiectasis, MRC Dyspnoea score ⩾2 (n=548)

- Excluded (n=335):
  - Absence of diagnostic CT scan (n=41)
  - Coexisting diagnosis of COPD (n=188)
  - Smoking history ≥10 pack-years (n=37)
  - Coexisting cardiac comorbidity
  - Precluded exercise training (n=14)
  - Declined PR (n=55)

Patients with bronchiectasis (n=213)

- Propensity score matched 1:1
- age, sex, FEV1 % pred, BMI, MRC score, exercise capacity

Patients with COPD (n=213)

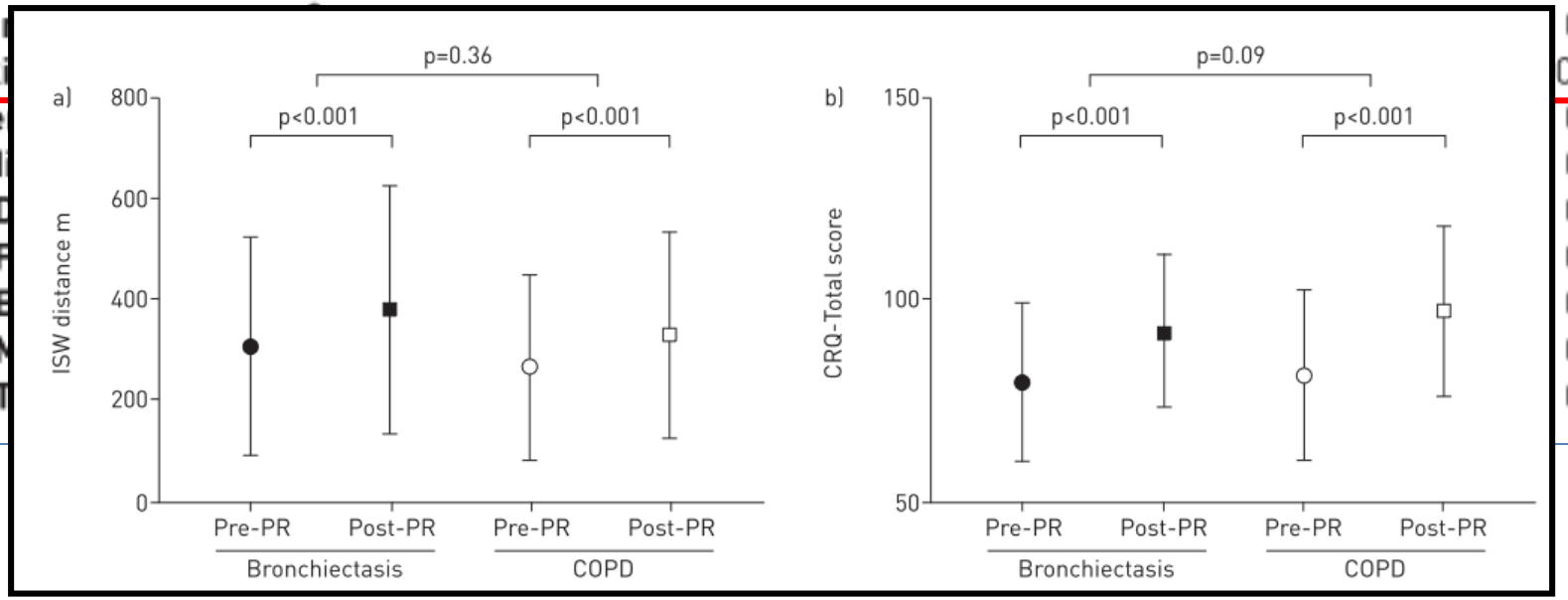
Completed PR (n=157, 74%)

- 8-week PR, 2+1 sessions/week
- Exercise training 1 hour (aerobic walking and cycling)
- Education 45-60 min

Completed PR (n=157, 74%)

Pulmonary rehabilitation in bronchiectasis: a propensity-matched study

	Bronchiectasis	COPD	p-value
Subjects	157	157	
ISW distance m	70 (58–84)	63 (50–76)	0.36
CRQ-Dyspnoea score	4.8 (3.8–5.8)	5.3 (4.5–6.4)	0.27
CRQ-Fatigue score	2.1 (1.5–2.8)	3.3 (2.6–4.0)	0.02
CRQ-Emotional Function score	3.5 (2.3–4.7)	4.6 (3.4–5.7)	0.22
CRQ-Mastery score	2.3 (1.5–3.0)	2.9 (2.1–3.6)	0.26
CRQ-Total score	12.8 (9.9–15.6)	16.2 (13.5–18.9)	0.09



Pulmonary Rehabilitation in Individuals With Bronchiectasis: A Systematic Review

- Supervised outpatient 8 weeks PR
- Benefits:
  - Exercise capacity
  - HRQoL
  - Frequency of exacerbations
- Benefits sustain: 6 months.

Summary

Indication of PR:

- Subjects with dyspnea, poor QoL, limitations in activities

Components of PR:

- Exercise training , respiratory muscle training, airway clearance

The benefits of PR:

- Exercise capacity, breathlessness, fatigue and acute exacerbation

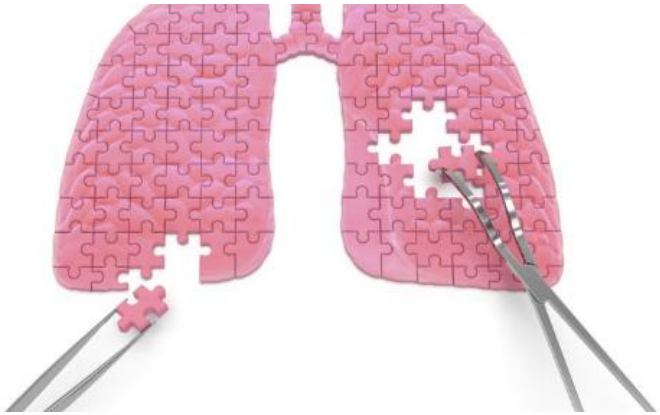
EDITORIAL
INFECTION AND BRONCHIECTASIS

Pulmonary rehabilitation for bronchiectasis: if not now, when?

Mark L. Metersky[1] and Richard L. ZuWallack[2]

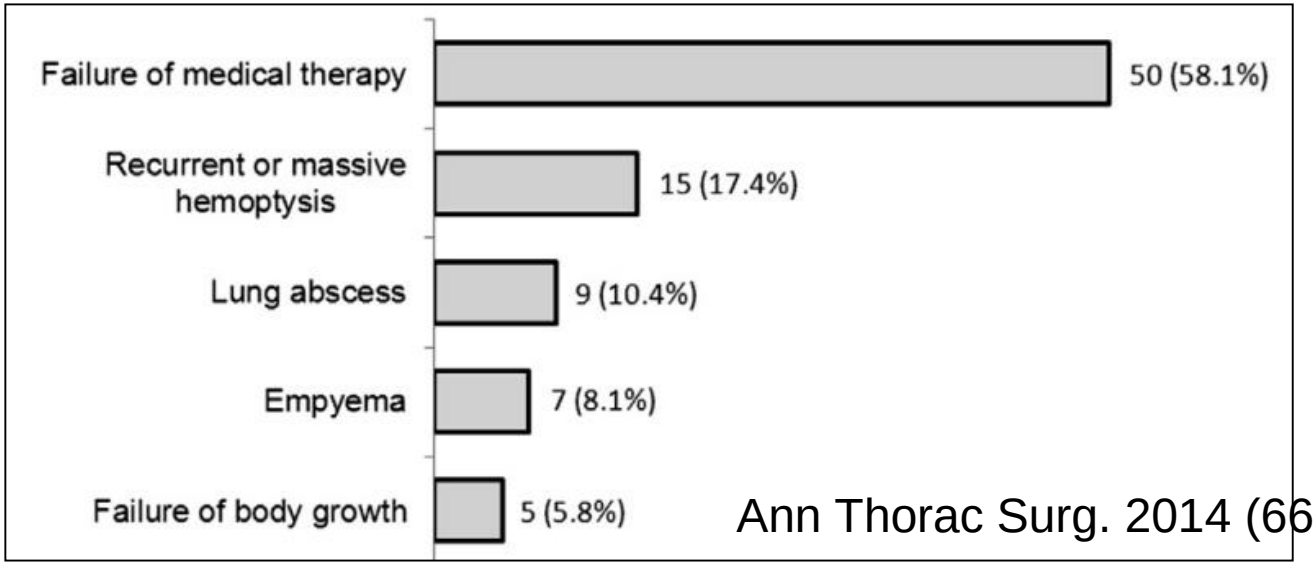
Eur Respir J 2019; 53: 1802474

Surgery for Bronchiectasis



Surgery for bronchiectasis

- Indication for surgery (BTS guideline, Thorax. 2019)
  1. Persistent symptoms (up to a year of medical treatment)
  2. Severe or frequent exacerbations
  3. Recurrent refractory or massive hemoptysis
  4. Post obstruction bronchiectasis distal to tumors
  5. Localized severely damaged lobe/segment (source of sepsis)



Ann Thorac Surg. 2014 (66 patients)

Analysis of surgery for bronchiectasis

First author [ref.]	Study period	Patients n	Age years	Males	Left-sided disease	Complete resection	Operative mortality
Dogan [9]	1976–1988	487	25.5 (2–56)	57	64	Not stated	3.5
Agasthian [5]	1976–1993	134	48 (4–89)	41	Not stated	80.6	2.2
Fujimoto [10]	1990–1997	90	44.7 (9–75)	49	59	83.3	0
Prieto [13]	1988–1999	119	42.2 (11–77)	40	Not stated	90.8	0
Kutlay [12]	1990–2000	166	34.1 (7–70)	45	59	88.5	1.7
Balkanli [8]	1992–2001	238	23.7 (15–48)	86	Not stated	64.7	0
Gursoy [11]	2002–2007	92	38.7 (10–67)	41	74	90.2	1.1
Bagheri [7]	1985–2008	277	34.7 (8–65)	72	70	82.7	0.7
Zhang [22]	1989–2008	790	41.6 (6–79)	59	Not stated	89	1.1

First author [ref.]	Lobectomy	Pnemonectomy	Segementectomy/ wedge	Lobectomy + segment	Bilobectomy
Dogan [9]	41.5	39	0	14.8	4.7
Agasthian [5]	64.2	15.7	13.4	6.7	0
Ashour [6]	64.7	16.5	18.8	0	0
Fujimoto [10]	54.3	6.5	33.7	0	5.4
Prieto [13]	62	8	13	14	3
Kutlay [12]	63.4	7.5	12.2	10.5	6.4
Balkanli [8]	79.4	5.5	2.1	13	0
Gursoy [11]	39.1	10.9	Not stated	34.8	Not stated
Bagheri [7]	42.2	7.9	6.5	23.5	19.9
Zhang [22]	62.9	11.3	4.7	14	7.1

Eur Respir Mon 2011

Analysis of surgery for bronchiectasis

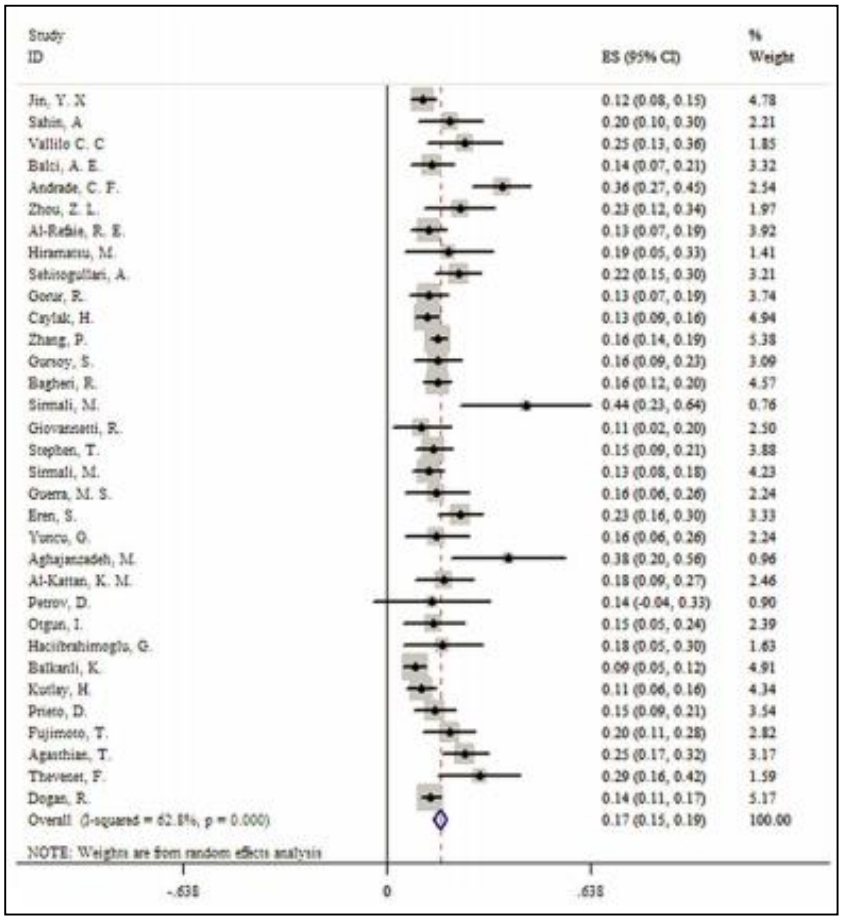
First author [ref.]	Prolonged air leak/space issues	Atelectasis	Empyema/ BPF	Wound infection	Bleeding	Arrhythmia	Overall morbidity
Dogan [9]	0	1.4	1.8	7.4	0	0	10.6
Agasthian [5]	4.5	6.7	4.5	0	3	2.2	24.6
Fujimoto [10]	5.6	6.7	6.7	0	1.1	0	19.6
Prieto [13]	5.9	0	0	0	3.4	3.4	12.6
Kutlay [12]	1.7	2.3	1.2	0	1.7	0	11.4
Balkanli [8]	2.5	2.9	1.7	0	1.7	0	8.8
Gursoy [11]	9.8	3.2	0	3.3	0	0	16.3
Bagheri [7]	3.2	3.6	3.2	5.7	0	0	15.8
Zhang [22]	2.7	2	1	0	1.1	4	16.2

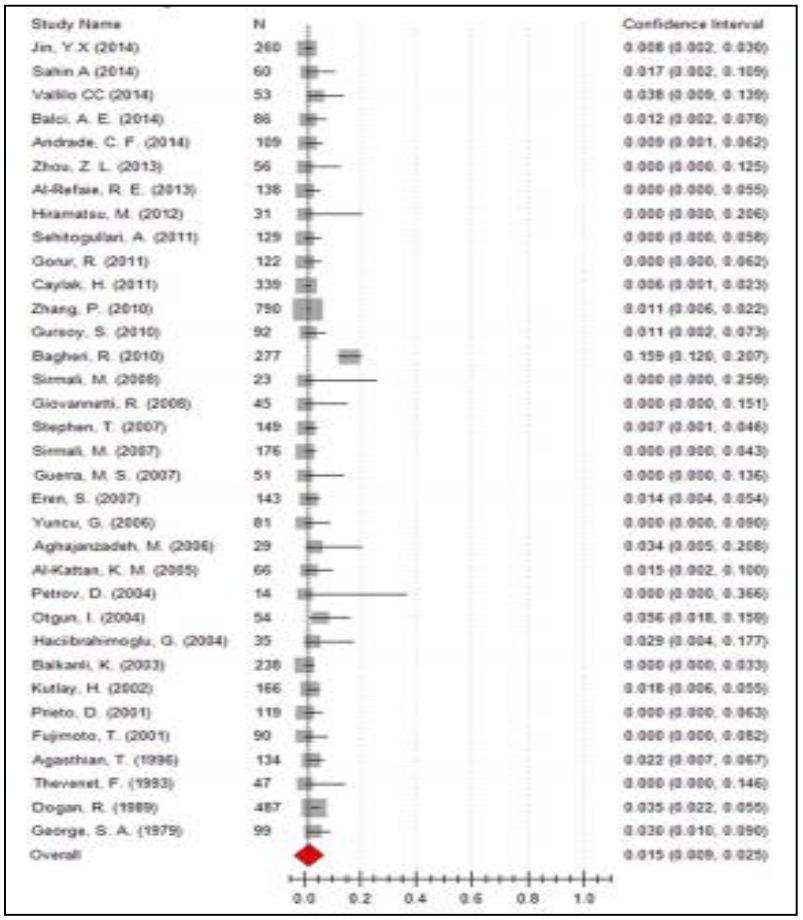
First author [ref.]	Mean follow-up time years	% Follow-up	Asymptomatic	Symptomatic improvement	No change in symptoms/worse
Dogan [9]	4.6	Not stated	71	Not stated	Not stated
Agasthian [5]	6	76.9	45.5	22.4	9
Ashour [6]	3.8	100	74.1	22.4	3.5
Fujimoto [10]	6.1	87.8	40	33.3	14.5
Prieto [13]	4.5	90.8	61.3	26.1	3.4
Kutlay [12]	4.2	89.2	66.9	18.7	3.6
Balkanli [8]	0.75	96.2	79.4	12.2	4.6
Gursoy [11]	1.3	81.5	68.5	8.7	4.3
Bagheri [7]	4.5	100	68.5	23.8	7.5
Zhang [22]	4.2	89.4	60.5	14.1	14.8

Eur Respir Mon 2011

Efficiency and safety of surgical intervention to patients with NonCystic Fibrosis bronchiectasis: a meta-analysis

Sci Rep. 2015



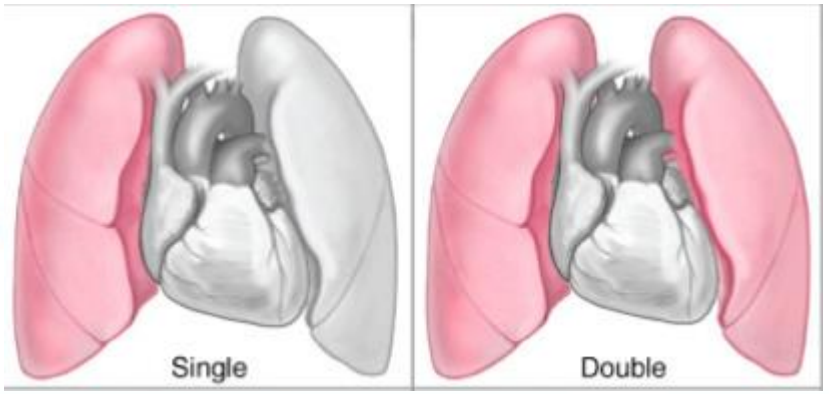


Morbidity from 33 studies (4583 patients): 16.7% (95% CI, 14.8–18.6%).

Mortality from 34 studies (4788 patients): 1.5% (95% CI, 0.9–2.5%).

Free of symptoms: 66.5% (95% CI, 61.3–71.7%); improved: 27.5% (95% CI, 22.5–32.5%)

Lung transplantation for Bronchiectasis



Guidelines for lung transplantation in **diffuse** bronchiectasis

Guidelines for referral to a transplant centre	FEV_1 <30% predicted or a rapid decline in FEV_1, particularly in young female patients
	Exacerbation of pulmonary disease requiring ICU stay
	Increasing frequency of exacerbations requiring antibiotic therapy
	Refractory and/or recurrent pneumothorax
	Recurrent haemoptysis not controlled by embolisation
Guidelines for transplantation	Progressive decline in lung function
	Oxygen-dependent respiratory failure
	Hypercapnia
	Pulmonary hypertension

Eur Respir Mon 2011

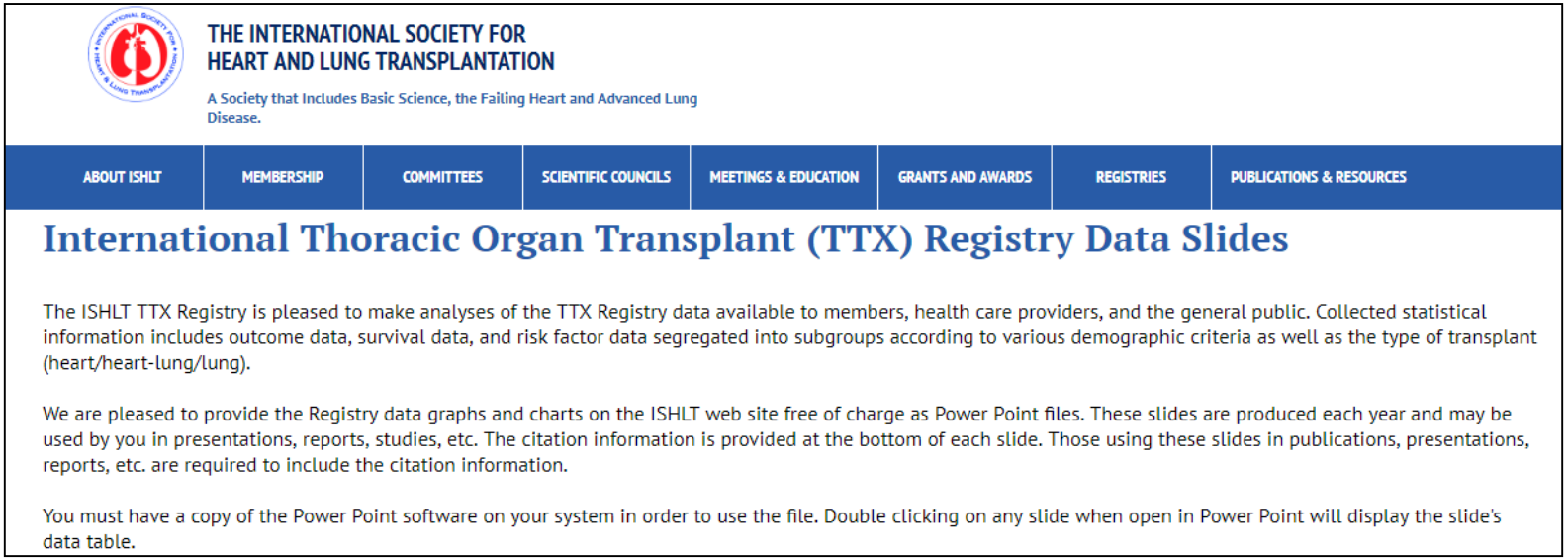
Generally lung transplantation is indicated where survival is anticipated at 50% at 2 years without lung transplantation

Procedures of for lung transplantation in diffuse bronchiectasis
1) Bilateral transplantation.
2) Single lung transplantation + contralateral pneumonectomy.

Thorax. 2019

Overall indication of lung transplantation (international registry)

- < 1200 for bronchiectasis
- 1280 for pulmonary hypertension
- 6862 for cystic fibrosis
- 13672 for COPD



THE INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION

A Society that Includes Basic Science, the Failing Heart and Advanced Lung Disease.

ABOUT ISHLT | MEMBERSHIP | COMMITTEES | SCIENTIFIC COUNCILS | MEETINGS & EDUCATION | GRANTS AND AWARDS | REGISTRIES | PUBLICATIONS & RESOURCES

International Thoracic Organ Transplant (TTX) Registry Data Slides

The ISHLT TTX Registry is pleased to make analyses of the TTX Registry data available to members, health care providers, and the general public. Collected statistical information includes outcome data, survival data, and risk factor data segregated into subgroups according to various demographic criteria as well as the type of transplant (heart/heart-lung/lung).

We are pleased to provide the Registry data graphs and charts on the ISHLT web site free of charge as Power Point files. These slides are produced each year and may be used by you in presentations, reports, studies, etc. The citation information is provided at the bottom of each slide. Those using these slides in publications, presentations, reports, etc. are required to include the citation information.

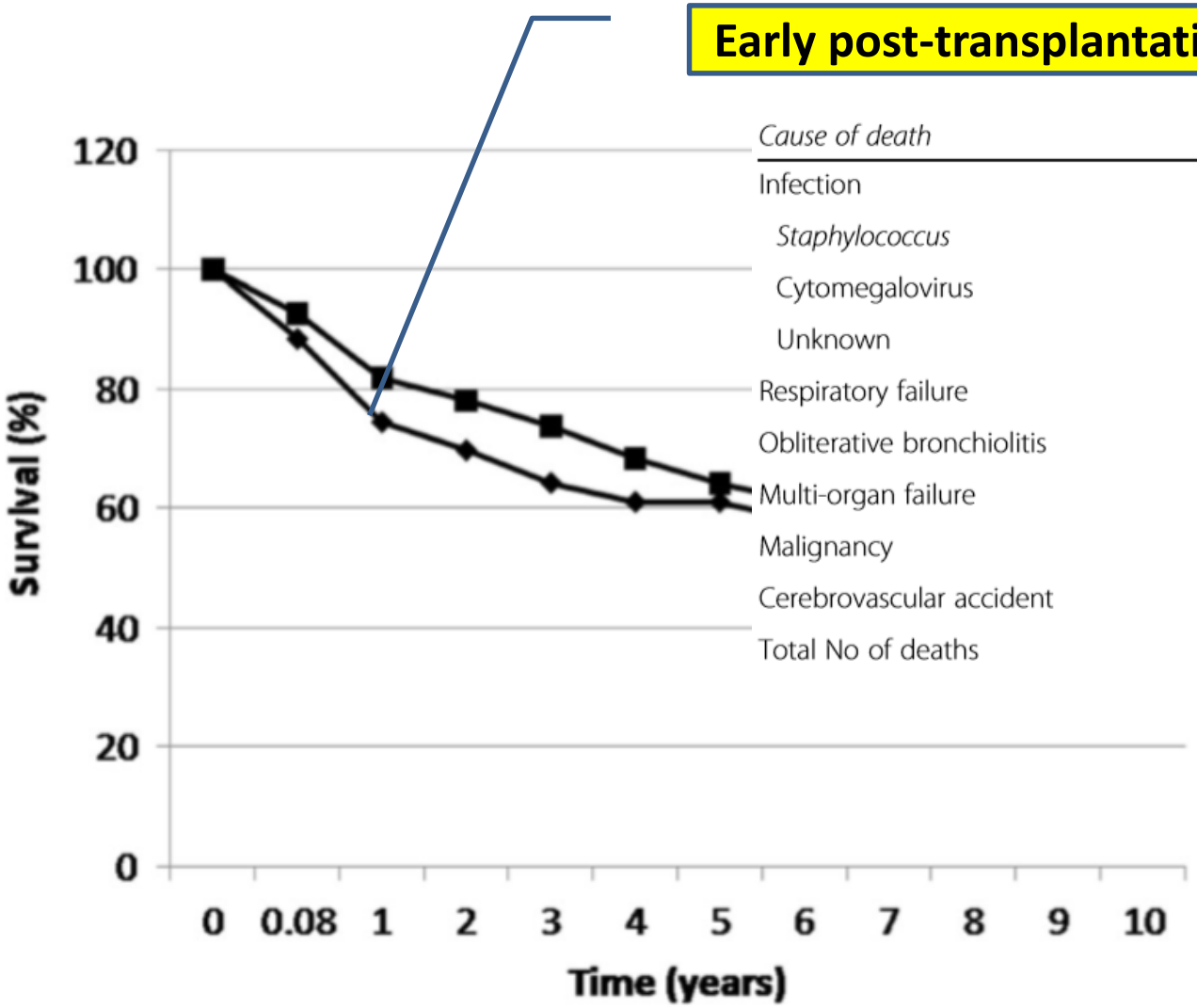
You must have a copy of the Power Point software on your system in order to use the file. Double clicking on any slide when open in Power Point will display the slide's data table.

Outcomes of lung transplantation in adults with bronchiectasis

- A retrospective review, between 1990 and 2013.
- 42 patients underwent lung transplantation
- Majority having bilateral sequential lung transplantation.
- Mean age 47.1 years
- pre-transplantation FEV_1 0.71 ± 0.27 (22 % predicted)
- 32 in respiratory failure (89 %) and on long-term oxygen therapy.

BMC Pulm Med. 2018 May 22;18(1):82

Early post-transplantation deaths ➔ sepsis



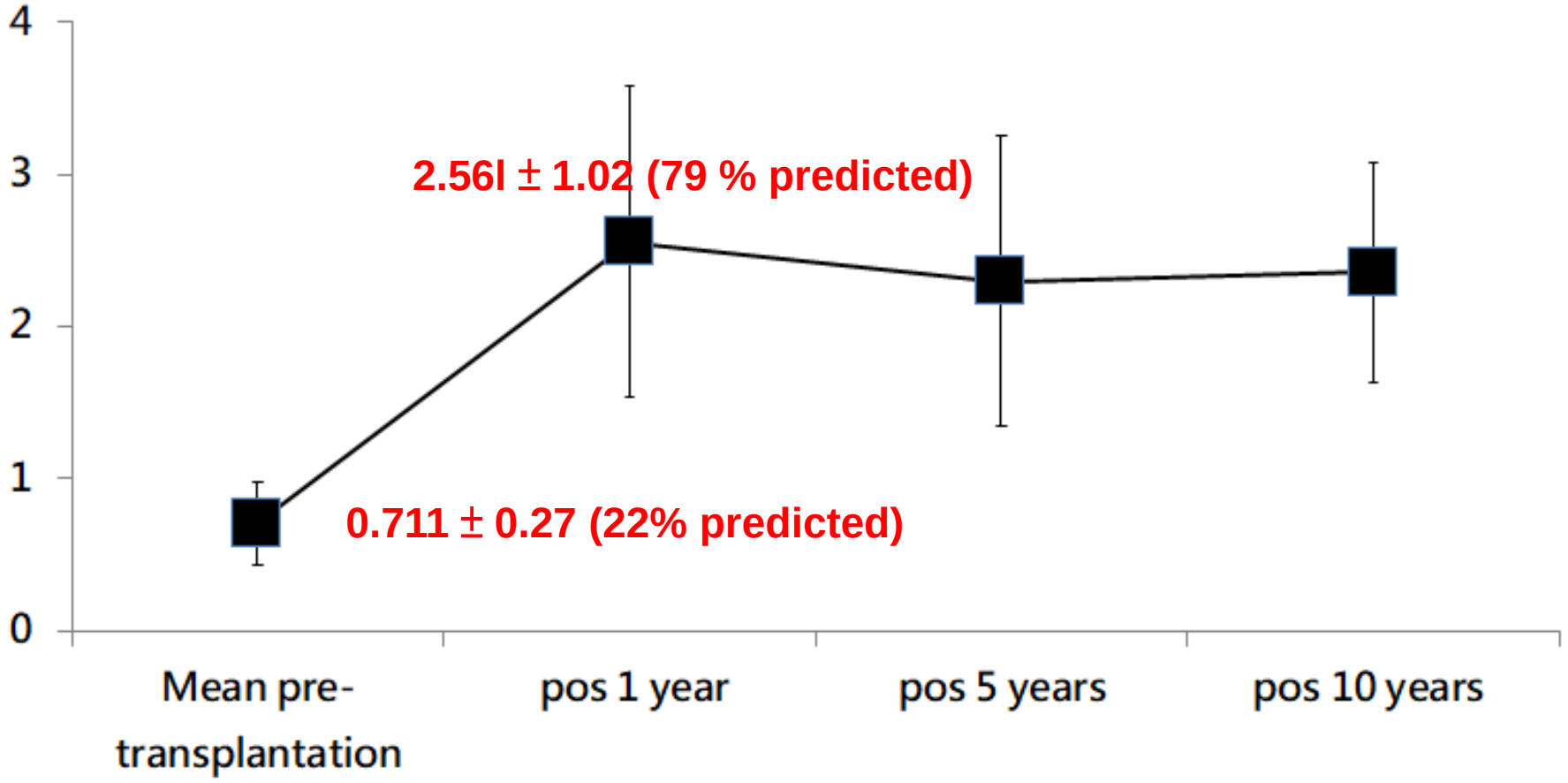
Cause of death	*No of patients (%)*
Infection	5 (38)
Staphylococcus	2 (15)
Cytomegalovirus	1 (8)
Unknown	2 (15)
Respiratory failure	2 (15)
Obliterative bronchiolitis	2 (15)
Multi-organ failure	2 (15)
Malignancy	1 (8)
Cerebrovascular accident	1 (8)
Total No of deaths	13 (100)

Survival results:

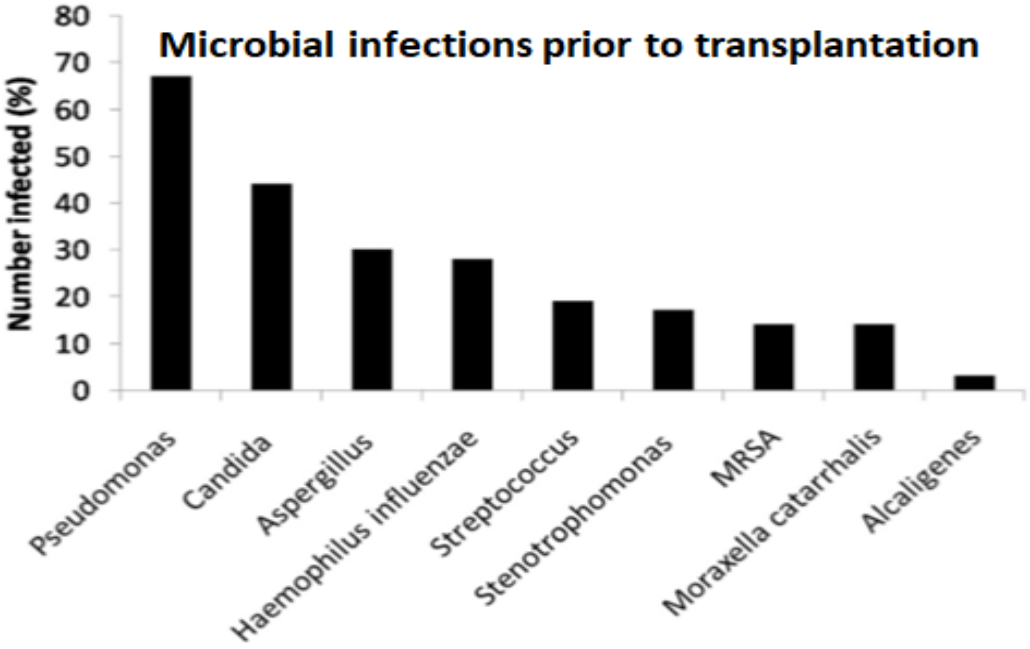
74% at 1 year, 64% at 3 years, 61% at 5 years and 48% at 10 years.

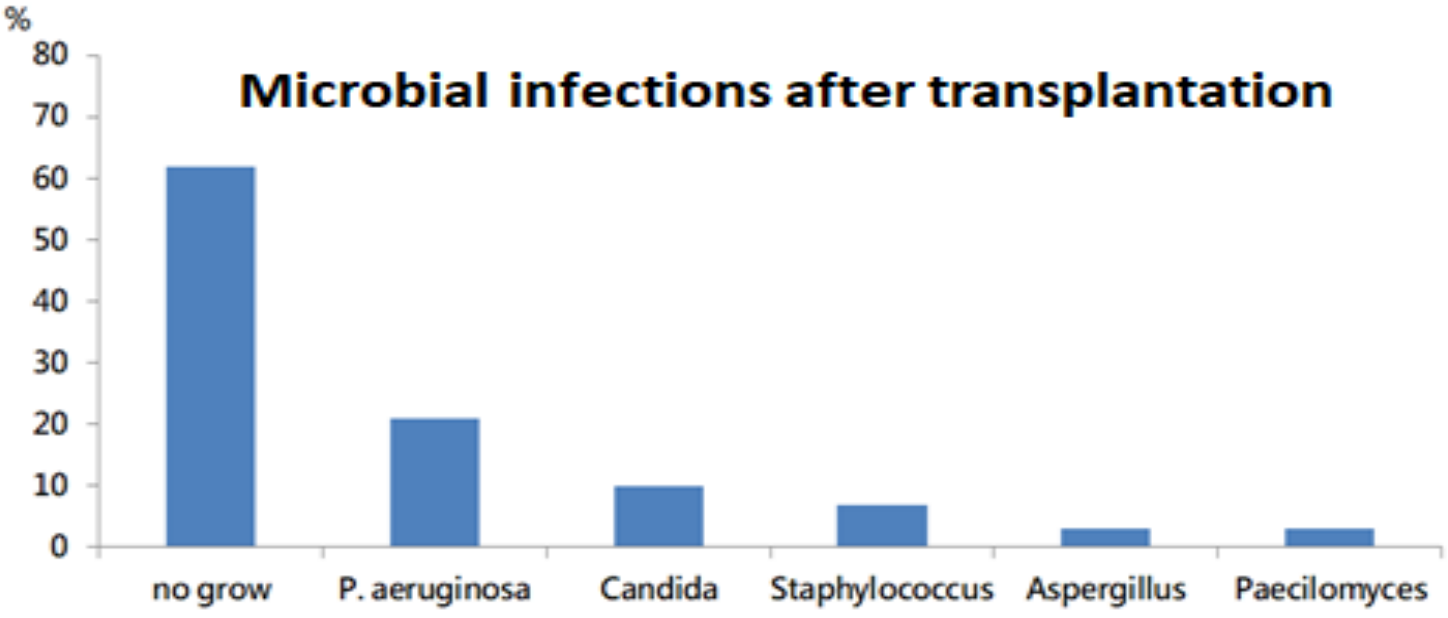
BMC Pulm Med. 2018 May 22;18(1):82

Pre- and post-transplantation FEV1 (L/min)



BMC Pulm Med. 2018 May 22;18(1):82

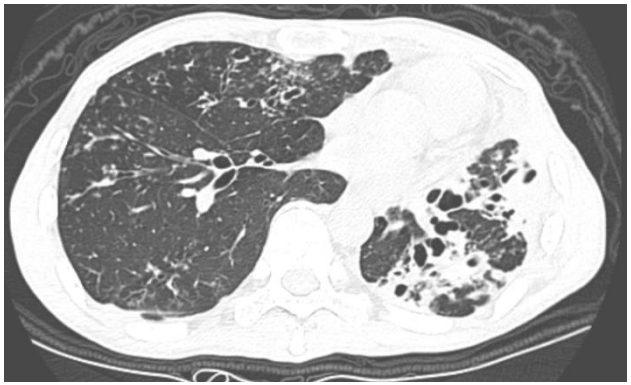

Microbial infections prior to transplantation
Number infected (%)
80
70
60
50
40
30
20
10
0
Pseudomonas
Candida
Aspergillus
Haemophilus influenzae
Streptococcus
Stenotrophomonas
MRSA
Moraxella catarrhalis
Alcaligenes


%
Microbial infections after transplantation
80
70
60
50
40
30
20
10
0
no grow
P. aeruginosa
Candida
Staphylococcus
Aspergillus
Paecilomyces


Case sharing

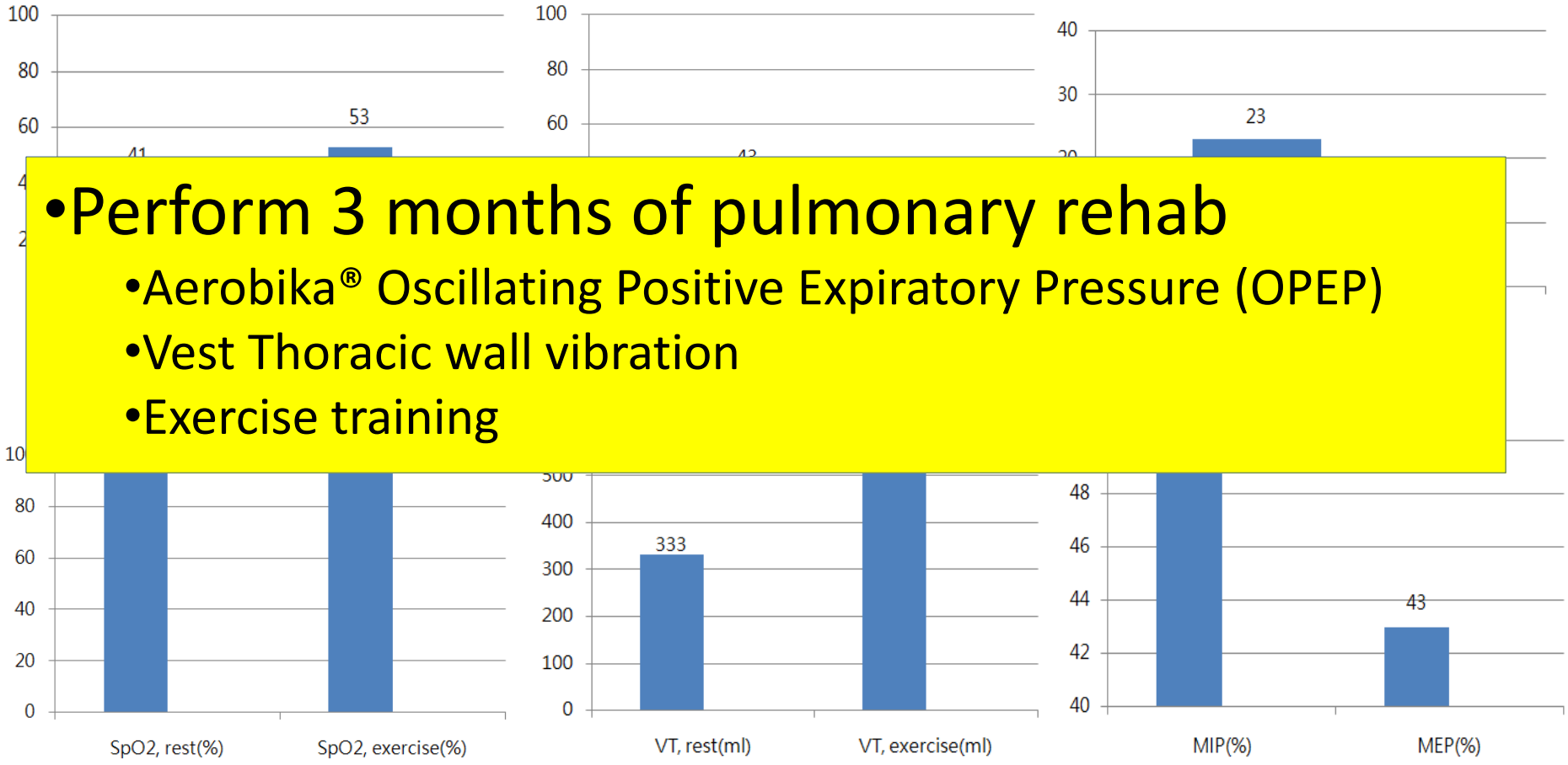
64 year-old male:

- Cough with purulent sputum
- Exertional dyspnea
- Frequent fever and infection



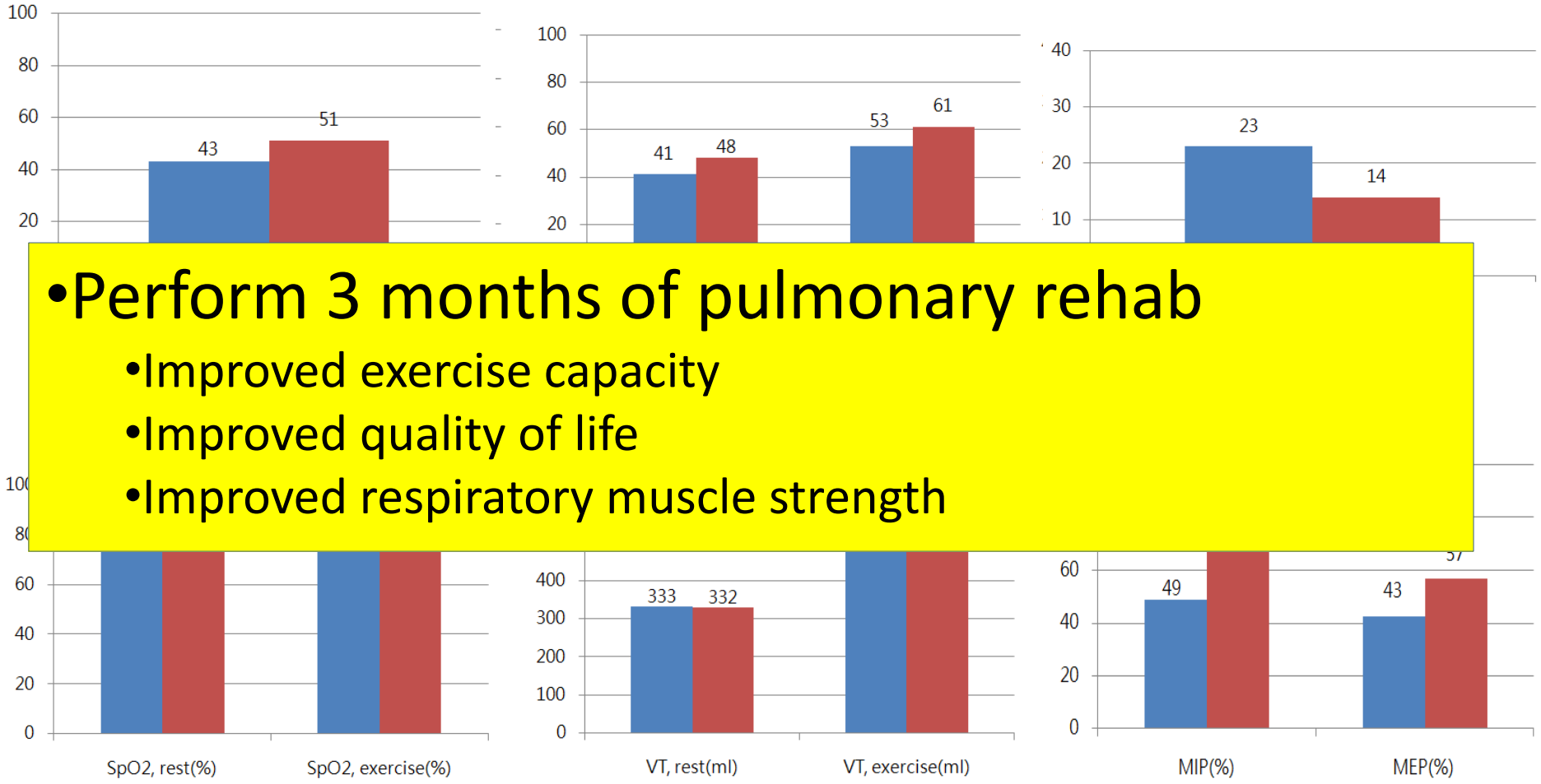
	Actual	Pred	%Pred
---- SPIROMETRY ----			
FVC (L)	1.59	3.49	45
FEV1 (L)	1.59	2.79	57
FEV1/FVC (%)	100		
FEF 25% (L/sec)	5.76	5.63	102
FEF 75% (L/sec)	1.42	1.25	113
FEF 25-75% (L/sec)	3.33	2.89	115
FEF Max (L/sec)	5.95	7.56	78
FIVC (L)	0.08		
FIF Max (L/sec)			
IC (L)	1.12	3.01	37
SVC (L)	1.82	3.49	52
MVV (L/min)	64	122	52

Poor exercise capacity and quality of life



- Perform 3 months of pulmonary rehab
  - Aerobika® Oscillating Positive Expiratory Pressure (OPEP)
  - Vest Thoracic wall vibration
  - Exercise training

Pulmonary rehabilitation improved exercise capacity and quality of life



- Perform 3 months of pulmonary rehab
  - Improved exercise capacity
  - Improved quality of life
  - Improved respiratory muscle strength

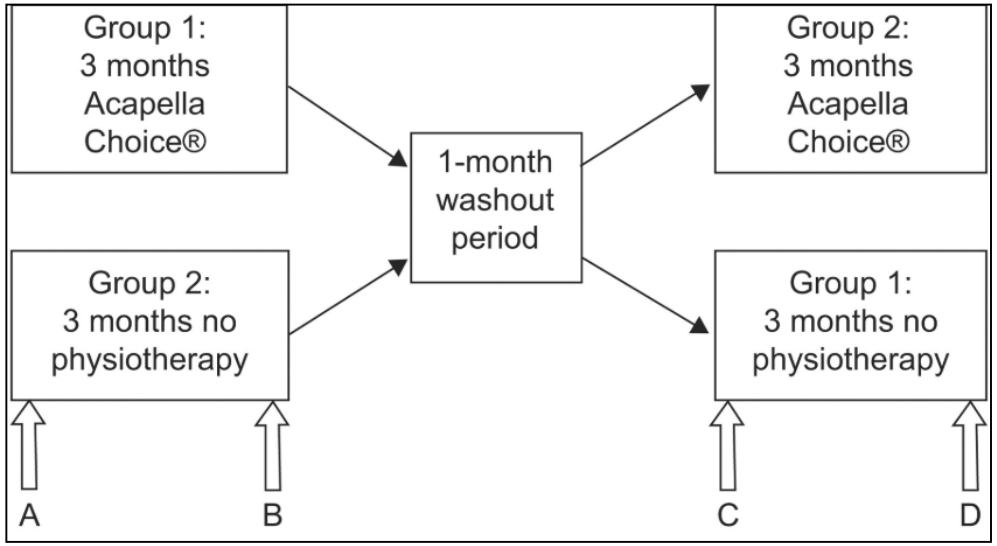
Chest physiotherapy

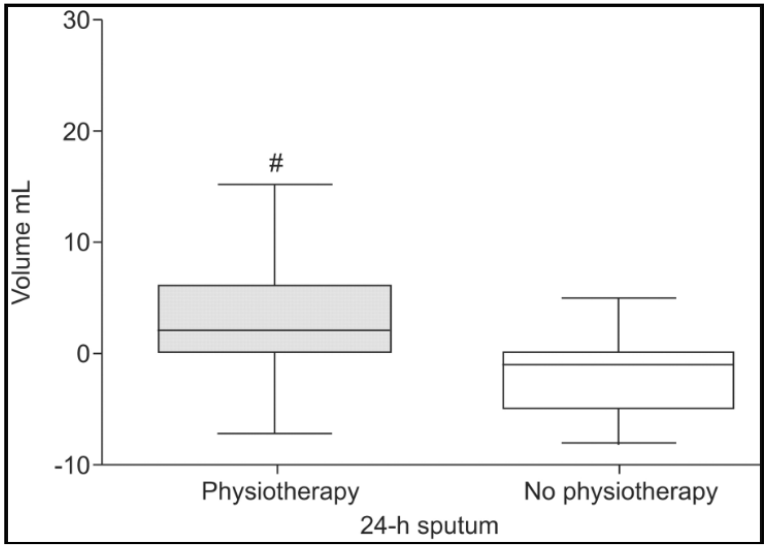
- Mucus problems
  - Positioning
    - Postural drainage
  - Expiratory Flow modification
    - Slow expiration
      - AD
      - ELTGOL
    - Forced expiration
      - ACBT
      - Cough
      - Huffing
  - Instrumental techniques
    - PEP
      - PEP mask
      - T-PEP
    - Oscillatory PEP
      - Flutter
      - Acapella
      - HFCWO
- Exercise intolerance
  - Aerobic training
  - Strength training
  - Physical activity Counseling
- Respiratory/ Muscle weakness
  - Inspiratory muscle training

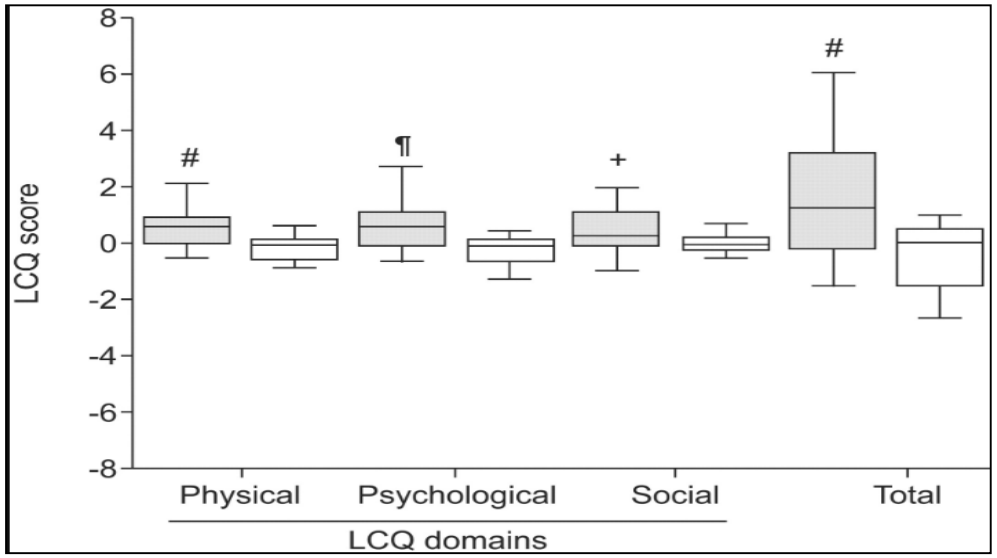
Eur Respir J 2017

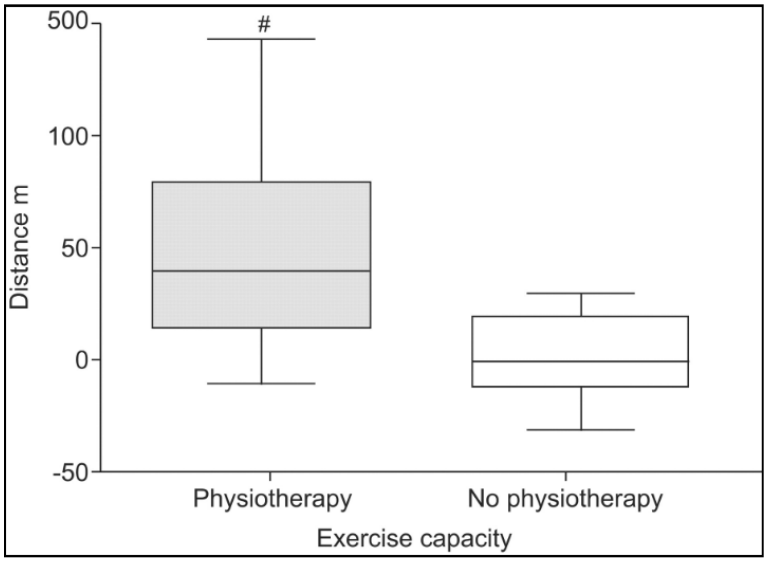

Thank You
For Your Atten

A randomised crossover trial of chest physiotherapy in bronchiectasis







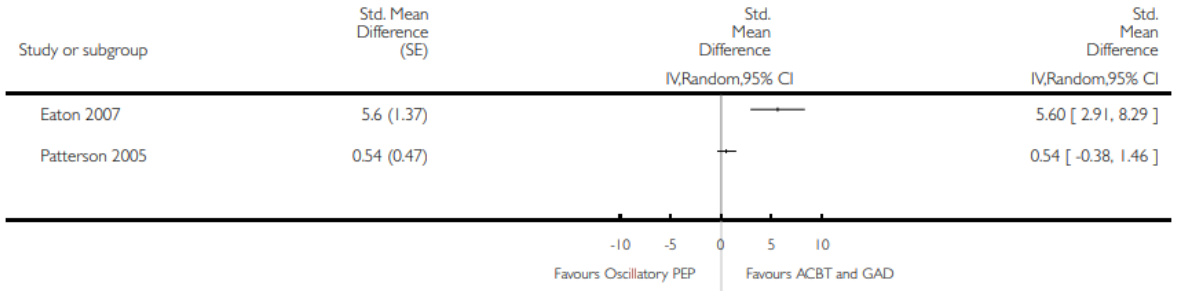


Eur Respir J. 2009

Positive expiratory pressure therapy versus other airway clearance techniques for bronchiectasis

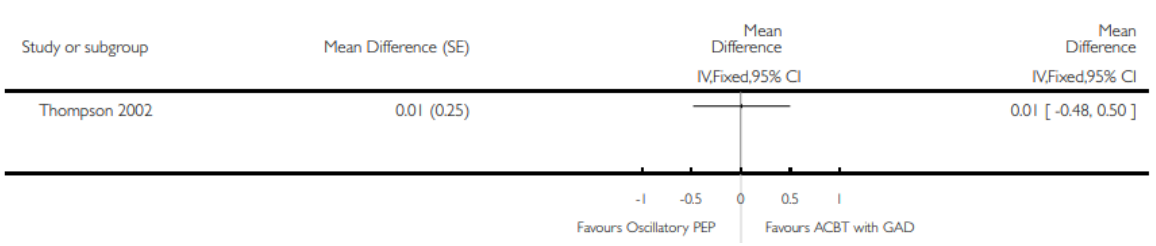
- Oscillatory PEP therapy twice daily for four weeks
- ACBT with GAD when applied daily for four weeks
- Stable or during AE
- Single session or long-term clinical effects

Sputum weight (g)

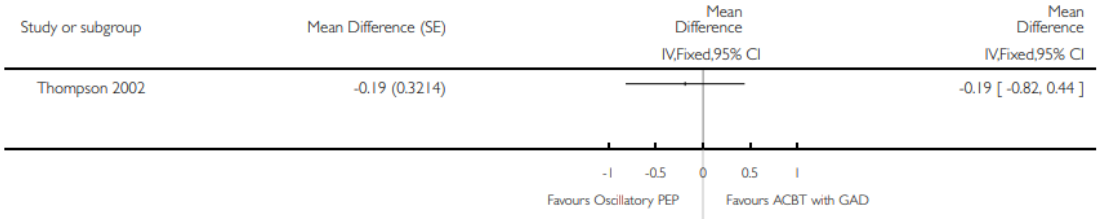


Cochrane Database Syst Rev. 2017

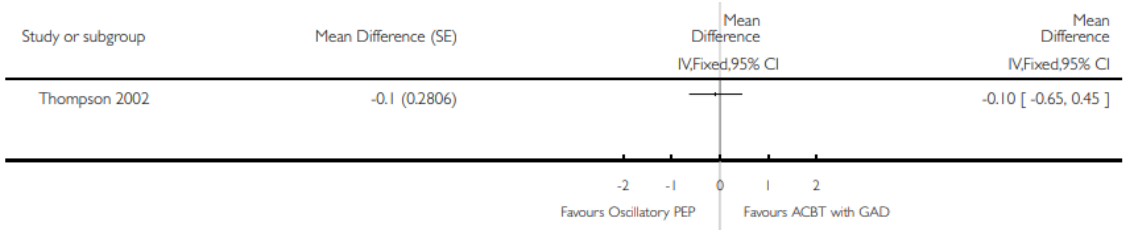
CRQ Dyspnoea score.



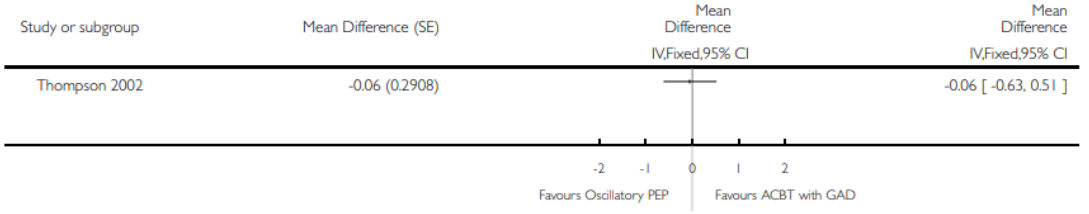
CRQ Fatigue score



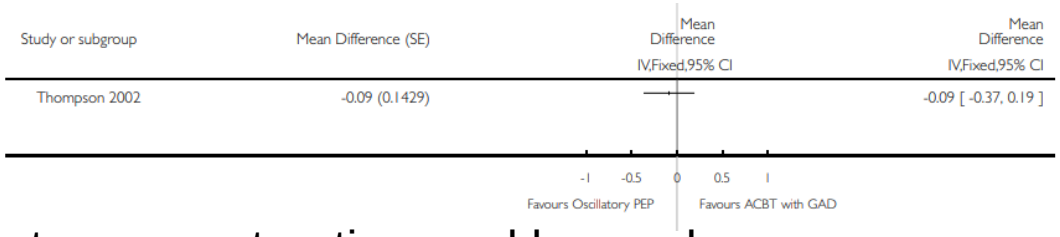
CRQ Mastery score



CRQ Emotional function score



CRQ Total score



OPEP vs ABCT+GAT

- similar effects on HRQOL, sputum expectoration, and lung volumes
- when prescribed within a stable clinical state or during an acute exacerbation.

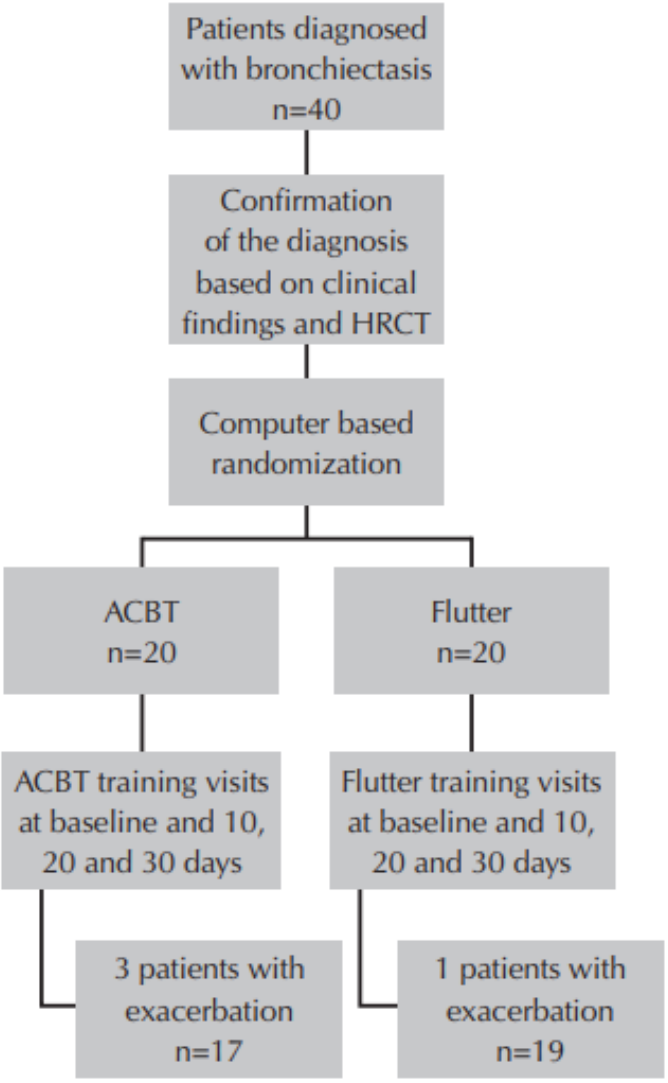
Cochrane Database Syst Rev. 2017

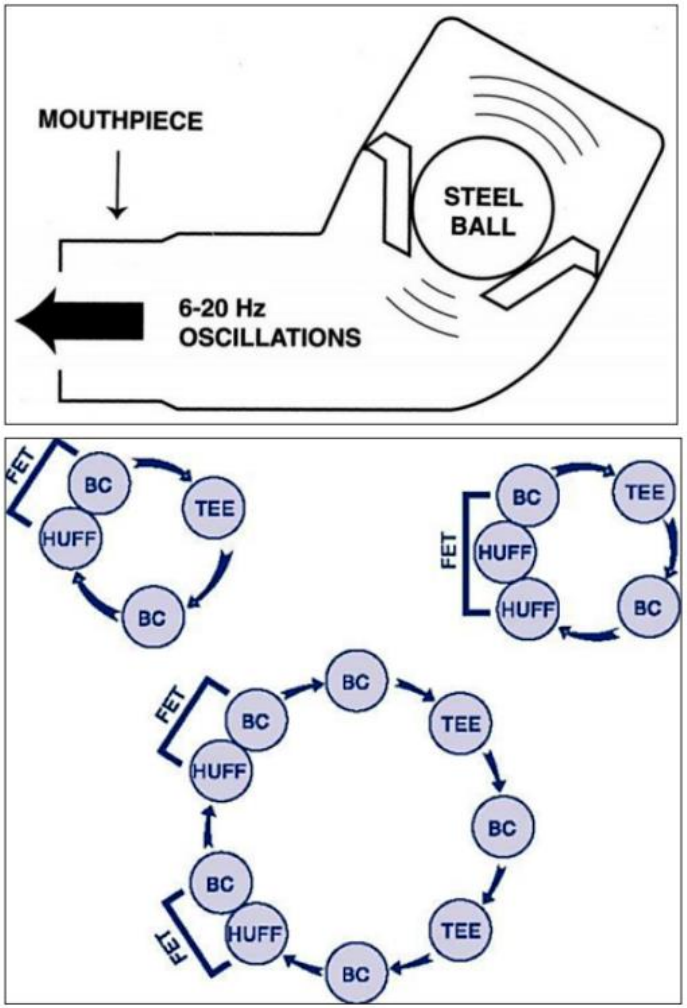
Active Cycles of Breathing Technique (ACBT) versus conventional chest physical therapy

- A randomized crossover single intervention study by Syed et al
- compared ACBT to conventional chest physical therapy (CPT)
  - Both groups completed 10–15 min of postural drainage (PD) prior to their intervention.
  - No significant differences in
    - sputum weight, sputum volume
    - FEV1 and FVC.
  - ACBT more comfortable

Adv Physiother 2009;11:193–8

The Efficacy of Flutter® and Active Cycle of Breathing Techniques in Bronchiectasis: A Prospective, Randomized, Comparative Study





Turk Thorac J. 2018 Jul;19(3):103-109

Distribution of patients with increased sputum after physiotherapy

	ACBT (n:17)		Flutter (n:19)	
	After physiotherapy (n)	p	After physiotherapy (n)	p
Sputum increase	4	*0.004	5	*0.003

Changes in symptoms after physiotherapy in study groups

	ACBT (n:17)			Flutter (n:19)		
	Before physiotherapy (n)	After physiotherapy (n)	p	Before physiotherapy (n)	After physiotherapy (n)	p
Cough	14	4	*0.002	10	5	0.13
Wheezing	5	2	0.38	8	8	1.0
Fatigue	11	7	0.22	12	4	*0.021

Turk Thorac J. 2018 Jul;19(3):103-109