Pulmonary Rehabilitation

Presented by:

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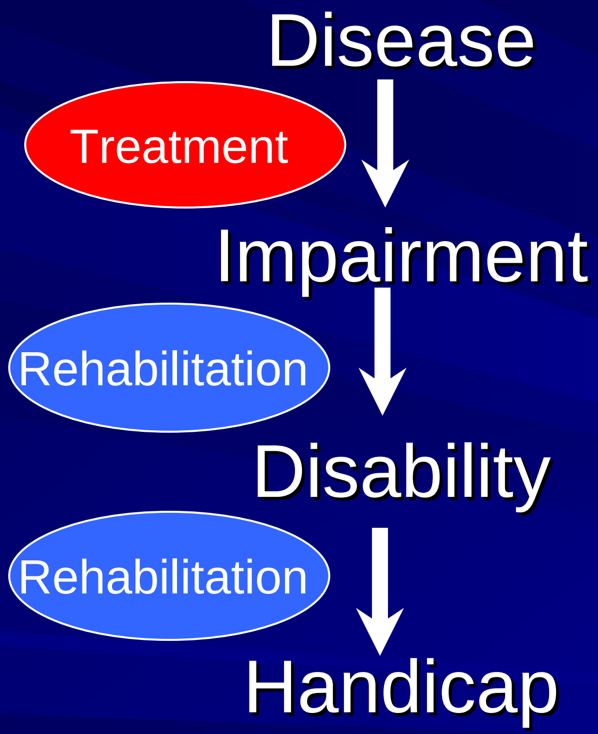
Rehabilitation



Pulmonary Rehabilitation

Art of medical practice wherein individually tailored multidisciplinary program is formulated, which through accurate diagnosis, therapy, emotional support and education stabilizes or reverses both physio and psychopathology of pulmonary disease in attempts to return the patient to highest possible functional capacity allowed by pulmonary handicap and overall life situation

American College of Chest Physicians, 1974

American Thoracic Society 1981

ATS – ERS definition (2005)

Evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities.

Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health care costs through stabilizing or reversing systemic manifestations of the disease

History

Charles Denison 1895

After recovery from PTB

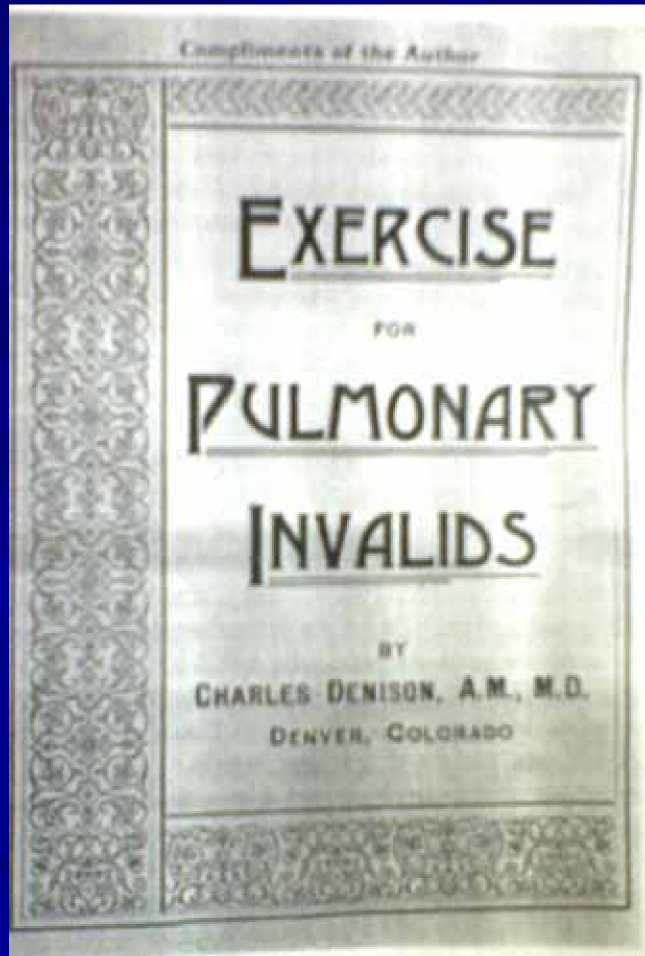
Walking each day

- Made him feel better
- Increased exercise tolerance
- Reduced respiratory and pulse rate

Albert Haas 1932

Carrying heavy books

- Noticed weight gain
- Feeling of well being


Compliments of the Author

EXERCISE

FOR

PULMONARY

INVALIDS

BY

CHARLES DENISON, A.M., M.D.

DENVER, COLORADO

History

1965: Eighth (Thomas L. Petty) Aspen emphysema conference COPD is not a hopeless and inexorably progressive disease and is amenable to emerging therapies

1969: Haas and Cordon first showed benefits of pulmonary rehabilitation over conventional therapy in a cohort study

1974: ACCP definition of pulmonary rehabilitation

1979: Detailed monograph on pulmonary rehabilitation by ACCP in *JAMA*

Aims of Pulmonary Rehabilitation

- Increase exercise tolerance and reduce dyspnea
- Increase muscle strength and endurance (peripheral and respiratory)
- Improve health related quality of life
- Increase independence in daily functioning
- Increase knowledge of lung condition and promote self management
- Promote long term commitment to exercise

Essentials of Pulmonary Rehabilitation

– Exercise training

– Education

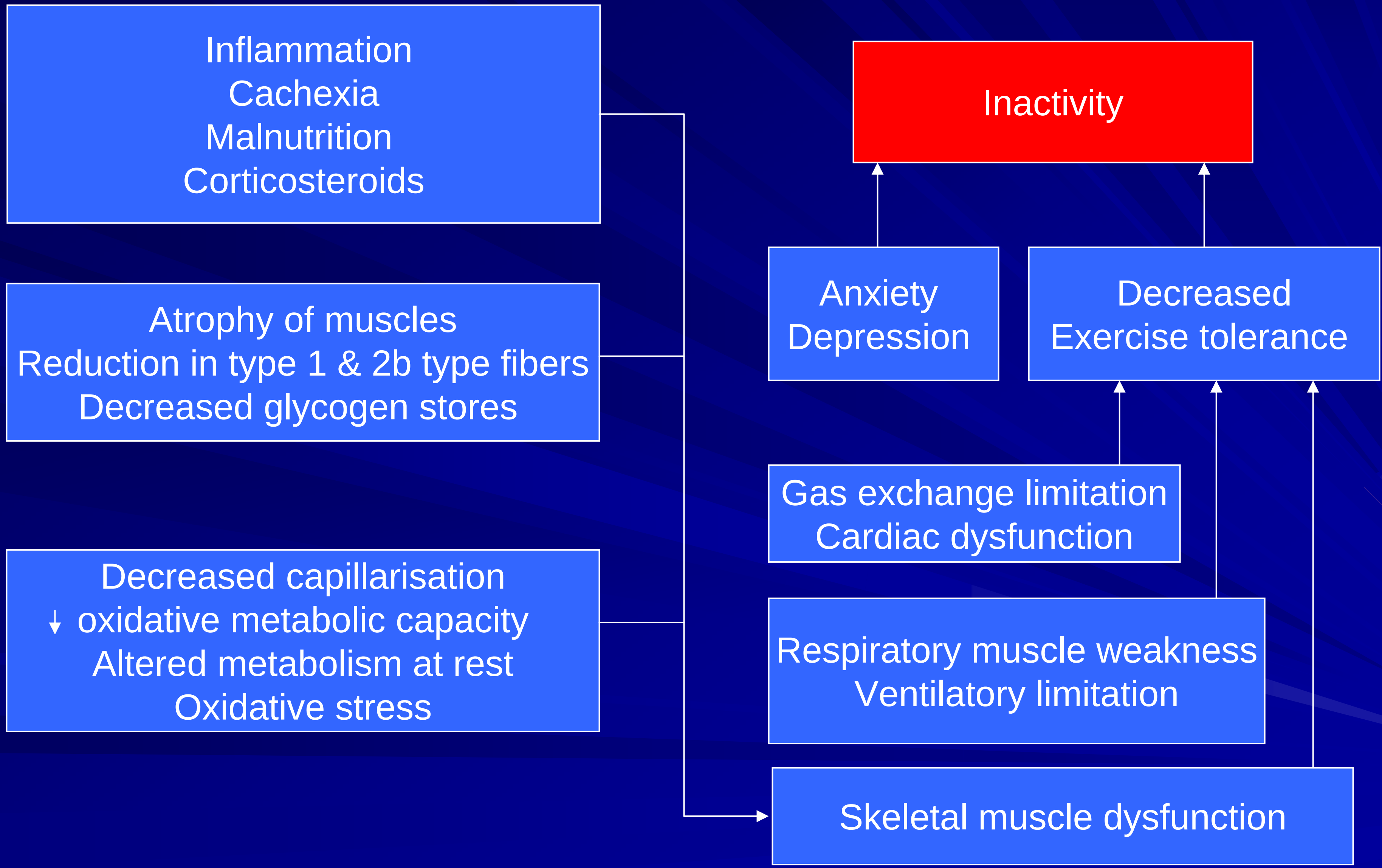
– Nutritional therapy

– Psychosocial / Behavioural intervention

– Outcome assessment

– Promotion of long-term adherence

Pathophysiology



Exercise training

Benefits of Exercise training

Pathophysiological abnormality	Benefits of exercise training
Decreased lean body mass	Increases fat free mass
Decreased TY1 fibers	Normalizes proportion
Decreased cross sectional area of muscle fibers	Increases
Decreased capillary contacts to muscle fibers	Increases
Decreased capacity of oxidative enzymes	Increases
Increased inflammation	No effect
Increased apoptotic markers	No effect
Reduced glutathione levels	Increases
Lower intracellular pH, increased lactate levels and rapid fall in pH on exercise	Normalization of decline in pH

Exercise training

Benefits of exercise training (mainly endurance training) :

- Improves exercise tolerance
- Improve motivation for exercise
- Reduce mood disturbance
- Decreases dyspnea

- Strength training improves bulk and strength of muscles but does not add to overall exercise tolerance or health status

Exercise training

Components of exercise training:

- Lower extremity exercises
- Arm exercises
- Ventilatory muscle training

Types of exercise:

- Endurance or aerobic
- Strength or resistance

Lower extremity exercise

- Walking
- Treadmill
- Stationary bicycle
- Stair climbing

Benefits in COPD

- Increased work capability as assessed by incremental treadmill protocol, 6 min walking distance and 12 min walking distance *(1,2,3,9,10)*
- No increase in peak work rate or VO_2 max *(1-5)*
- 40 – 102% increase in endurance of maximal work rate *(6-8)*
- Decreased VO_2 at a given exercise level *(1)*
- Significant improvement in subjective assessment using Borg dyspnea scale *(9,10)*
- No changes in hemodynamics during exercise *(1)*

1.Chester EH. Chest 1977; 72:695-70
2.Mc Gavin CR. Thorax 1977; 32:307-11
3.Cockroft AE. Thorax 1981; 36:200-03
4.Buscke AJ. Phys Ther 1988; 68:469-74
5.Lake FR. Chest 1990; 97:1077-82
6.Weiner P. Chest 1992; 102:1351-56
7.Reardon J. Chest 1994; 105:1046-52
8.Goldstein RS. Lancet 1994;344:1394-97
9.Strijbos JH. Chest 1996; 109:366-72
10.Berry MJ. AJRCCM 1996; 153:1812-16

Intensity of exercise & benefits

- Achievements of exercise training are proportional to intensity of exercise
- Exercising at maximal tolerated intensity led to greater VO_2 max. and reduction in blood lactate levels at iso-exercise.

Giminez M. Arch Phys Med Rehabil. 2000;81:102-109

- Most of the patients with FEV_1 38 %(+/- 13) could achieve exercise intensity of >60% W_{max} (mean intensity was 60.4% W_{max}). But only 5/42 could reach 80% W_{max}.

% increase in W_{max} was not influenced by FEV 1 (same in FEV_1< 40 and FEV_1>40%)

Maltias F.Am J Respir Crit Care Med.1997;155:555-561

Arm exercise training

- Arm cycle ergometer
- Unsupported arm lifting
- Lifting weights

Potential benefits

- Has the potential to improve arm exercise performance by decreasing ventilatory demand during arm work, and by improving arm endurance.

- Arm training improves the ventilatory contribution of those muscles by increasing shoulder girdle muscle strength.

Banzett RB. Am Rev Respir Dis 1988; 138:106-09

COPD: What does evidence say?

- Increases exercise capacity of the arms.

Belman MJ. Am Rev Respir Dis 1981;123:256-61

- Decreases metabolic and ventilatory demand for similar arm work (measured by Vo_2)

Couser JI Jr. Chest 1993;103:37–41
Epstein SK. J Cardiopulm Rehabil 1997;17:171–177
Martinez FZ. Chest 1993;103:1397-1402

- No significant effect on outcomes, such as functional status and performance when arm training used alone.

Lake FR Chest 1990; 97:1077-82
Ries AL. Chest 1988; 93:688-92
Bernard S. Am J Respir Crit Care Med1999;159(3):896-901

Strength exercise

When strength exercise was added to standard exercise protocol led to greater increase in muscle strength and muscle mass

But **NO additional benefit** in:

- Exercise capacity as assessed by 6MWD
- HRQOL
- Physiological parameters of heart rate or blood lactate levels

Bernard M. Am J Respir Ctir Care Med.1999;139:896-901

Ventilatory muscle training

Resistive IMT:

Patient breaths through hand held device with which resistance to flow can be increased gradually

- Difficult to standardize the load
- Patients may hypoventilate.
- Leads to increased Pulm. Atr. Pressure and fall in oxygen tension

Threshold IMT:

Patient breaths through a device equipped with a valve which opens at a given pressure.

- Easily quantitated and standardized

Ventilatory muscle training

Isocapnic hyperventilation:

- Patient hyperventilates into a rebreathing bag so as to maintain pH.
- Cumbersome and requires CO2 tension monitoring.
- Predominantly a research tool and not for routine clinical use

- Meta-analysis of 17 RCTs, demonstrated overall lack of positive treatment effect. But adequate training loads (an intensity of at least 30% of PImax) had showed improvements in respiratory muscle strength and endurance.

Smith K. Am Rev Respir Dis.1992;145:533-539

VMT: Conflicting evidence

- No additional increase in exercise tolerance by VMT when added to limb exercises although inspiratory muscle strength and endurance had increased

Larson JL. Am J Respir Crit Care Med.1999;160: 500-507

- Increase in 12 MWD and bicycle exercise endurance compared to limb exercise alone was observed when **Threshold IMT** was added.

Weiner P. Chest 1992;102:1351-1356

- Increased exercise tolerance (6MWD) was observed in patients receiving additional R**esistance IMT**

Van Herwardeen CLA. Chest 1991;99:128-133

ATS/ERS statement (2005)

- A minimum of 20 sessions should be given.
- At least three times per week Twice weekly supervised plus one unsupervised home session may also be acceptable.
  Once weekly sessions seem to be insufficient
- Each session to last 30 minutes
- High-intensity exercise (>60% of maximal work rate) produces greater physiologic benefit and should be encouraged; however, low-intensity training is also effective for those patients who cannot achieve this level of intensity

ATS/ERS STATEMENT (2005)

- Both upper and lower extremity training should be utilized
- Lower extremity exercises like treadmill and stationary bicycle ergometer &
  Arm exercises like lifting weights and arm cycle ergometer are recommended
- The combination of endurance and strength training generally has multiple beneficial effects and is well tolerated; strength training would be particularly indicated for patients with significant muscle atrophy.
- Respiratory muscle training could be considered as adjunctive therapy, primarily in patients with suspected or proven respiratory muscle weakness

BTS STATEMENT (2001)

- A course duration of 4–12 weeks
- Supervised training sessions 2–5 times per week
- A session duration of 20–30 minutes
- A target exercise intensity corresponding to at least 60% of the maximum attained power output or VO_2 peak in a preliminary progressive maximal exercise test; Alternatively,60% of the maximal walking speed achieved on the shuttle walk test could be used.

- Strength training can be offered

- Respiratory muscle training is not an essential component

GOLD 2006

- The minimum length of an effective rehabilitation program is 6 weeks.
- Daily to weekly sessions
- Duration of 10 minutes to 45 minutes per session
- Intensity of 50% of VO2 max to maximum tolerated
- Endurance training can be accomplished through continuous or interval exercise programs.
- The latter involve the patient doing the same total work but divided into briefer periods of high-intensity exercise, which is useful when performance is limited by other co-morbidities

Additional considerations

- Optimal bronchodilator therapy should be given prior to exercise training to enhance performance.
- Patients who are receiving long-term oxygen therapy should have this continued during exercise training, but may need increased flow rates.
- Oxygen supplementation during pulmonary rehabilitation, regardless of whether or not oxygen desaturation during exercise occurs, often allows for higher training intensity and/or reduced symptoms in the research setting.

ATS/ERS STATEMENT 2005

- Reasonable to recommend supplementary oxygen to those showing significant hypoxia ($Spo_2 < 90\%$) during exercise.

BTS STATEMENT 2001

Neuromuscular electrical stimulation (NMES)

- In severely disabled COPD patients with incapacitating dyspnea, 6 week NMES of muscles involved in ambulation improved muscle strength and endurance, whole body exercise tolerance, and breathlessness during ADL.

Neder JA. Thorax 2002;57:333–337

- 14 COPD patients with Ty 2 RF on MV through tracheostomy tube received NMES as a part of rehabilitation. Significant reduction in duration required for transfer from bed to chair (14.33 +/- 2.53 Vs 10.75 +/-2.41)

Zanotti E. Chest 2003;124:292–296

- NMES may be an adjunctive therapy for patients with severe chronic respiratory disease who are bed bound or suffering from extreme skeletal muscle weakness.

ATS/ERS Guidelines 2005

Non invasive mechanical ventilation

- Proportional assist ventilation while exercise training, enabled a higher training intensity, leading to a greater maximal exercise capacity.

Hawkins P. Thorax 2002;57:853–859.

- Addition of nocturnal domiciliary NPPV in combination with pulmonary rehabilitation in stable COPD patients (FEV1 0.96 L, PaO_2 65.4 and $PaCO_2$ 45.6) resulted in improved exercise tolerance and quality of life.

Garrod G. Am J Respir Crit Care Med 2000;162:1335–1341.

- Because NPPV is a very difficult and labor-intensive intervention, it should be used only in those with demonstrated benefit from this therapy. Further studies are needed to further define its role in pulmonary rehabilitation.

ATS/ERS guidelines 2005

Bronchial asthma

- A 10-week aerobic conditioning program led to decrease in dyspnea, ventilatory requirement and oxygen consumption for a given level of exercise.

Haalstrand TS. Chest. 2000;118:1460-1469

- 6 week swimming training programme has a beneficial effect on aerobic capacity assessed with bicycle ergometer 4.5 watt Vs 3.8 watt $p<0.001$)

  No effect on bronchial airway reactivity measured by histamine response.

Matsumoto I. Thorax 1999;54:196-201

Bronchial asthma

- Aerobic exercise training for 8 weeks led to short term decrease in the daily use of inhaled and oral steroids, in moderate to severe disease.

  Reduction of inhaled steroid dose of fluticasone from 1125 to 575 micro grams per day ($p<0.05$).

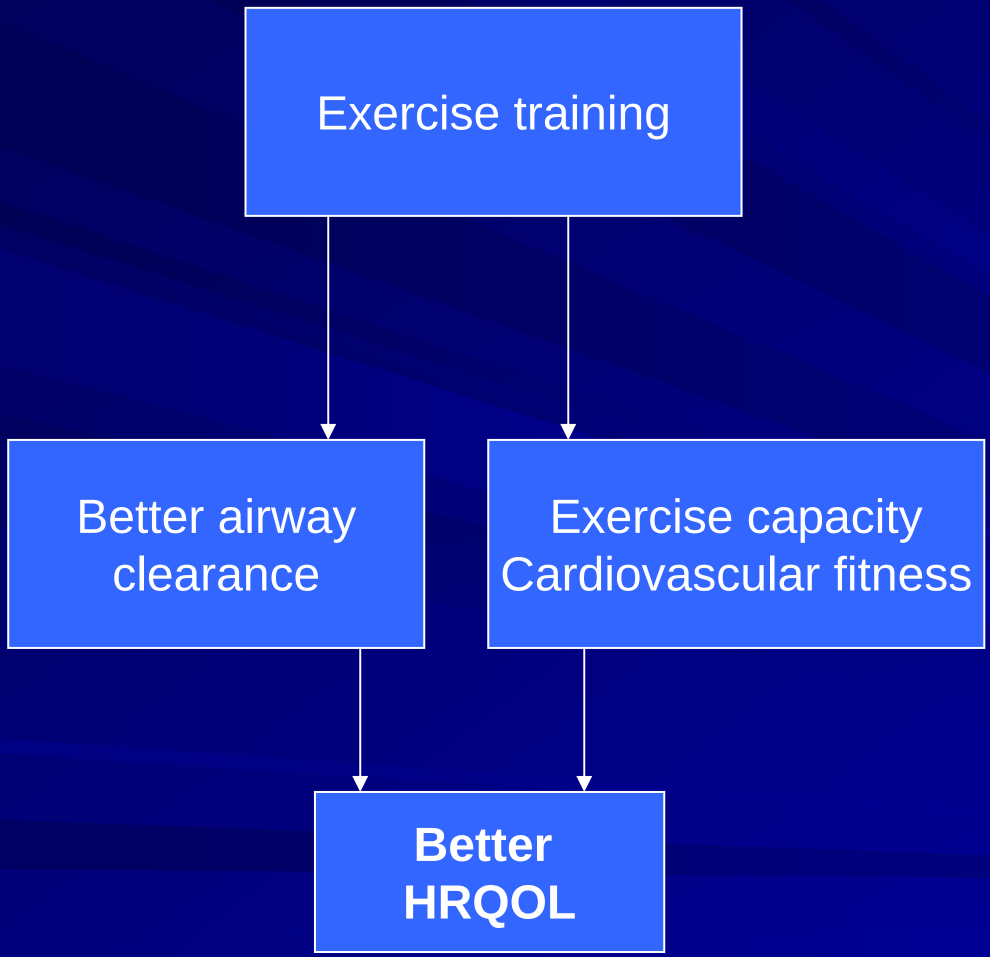
  Oral steroids could be withdrawn in all the 4 patients

  Neder JA.Thorax 1999;54:202-206

- Insufficient evidence to suggest that IMT provides any clinical benefit to patients with asthma (review of 5 RCTs)

  Ram FSF. Eur Respir J 2004; 24: Suppl. 48, 520s

Cystic fibrosis



Physical activity augments airway clearance in cystic fibrosis

Zach MS. Lancet 1981;2:1200-1203
Anderson B. Acta Pediatrica Scand. 1987;76:70-75

Cystic fibrosis

- Regular aerobic exercise attenuates the decline in pulmonary function over a 3-year period compared to a control group

Schneiderman-Walker, JJ Pediatr 2000;136,304-310

- Review of 3 RCTs suggested addition of exercise to standard physiotherapy halted fall in FEV1 and an increase of FEV1 by 6.4% ($p<0.04$) was observed

Thomas J. Am J Respir Crit Care Med.1995;151:846-850

Cystic fibrosis

- Appropriate vigorous physical exercise enhances cardiovascular fitness, increases functional capacity, and improves quality of life.
- Pulmonary rehabilitation regimens previously targeted for adults with emphysema and chronic bronchitis will likely prove to be effective in the CF population.

Aerobic activities, such as swimming, jogging, and cycling, are recommended

Cystic Fibrosis Adult Care - Consensus Conference Report
Chest. 2004;125:1S-39S

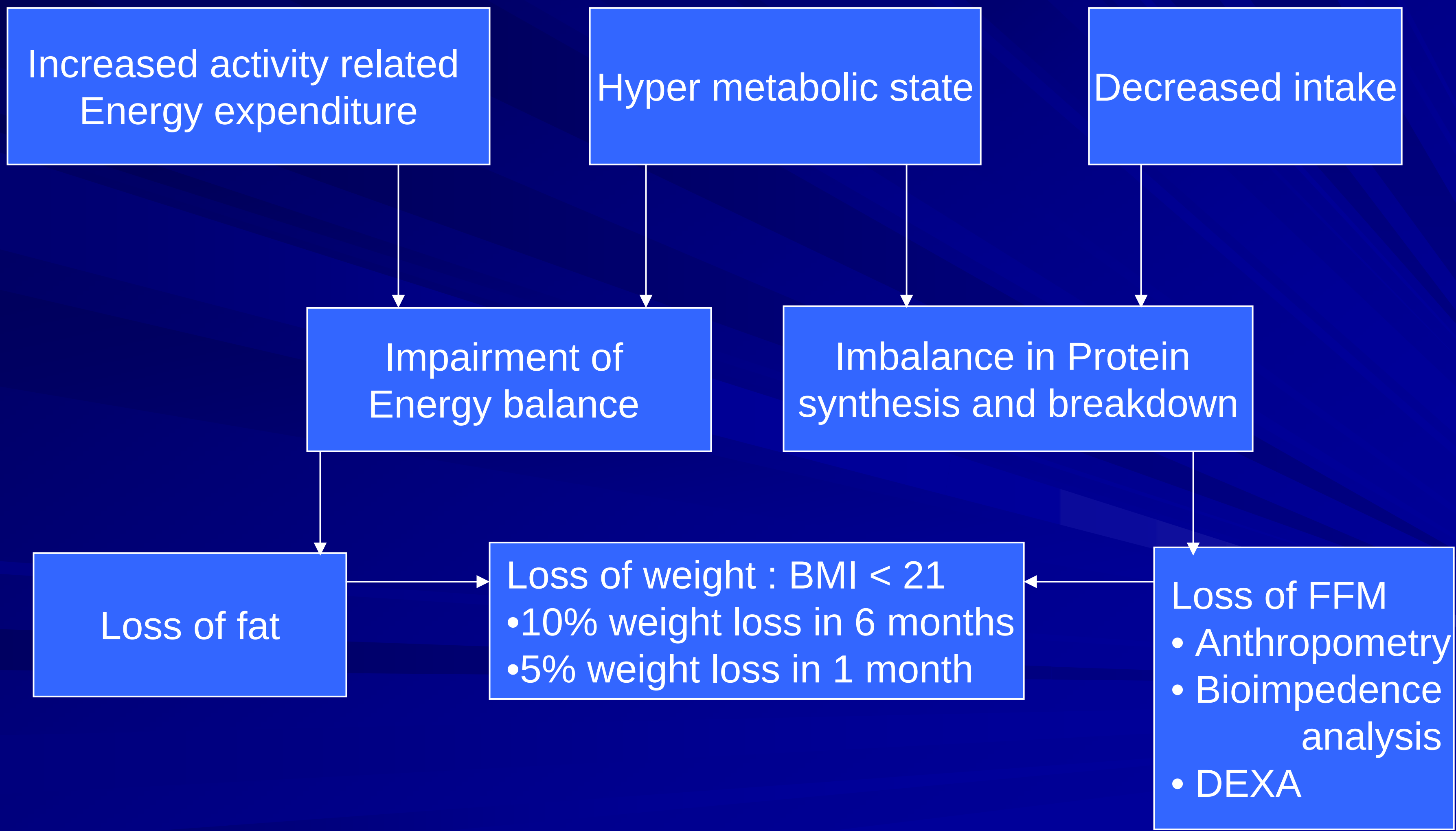
Idiopathic Pulmonary Fibrosis

For motivated patients a combination of exercise training, education, and psychosocial support **may help**, not by improvements in lung function, which are not likely to occur, but with improvement in exercise tolerance, together with decreased symptoms of breathlessness, improved quality of life

ATS/ERS statement on treatment of IPF 1999

Body composition abnormalities: interventions

Body composition abnormalities



Under weight : Low BMI

- One-third of outpatients and up to two thirds of those referred for pulmonary rehabilitation are under weight

Enjelen MPKJ. Eur Respir J 1994;7:1793-97
Schols AWMJ. Am Rev Respir Dis 1993;147:1151–1156

- Underweight patients with COPD have significantly greater impairment in HRQL than those with normal weight

Schoup R. Eur Respir J 1997;10:1576–1580

- In COPD, there is an association between underweight status and increased mortality, independent of the degree of airflow obstruction.

Schols AWMJ .Am J Respir Crit Care Med 1998;157:1791–1797

Low lean body mass (FFM)

- Because normal-weight patients with COPD and low FFM (FFM <16 kg/m2 for men and <15 kg/m2 for women) have more impairment in HRQL than underweight patients with normal FFM, this body composition abnormality appears to be an important independent of weight loss

Mostert R. Respir Med 2000;94:859–867

- Patients with COPD and reduced FFM have lower exercise tolerance as measured using either 12-minute walk distance (a) or VO_2max (b,c) than those with preserved FFM.

(a) Mostert R. Respir Med 2000;94:859–867
(b) Baarends EM. Eur Respir J 1997;10:2807–2813
(c) Kobayashi A. Lung 2000;178:119–127

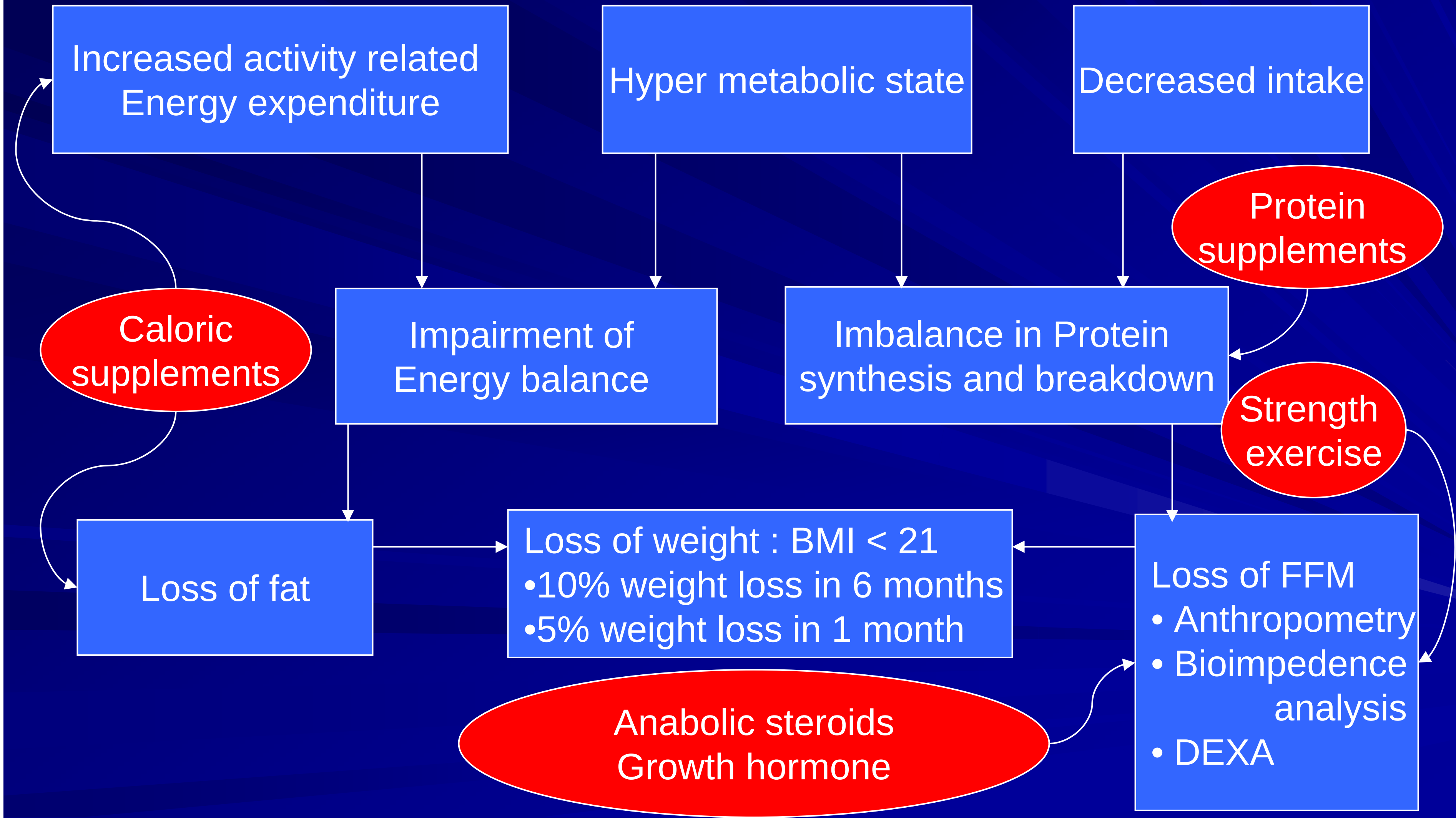
Why intervene?

High prevalence and association with morbidity and mortality

Higher caloric requirements from exercise training in pulmonary rehabilitation, which may further aggravate these abnormalities (without supplementation)

Enhanced benefits, which will result from structured exercise training.

Body composition abnormalities: interventions



Caloric supplementation

Should be considered if :

- BMI less than 21 kg/m2
- Involuntary weight loss of >10% during the last 6 months or more than 5% in the past month
- Depletion in FFM or lean body mass.

May be unsuccessful if :

- A reduction in spontaneous food intake
- Suboptimal implementation of nutritional supplements in daily meal and activity pattern
- Portion size and macronutrient composition of nutritional supplements
- Presence of systemic inflammation

Caloric supplementation

- Much of the weight gain with caloric supplementation is in the form of fat but not fat free mass. *Schols AM. Am J Respir Crit Care Med 1995;152:1268–127*
- Meta- analysis of 9 RCTs showed nutritional support alone cannot increase exercise capacity or anthropometric measures *Ferreira I M. Chest 2000 117:672–8*
- Nutritional supplementation combined with supervised exercise training increased body weight and FFM in underweight patients.. *Creutzberg EM. Nutrition 2003;19:120–127*

Table 2—*Nutritional Support in COPD–Primary Results**

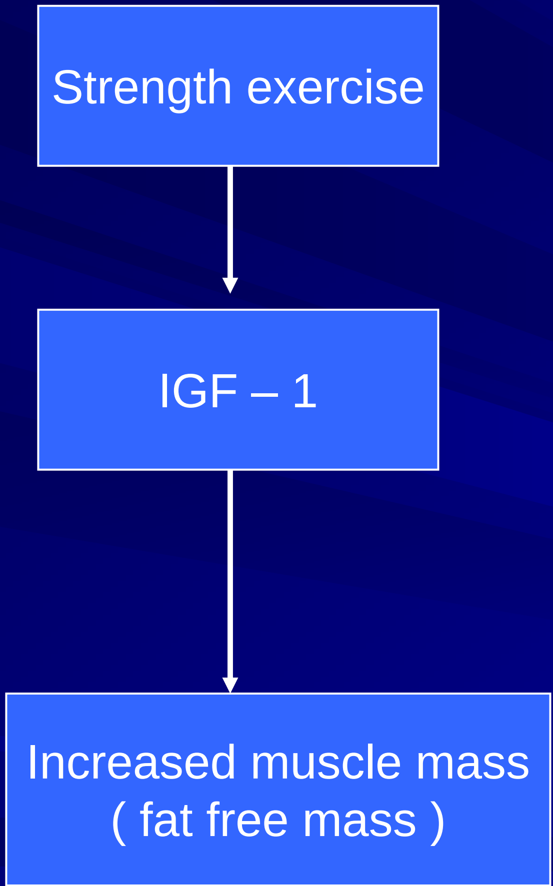
Outcome Measures	Trials, No.	Patients, No. Treat/Control	Effect size, SD Unit: Common Effect	Effect size, SD Unit: (95% CI)	Effect Size, Natural Unit: Common Effect	Effect Size, Natural Unit: (95% CI)	p Homogeneity
Weight	9	144/133	0.24	(0.00/0.48)	1.65 kg	(0.00/3.29)	1.00
AMC	6	66/66	0.11	(−0.23/0.45)	0.3 cm	(−0.5/1.0)	0.40
TSF	5	48/49	0.36	(−0.04/0.76)	1.4 mm	(−0.2/2.9)	0.90
6-min walk	3	38/39	0.03	(−0.41/0.47)	3.4 m	(−46.1/52.9)	0.19
FEV_1	5	60/59	0.03	(−0.33/0.39)	0.5% pred	(−5.4/6.4)	0.49
PImax	4	36/34	0.01	(−0.46/0.48)	0.1 cm H_2O	(−8.1/8.5)	0.80
PEmax	4	36/34	−0.10	(−0.57/0.37)	−3.0 cm H_2O	(−16.6/10.8)	0.24

Nutritional supplementation

- Energy dense foods
- Well distributed during the day
- No evidence of advantage of high fat diet
- Patients experience less dyspnea after carbohydrate rich supplement than fat rich supplement. (probably due to delayed gastric emptying)

- Daily protein intake should be 1.5 gm/kg for positive balance

Physiological intervention: Strength exercise



- 8 weeks of strength exercise lead to increase in FFM (52.4 +/- 7.3 to 53.4 +/- 7.7 kg, $p<0.05$)

Fransen FM. Chest 2004;125:2021–2028

- Addition of strength training lead to increase in strength and mid thigh circumference (measured by CT)
- No difference in 6MWD, HRQOL

Bernard S. Am J Respir Crit Care Med 1999;159:896–901

Pharmacological intervention : Anabolic steroids

Anabolic steroids
Nandrolone decanoate
50 mg for male
25 mg for females
2 Weekly for 4 doses

↓

IGF – 1
Anti Glucocorticoid action
Erythropoietic action

↓

Increase fat free mass

- Anabolic steroids increased lean body mass (1.4 +/-2.6 kg, $p<0.05$)
- No side effects seen
- Anabolic therapy alone increases muscle mass but not exercise capacity (assessed with 12MWD)

Schols AM. Am J Respir Crit Care Med 1995;152:1268–1274

Growth hormone

- rhGH 0.05 mg/kg for 3 weeks in addition to 35 Kcal/kg and 1gm protein/kg per day has shown to increase fat free mass (1.37 +/- 0.23 Vs 0.07+/-0.11 kg) significantly. (p<0.01)

  Pape GS. Chest 1991;99:1495-1500

- Daily administration of 0.15 IU/kg rhGH during 3 wk increases lean body mass when assessed in in underweight patients with COPD.

  at 3 weeks (2.3 +/- 1.6 Vs 1.1 +/- 0.9 kg , p<0.01) and

  at 8 weeks (1.9 +/- 1.6 Vs 0.7 +/-1.1 kg, p<0.05).
- But does not improve muscle strength or exercise tolerance (hand grip and maximal exercise) and no change in well being of the patient.
- REE has significantly increased by 107.8% in study group (p<0.001)

  Burdet C. Am J Respir Crit Care Med. 1997;156: 1800-1806

Testosterone

- Testosterone 100 mg weekly for ten weeks in men with low testosterone levels 320 ng/ml showed weight gain of 2.3 kg
- Addition of exercise to testosterone has augmented weight gain to 3.3 kg ($p<0.001$)

Casburi R. Am J Respir Crit Care Med.2004;170:870-878

- Physiological consequences and long term effects not studied.

Body composition abnormalities: interventions

Intervention	Weight gain	FFM gain	Exercise capacity
Caloric supp.	+	-	-
Caloric supplementation + exercise training	++	+	+
Strength exercise	-	+	-
Anabolic steroids	++	++	-
Anabolic steroids + exercise	++	+++	?

Guidelines

- Increased calorie intake is best accompanied by exercise regimes that have a nonspecific anabolic action
- Anabolic steroids in COPD patients with weight loss increase body weight and lean body mass but have little or no effect on exercise capacity.

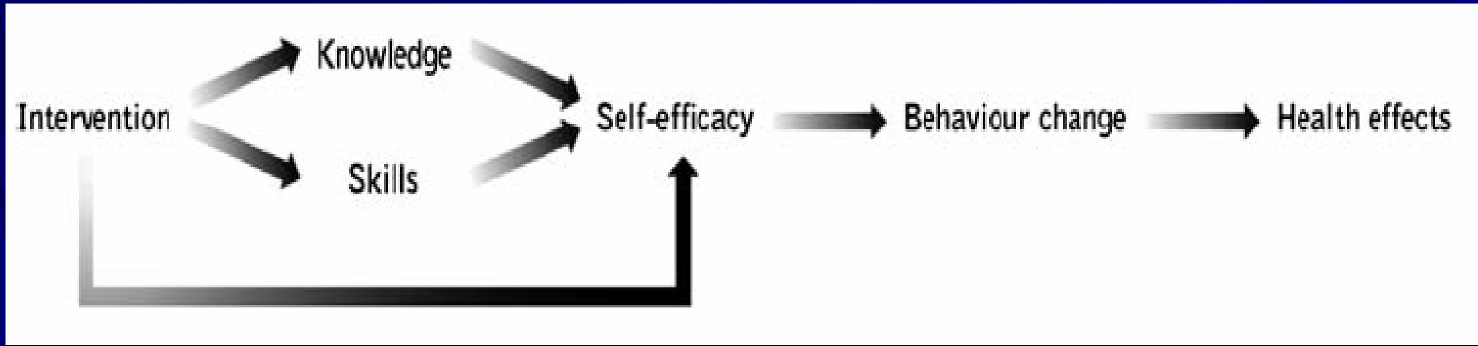
GOLD 2006

- Pulmonary rehabilitation programs should address body composition abnormalities. Intervention may be in the form of caloric, physiologic, pharmacologic or combination therapy.

ATS/ERS STATAEMENT 2005

Education

Self management education



Should involve :

- Patient
- Family
- Primary care physician
- Other health care providers

Patient education : BTS statement 2001

- Anatomy, physiology, pathology and pharmacology (including oxygen therapy)
- Dyspnoea/symptom management, chest clearance techniques
- Energy conservation/ pacing
- Nutritional advice
- Managing travel
- Benefits system
- Advance directives
- Making a change plan
- Anxiety management
- Goal setting and rewards
- Relaxation
- Identifying and changing beliefs about exercise and health related behaviours
- Loving relationships/sexuality
- Exacerbation management (including coping with setbacks and relapses)
- The benefits of physical exercise

Box 3 Suggested content of education sessions.

Self management Education

Breathing Strategies
Normal Lung Function and Pathophysiology of Lung Disease
Proper Use of Medications, including Oxygen
Bronchial Hygiene Techniques
Benefits of Exercise and Maintaining Physical Activities
Energy Conservation and Work Simplification Techniques
Eating Right
Irritant Avoidance, including Smoking Cessation
Prevention and Early Treatment of Respiratory Exacerbations
Indications for Calling the Health Care Provider
Leisure, Travel, and Sexuality
Coping with Chronic Lung Disease and End-of-Life Planning
Anxiety and Panic Control, including Relaxation Techniques and Stress Management

ATS & ERS Joint statement on pulmonary rehabilitation, 2005

Early treatment of exacerbations

- Detection of exacerbation:

  Sustained worsening of symptoms from beyond day to day variations

- Activating predetermined action plan:

  Pre-determined medication regime

  Informing health care providers

Bronchial hygiene techniques

- Postural drainage
- Percussion & vibration

- Directed cough
- Forced expiratory technique (huff cough)
- Active cycle of breathing
- Autogenic drainage
- Positive expiratory pressure

Bronchial hygiene techniques

- Meta analysis of 6 RCTs suggested chest percussion and vibration to be very effective in clearance of secretions in cystic fibrosis. SD 0.61, $p<0.0001$.

  Thomas J. Am J Respir Crit Care Med.1995;151:846-850

- Combination of postural drainage, percussion, directed cough and forced expiration improved airway clearance, but not pulmonary function, in patients with COPD and bronchiectasis

  The Cochrane Database of Systematic Reviews 2007 Issue 1

- PT advice to patients with sputum production is appropriate.

  BTS STATEMENT 2001

- In selected patients bronchial hygiene techniques can be considered.

  ATS/ERS STATEMENT 2005

Breathing strategies

- Adopting specific postures : Leaning forward
- Slow deep breathing
- Purse lipped breathing

Bianchi R. Chest 2004;125:459–465

- Diaphragmatic breathing :

  Increases work & increases dyspnea

Gosselink RA. Am J Crit Care Med.1995;151:1136-442

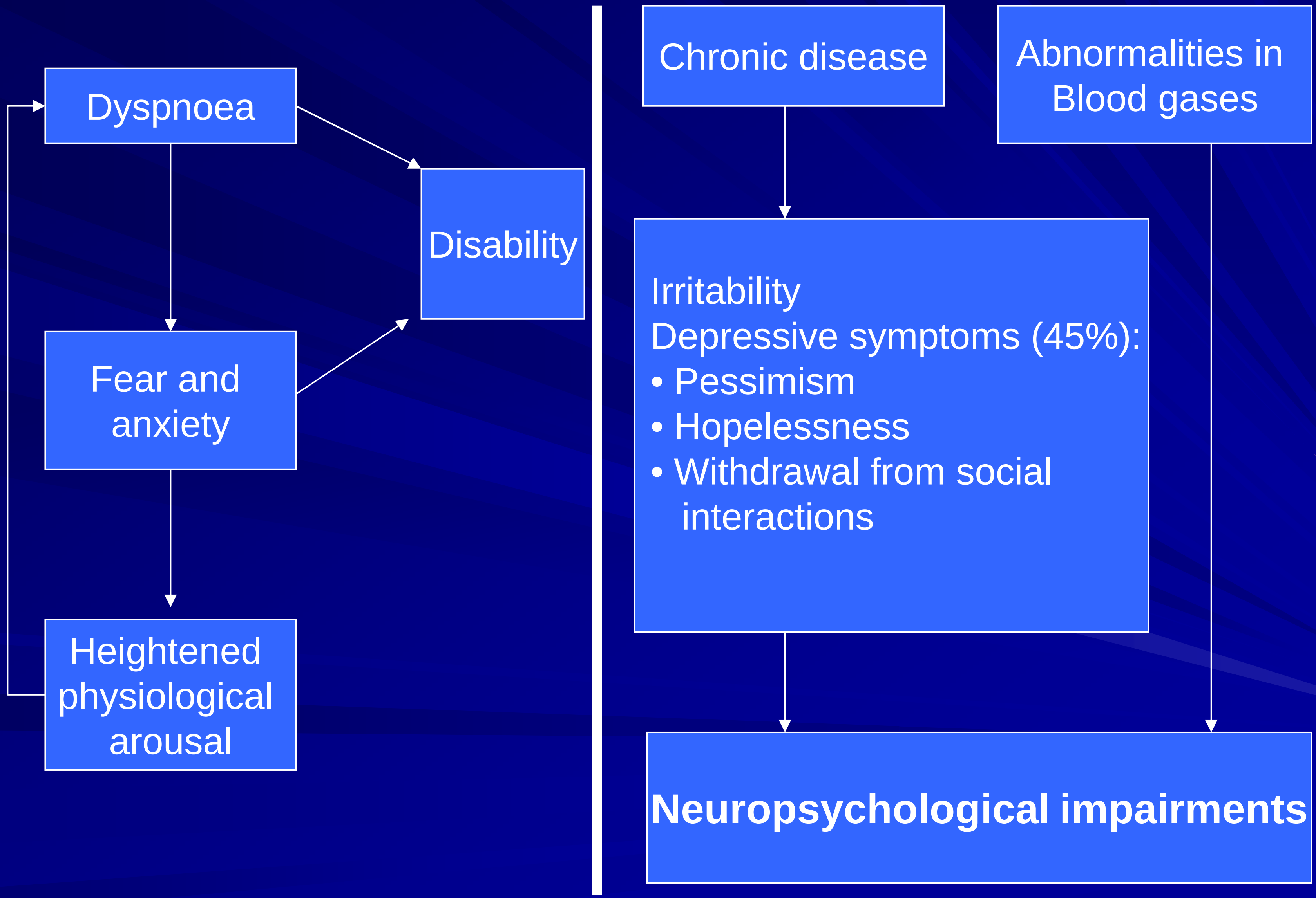
Vitacca M. Eur Respir J. 1998;11:408-415

Should be considered (although individualized)

ATS & ERS statement 2005

Psychological considerations

Psychological considerations



Magnitude of problem

- Approximate prevalence of symptoms of depression in moderate to severe COPD is about 45%

Mills TL. Soc Sci Med 2001;53:569–578

- Sub-threshold depression (clinically relevant depression that does not fit operational criteria) is seen in 25% of elderly patients with COPD

Yohannes AM. Int J Geriatr Psychiatry 2003;18:412–416

Psychological considerations

- Screening for anxiety and depression should be part of the initial assessment.
- Mild or moderate levels of anxiety or depression related to the disease process may improve with pulmonary rehabilitation

Withers NJ. J Cardiopulm Rehabil 1999;19:362-5

- Patients with significant psychiatric disease should be referred for appropriate professional care.

ATS/ERS STSTEMENT

- Antidepressants and anxiolytics appear not to have additional general value

BTS STATEMENT

Patient selection

and

Assessment

Patient selection

- Gains can be achieved from pulmonary rehabilitation regardless of age, sex, lung function, or smoking status

  ATS/ERS statement 2005

- No justification for selection on the basis of age, impairment, disability or smoking status.

  BTS statement 2001

- COPD patients at all stages of disease appear to benefit from exercise training programs, improving with respect to both exercise tolerance and symptoms of dyspnea and fatigue

  GOLD 2006

Initial assessment

Table 1—***Components of the Initial Evaluation of Patients for Pulmonary Rehabilitation***

Components
Medical history and physical examination
Measure dyspnea
Multidimensional clinical instruments
Ratings during exercise
Measure HRQL
Disease-specific instruments
Generic instruments
Diagnostic testing
Pulmonary function tests
Cardiopulmonary exercise tests
Pulse oximetry or arterial blood gases
Psychosocial assessment
Evaluate anxiety/depression
Assess social and family support
Coping and self-care skills

Mahler DA. Chest 1998;113;263-268

Exclusion criteria

- Patients with severe orthopedic or neurological disorders limiting their mobility
- Severe pulmonary arterial hypertension
- Exercise induced syncope
- Unstable angina or recent MI
- Refractory fatigue
- Inability to learn, psychiatric instability and disruptive behavior.

Outcome assessment

- Control of symptoms of cough and fatigue:
  - Real time evaluation: VAS & Borg dyspnea scale
  - Recall of symptoms
- Performance evaluation: Ability to do ADL
  - Directly observed or self reported
- Exercise tolerance:
  - 6 minute walking test
  - Cardiopulmonary exercise testing
- Quality of life:
  - Chronic respiratory disease questionnaire
  - St Georges's respiratory questionnaire
  - SF- 36
- Assessment of respiratory and peripheral muscle strength (GOLD 2006)

Pulmonary rehabilitation: At what cost ?

- Incremental health care cost of pulmonary rehabilitation was 11,597 dollars per annum per patient.
- NNT for improvement in dyspnea 4.1, fatigue 4.4 and 3.3 for emotion

Goldstein RS. Chest 1997;112(2):370-9.

- Decreased no of exacerbations (3.7+/- 2.2 Vs 6.9+/-3.9) in 24 months. No change in hospitalization rates.

Guell K. Chest 2000;117:976-83

- Decrease in utilization of health care services:
    - Decreased length of hospital stay when admitted
    - No change in number of hospital admissions
    - Fewer primary care home visits

Grifiths TL. Lancet 2000;355:362-8.

Long term efficacy pulmonary rehabilitation

- Benefits of rehabilitation (exercise tolerance, dyspnea, HRQOL) are evident up to 1 year and may last longer.
  Foglio K. Eur Respir J.1999;13:125-32

- One third of the patients (both COPD and bronchial asthma) retain the benefits for 2 years (NNT 3)
  Guell R. Chest 2000;117:976-83

- Meta-analysis showed significant improvement in exercise capacity and 6 MWD 9 months post rehabilitation.
  Cambach W. Arch Phys Med Rehab 1999;80:103-111

Maintenance rehabilitation & Repeat rehabilitation program

- Continued participation in supervised program is essential for sustenance of benefits.

Swerts PMJ. Arch Phys Med Rehab 1990;71:570-573

- Yearly repeat rehabilitation program had shown:

Short term benefits in the form of less frequent exacerbations

But no long term physiological effects on exercise tolerance, dyspnea & HRQL.

Foglio K. Chest. 2001; 119:1696–1704

Current guidelines does not comment on maintenance & repeat rehabilitation

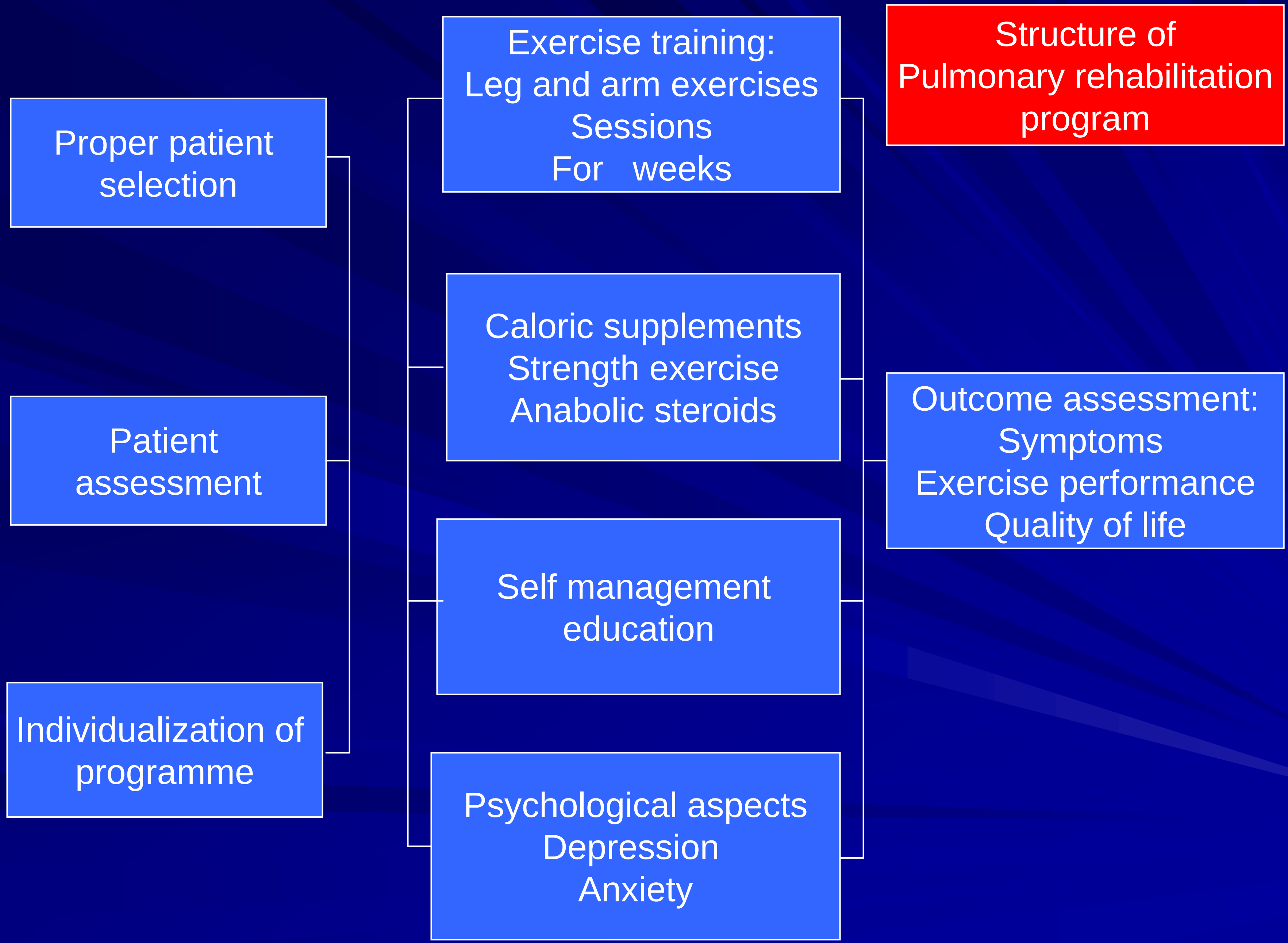

Structure of Pulmonary rehabilitation program
Proper patient selection
Patient assessment
Individualization of programme
Exercise training:
Leg and arm exercises
Sessions
For weeks
Caloric supplements
Strength exercise
Anabolic steroids
Self management education
Psychological aspects
Depression
Anxiety
Outcome assessment:
Symptoms
Exercise performance
Quality of life

Figure 5.3-10. Benefits of Pulmonary Rehabilitation in COPD

- Improves exercise capacity (**Evidence A**).
- Reduces the perceived intensity of breathlessness (**Evidence A**).
- Improves health-related quality of life (**Evidence A**).
- Reduces the number of hospitalizations and days in the hospital (**Evidence A**).
- Reduces anxiety and depression associated with COPD (**Evidence A**).
- Strength and endurance training of the upper limbs improves arm function (**Evidence B**).
- Benefits extend well beyond the immediate period of training (**Evidence B**).
- Improves survival (**Evidence B**).
- Respiratory muscle training is beneficial, especially when combined with general exercise training (**Evidence C**).
- Psychosocial intervention is helpful (**Evidence C**).

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Thank you