Pulmonary Disorders and Pulmonary Rehabilitation

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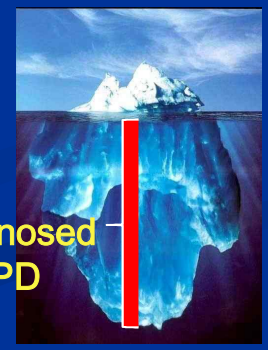
Overview

- Chronic Lung Diseases
  - Chronic Obstructive Lung Disease (COPD)
  - Asthma
  - Mycobacterium Tuberculosis
  - Restrictive Lung Diseases
- Pulmonary Rehabilitation
  - Key Components
    - Exercise Guidelines
    - Education on Disease Self-management
  - Evidence Based Guidelines
- Resources

COPD Definition and Incidence

- Airflow limitation – not fully reversible
  - Persistent, progressive dyspnea and chronic cough
  - History of smoking or particulate exposure
  - Significant systemic abnormalities
- WHO: 340 million with COPD worldwide
  - National COPD prevalence ranges: 4-20%
  - 70% of patients are under 65 years old
- 6th leading cause of death worldwide
  - Will be 4th leading cause by 2030
  - Worldwide deaths will increase 30% in 10 years[1]
- Often undiagnosed and untreated until advanced[2]
  - Nearly 80% undiagnosed and untreated[3]



[1]World health report 2002;reducing risks, promoting healthy life. www.who.int/whr/2002
[2] NHANES III, Mannino et al, MMWR 2002;51:1-16
[3] Buist AS, McBurnie MA, Vollmer W, et al. BOLD Study. Lancet 2007;370(9589):741-750.

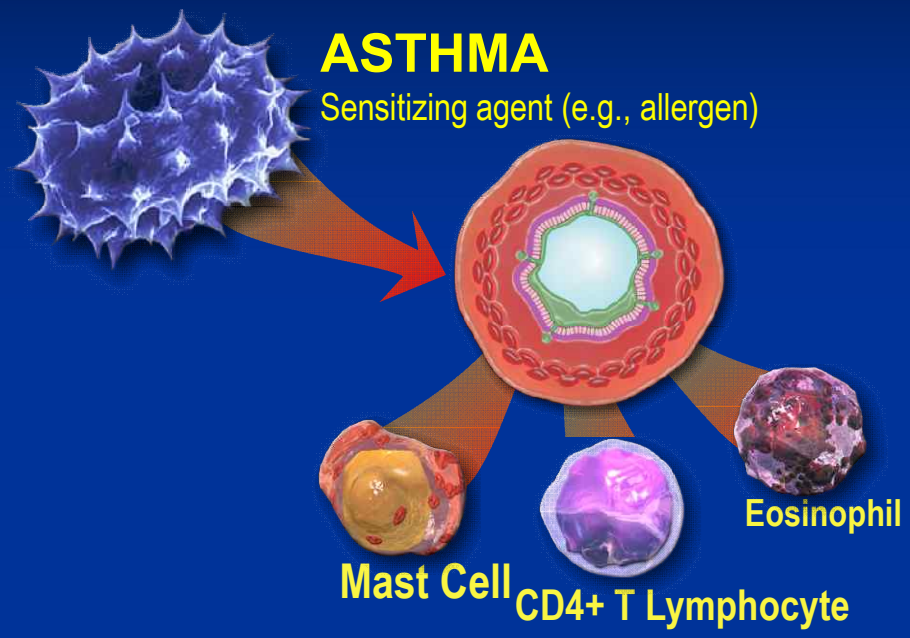
COPD in Korea

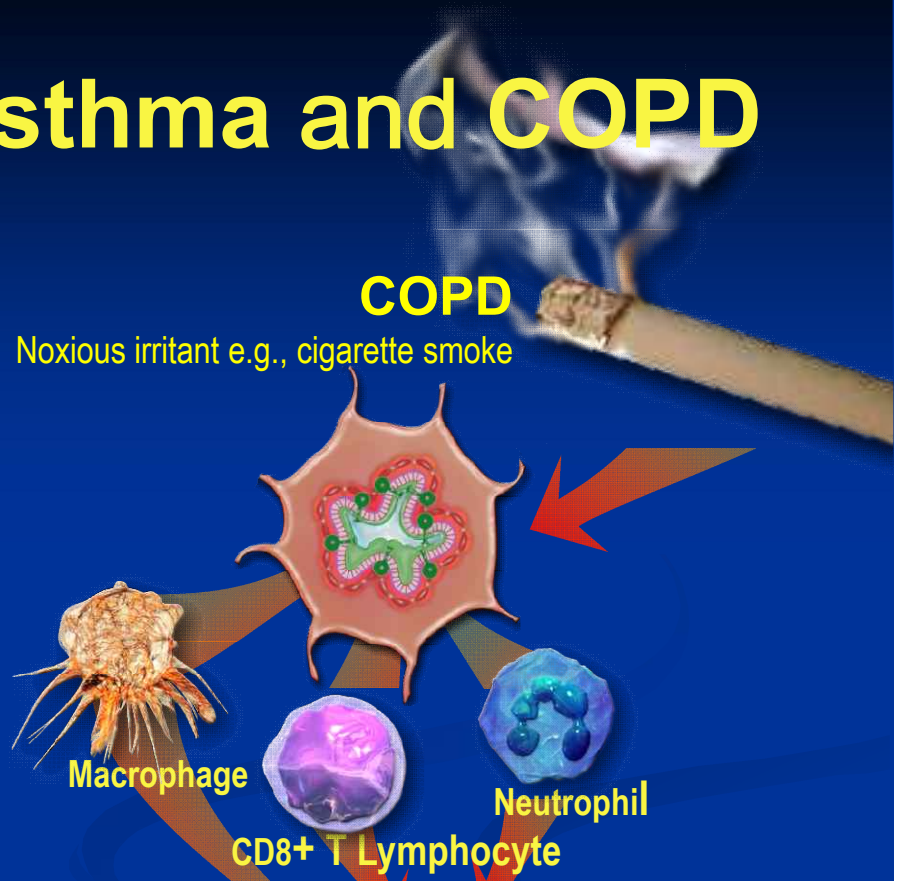
- Korean National Health & Nutrition Examination Survey
  - 9,243 adults over 18 years: COPD prevalence based on spirometry in those over 45 years old: 17%;

    Kim DS, et al. Prevalence of COPD in Korea; a population-based spirometry survey. Am J Respir crit Care Med 2005; 172:842-847.
- Asia Pacific Round Table Group: Korea COPD prevalence based on spirometry in persons over 45 years: 25.8%

  Asia Pacific Roundtable Group, Respirology 2003;8:192-198
- Korean Health and Genome Study:
  - 8140 without pulmonary diagnosis
  - Undiagnosed airflow obstruction:
    - 12% in men, 3.5% in women
    - Airflow obstruction common in men with respiratory symptoms - chronic cough, chronic sputum, wheezing, dyspnea, and smoking C Shin, et al. Respiratory symptoms and undiagnosed airflow obstruction in middle-aged adults. CHEST 2004;126:1234-1240.

Characteristics Asthma and COPD





Reversible (Improvement) on Spirometry after bronchodilator
Variable symptoms

Inhaled corticosteroids decrease inflammation

Not fully reversible on spirometry
Persistent symptoms with exacerbations

Long acting bronchodilators reduce dyspnea, hyperinflation

Modified from Barnes, 1998.

Diagnosis of COPD

SYMPTOMS

cough

sputum

dyspnea

EXPOSURE TO RISK FACTORS

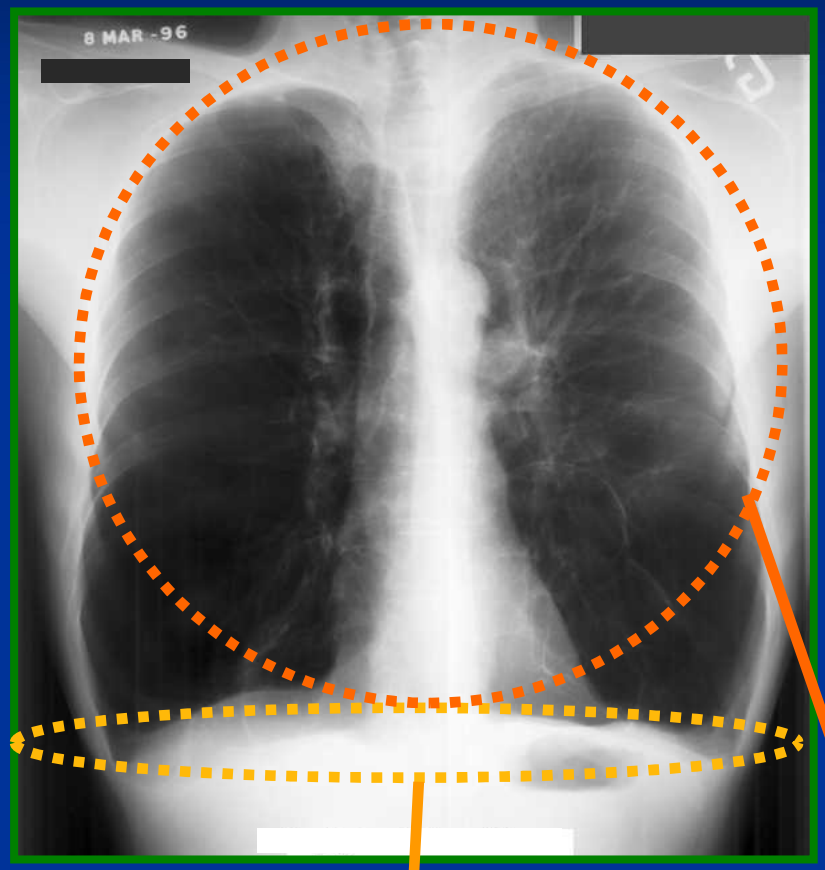
tobacco

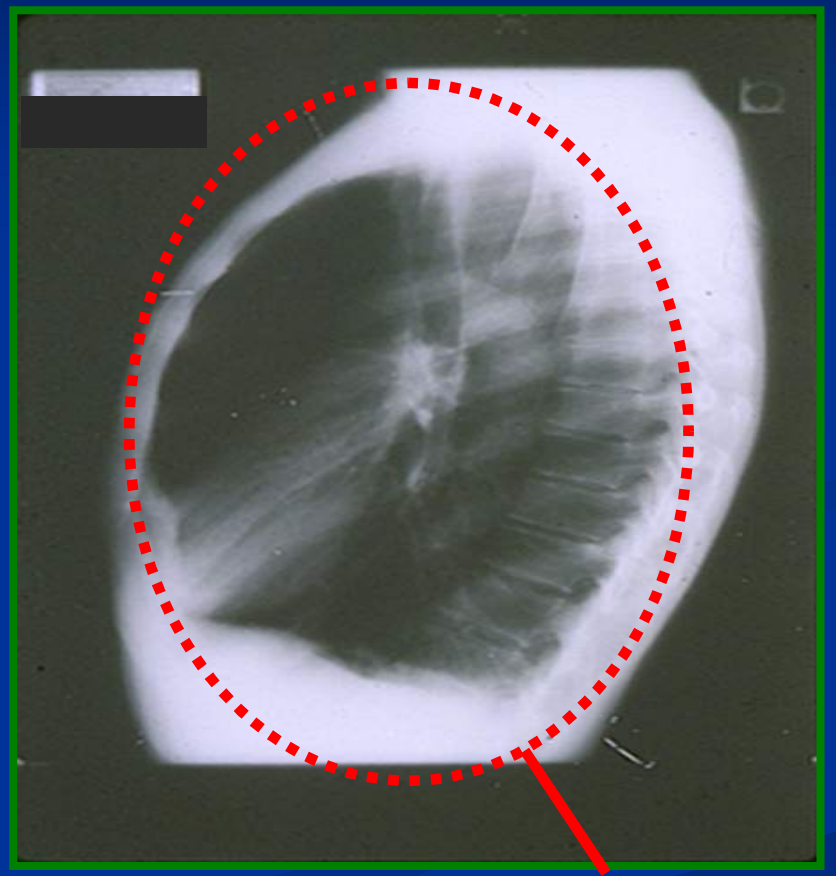
occupational dust and chemicals

indoor/outdoor pollution

SPIROMETRY

Hyperinflation and Air Trapping





Low, Flattened Diaphragm

Air Trapping

Increased A-P Diameter

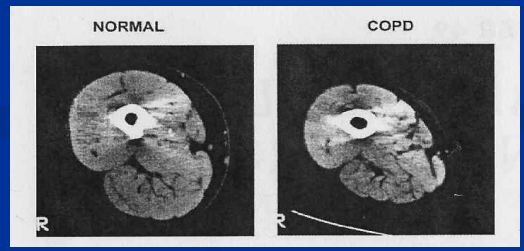
COPD - Abnormalities

Pulmonary Impairments:

- Hyperinflation – trapped air causes dyspnea
  - Increases with exercise
- Impaired ventilation – hypoxia, hypercapnea

Secondary Impairments:

- Skeletal muscle dysfunction
- Underweight or overweight
- Osteoporosis
- Depression, anxiety disorders
- Heart disease
  - Heart failure, Pulmonary hypertension
- Anemia



Cross section thigh
Bernard S, et al AJCCRM 1998

Undiagnosed Airflow Limitation in Cardiovascular Disease

- Airflow limitation in hospitalized patients
  - 17% in without cardiovascular disease (CVD)
  - 19% with CVD
  - 34% with coronary artery disease ($p < 0.5$)
- Under-diagnosis of airflow limitation range: 60% - 87%

  Soriano J, et al. High Prevalence of Undiagnosed airflow limitation in patients with CVD. CHEST 2010;137;2:333-340.
- Left ventricular (LV) structure and function measured by MRI in 2816 persons 45-84 years old
  - 10% increase in COPD linearly related to reduction in LV end-diastolic volume, stroke volume, cardiac output
  - Greater magnitude among current smokers

    R Graham Barr, et al. Percent Emphysema, airflow obstruction and impaired left ventricular filling. NEJM. 2010;32:217-27.
- COPD may be a risk factor for CVD

  Sin D, et al. COPD as a risk factor for CVD morbidity and mortality Proc Am Thorac Soc 2005;2(1):8-11.

Hospitalization and Death in COPD

- 2386 COPD patients – 50% men, 71% smokers
  - Mean follow-up: 12 years
  - 22% had hospitalization for COPD
  - Risks for hospitalization: older age, CVD, asthma, low physical activity, severe COPD
- 60% died during follow-up
  - Risks for death: older age, CVD, diabetes, low physical activity, more severe COPD

J Garcia-Aymerich, et al. Physical activity reduces hospital admission and mortality in COPD: Thorax 2006;61;772-728

- 341 COPD patients followed for mean 1.1 year
  - 92% men, 63% readmitted, 29% died during follow-up
- Readmission risk factors: low FEV_1, low PO_2, low physical activity, low quality of life

J Garcia-Aymerich, et al. Risk factors of readmission to hospital for a COPD exacerbation: Thorax 2003;58:100-105

Can We Reverse COPD?

- BODE Index: Impacts survival and hospitalizations
  - Body Mass Index ≥ 21
  - Obstruction: > Forced Expiratory Volume in one second
  - Dyspnea: < Medical Research Council dyspnea scale
  - Exercise: > 6 minute walk distance
  - Pulmonary Rehabilitation improves dyspnea & exercise
    http://content.nejm.org/cgi/content/abstract/350/10/1005
  - Rehabilitation to reverse muscle dysfunction
  - Quitting smoking reduces mortality, loss of lung function
  - Reduce hyperinflation - exercise, bronchodilators
  - Treat hypoxemia with oxygen
  - Limit exacerbations with education and exercise
  - Improve weight

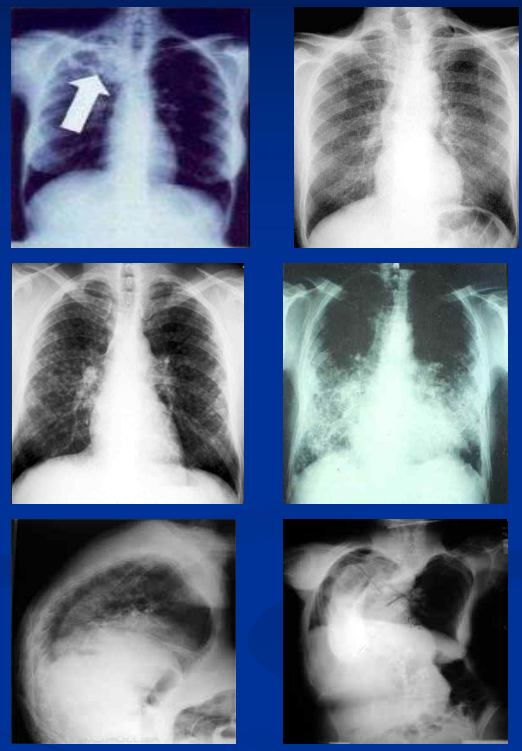
GOLD Stages of Therapy

All stages: $FEV_1/FVC < 70\%$	**Smoking cessation; avoidance of risk factors; influenza vaccination**
Stage I: Mild COPD FEV1 > 80%	**Add short-acting bronchodilator when needed**
Stage II: Moderate FEV1 >50 <80	**Add regular treatment with one or more long-acting bronchodilators; add rehabilitation**
Stage III: Severe FEV1 >30 <50	**Add inhaled glucocorticosteroids if repeated exacerbations**
Stage IV: Very Severe FEV1 >30	**Add long-term oxygen if chronic respiratory failure; consider surgical treatments**

Adapted from Global Initiative for Chronic Obstructive Lung Disease (GOLD) Executive Summary. Updated 2003. Available at: http://www.goldcopd.com.

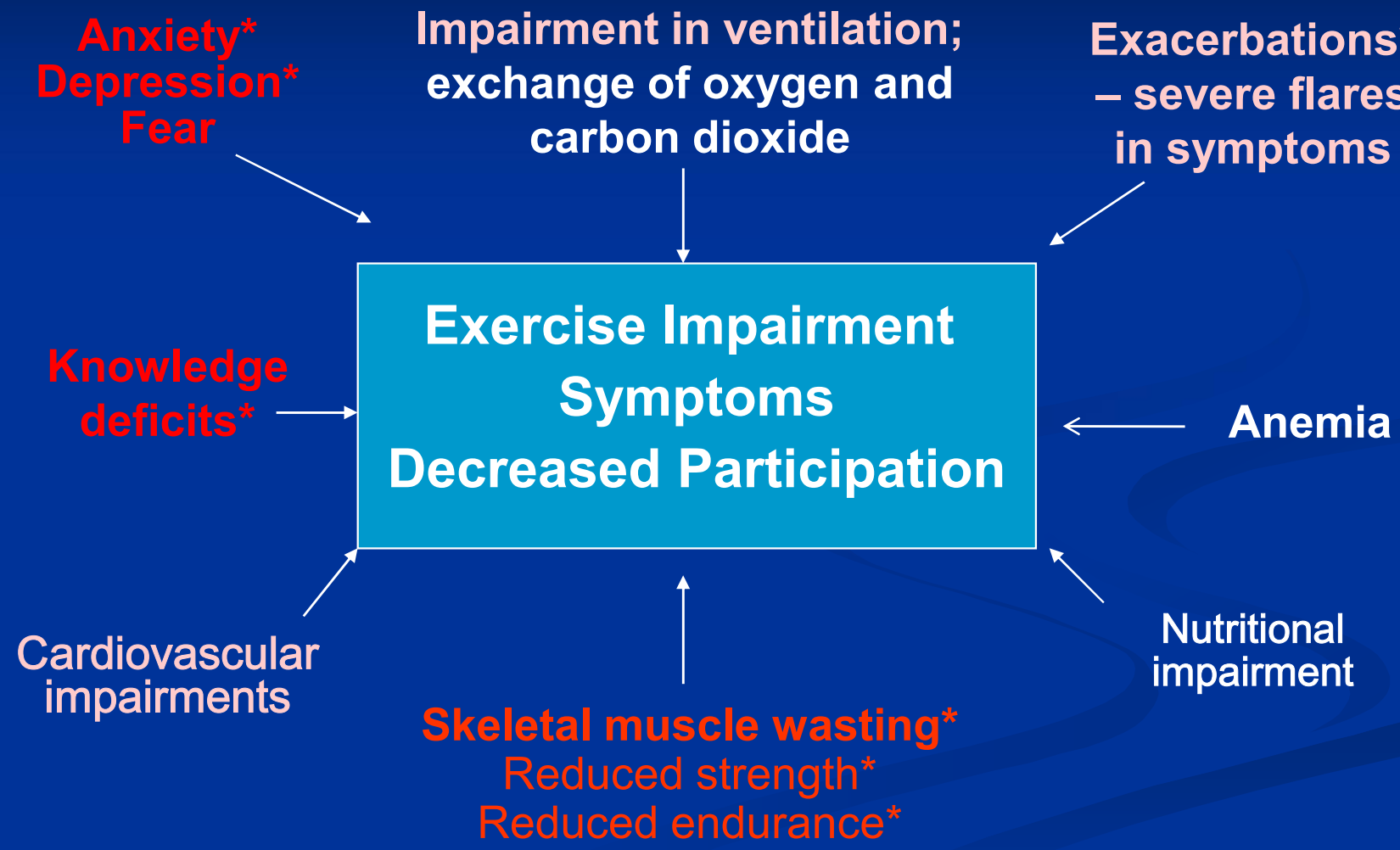
Restrictive Ventilatory Defect

- Mycobacterium Tuberculosis
  - Pulmonary complications
  - Cavitary lesion, miliary TB
- Interstitial Lung Disease:
  - Inflammation leading to scaring
  - Pulmonary Fibrosis, scleroderma, etc.
- Chest wall abnormalities
  - Kyphosis, kyphoscoliosis



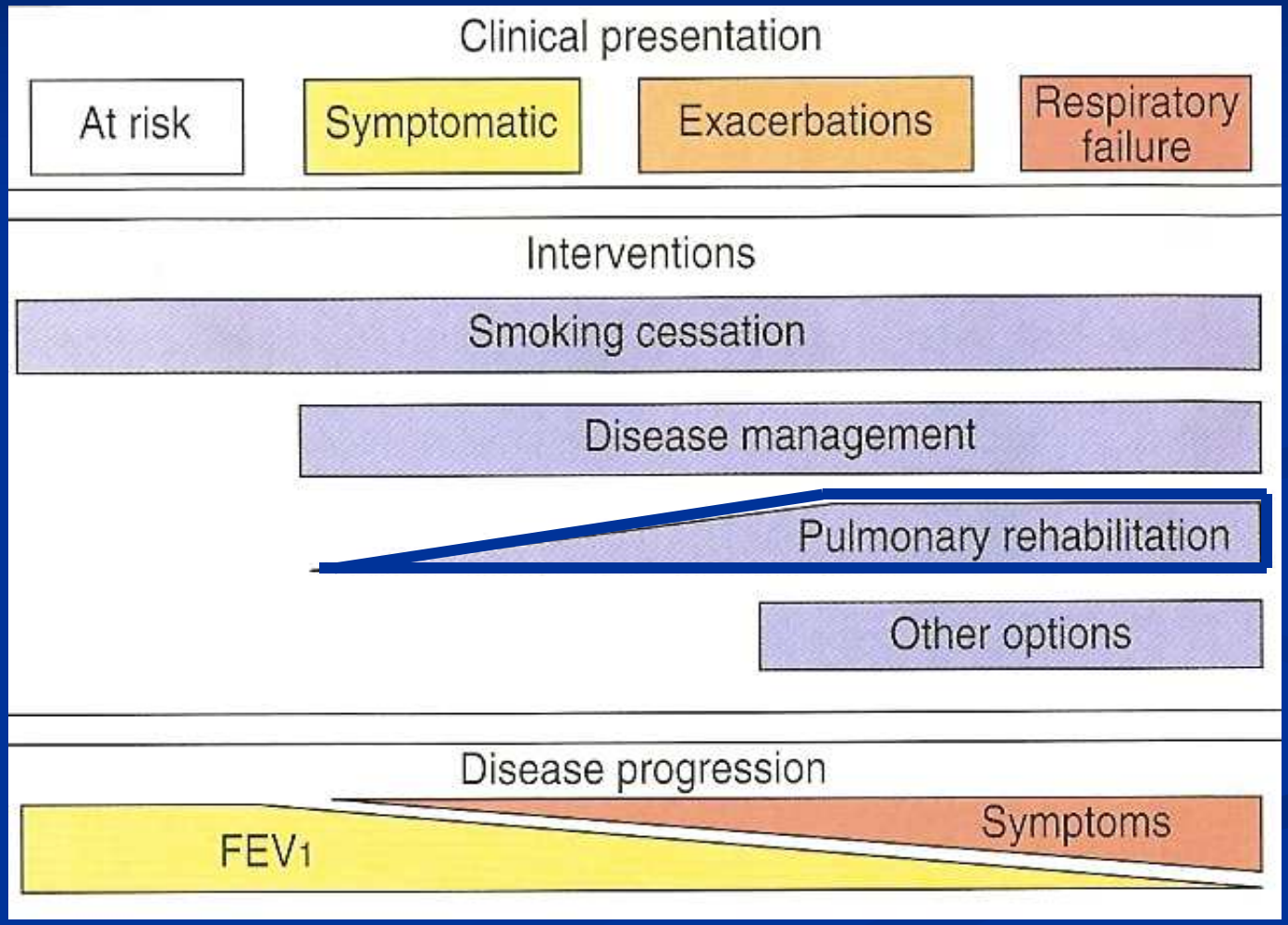
- Diagnosis: History and physical, Chest X ray, Pulmonary function test (PFT), Chest CT for interstitial lung disease
  Findings: Decreased forced vital capacity (FVC),
  Decreased total lung capacity (TLC) normal FEV_1 / FVC
- Management: disease-focused care
- Pulmonary Rehabilitation improves function, quality of life, dyspnea

Rationale for PR in Chronic Lung Disease



*Pulmonary Rehabilitation – strong evidence of improvement Adapted from Rochester 2008

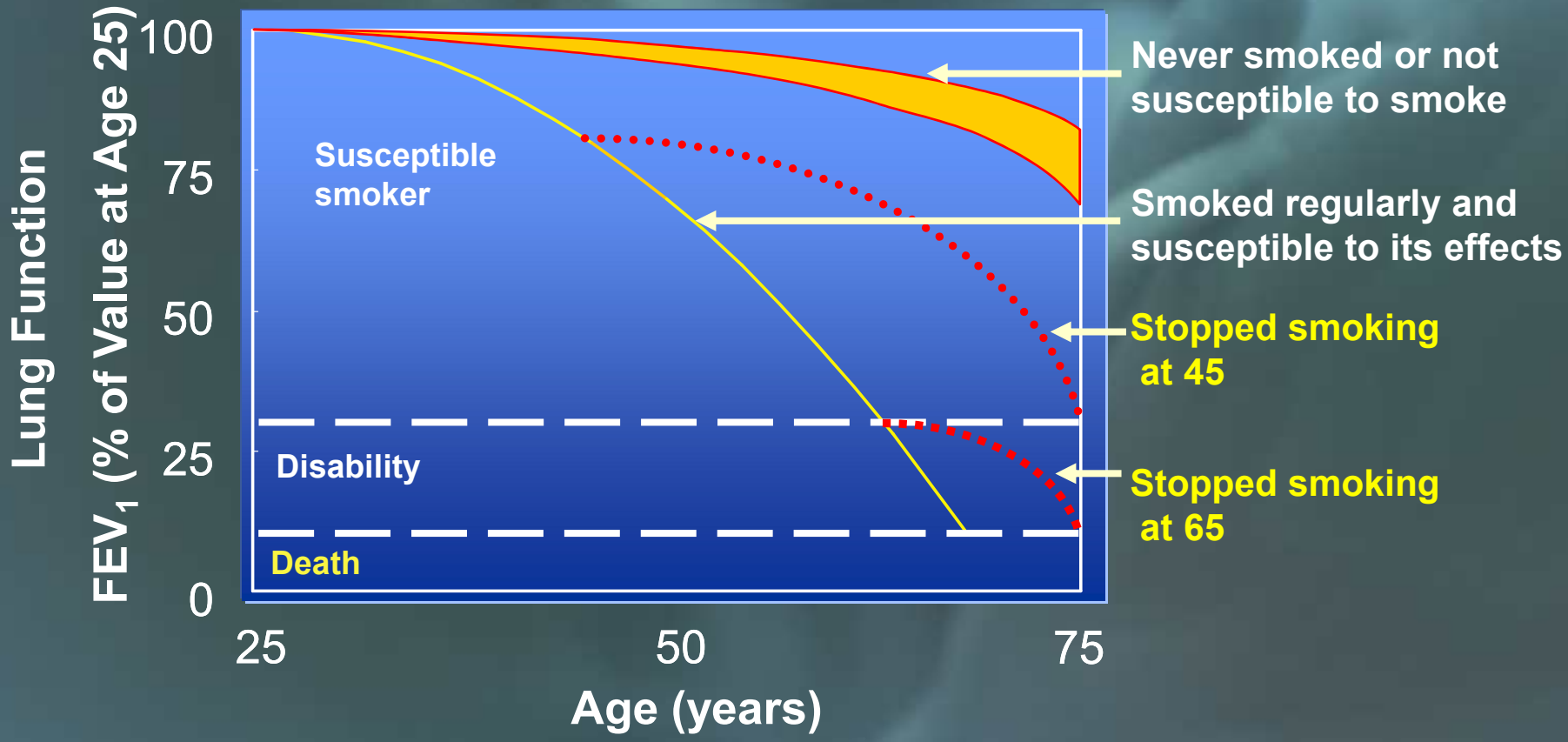
American Thoracic Society COPD Guidelines



www.thoracic.org/clinical/copd-guidelines/index.php

Quitting Smoking - Most Important To Prevent Onset and Progression of COPD

If exposure to noxious agents stops, disease progression slows



Fletcher et al. *Br Med J.* 1977;1:1645-1648. Used with permission from the BMJ Publishing Group.

Effect of Medications on COPD

Standards for the Diagnosis and Treatment of Patients with COPD: ATS / ERS Position Paper

	FEV_1	SOB	QOL	Exacer-bations	Exer-cise	Side effect
Albuterol	Yes	Yes	NA	NA	Yes	Some
Ipratropium	Yes	Yes	No	Yes	Yes	Some
Long Acting Beta Agonists	Yes	Yes	Yes	Yes	Yes	Minimal
tiotropium	Yes	Yes	Yes	Yes	Yes	Minimal
Inhaled steroids	Yes	Yes	Yes	NA	NA	Some
Theophylline	Yes	Yes	Yes	Yes	Yes	Important

American Thoracic Society Documents

American Thoracic Society/European Respiratory Society Statement on Pulmonary Rehabilitation

- Evidence-based, multidisciplinary, comprehensive program
  - Chronic respiratory diseases
  - Symptomatic, decreased daily activities
  - Integrated into individualized treatment
  - Designed to optimize functional status
    - Increase participation
    - Reduce healthcare costs
    - Reduce symptoms
- *Stabilizing or reversing systemic manifestations*

Nici, Garvey, et al ATS/ERS Statement on PR Am J Respir Crit Care Med V173. Pp 1390-413, 2006,

Pulmonary Rehabilitation

- Physician - supervised program
  - Supervised exercise
  - Education – disease self-management training
  - Outcome assessment
- Goal: Improvement in:
  - Functional capacity, long term exercise
  - Maximum potential in self care
  - Long term use of treatments
  - Quality of life
  - Reduce hospitalizations
- Chronic, stable, symptomatic lung disease
- Physically and mentally able to participate

Pulmonary Rehabilitation Setting

- Multidisciplinary Team:
  - Medical Director
  - May include nurses, physical therapists, respiratory therapists, social workers, dietitians
- Progressive exercise: aerobic and resistance
  - 30 minutes of moderate intensity physical activity such as walking five or more days per week

  Am Fam Physician 2008;77:8;1136-1138.
- Clinical monitoring: oxygen saturation, dyspnea, heart rate, blood pressure, blood glucose in diabetes
- Evaluate patient's progress related to rehabilitation
- Outcomes - pre and post Pulmonary Rehabilitation
  - Objective, patient-centered outcomes
  - Functional capacity, dyspnea, quality of life

Pulmonary Rehabilitation Education

- Dyspnea control – pursed lip breathing
- Prevention, management of exacerbations
- Energy conservation – Activities of Daily Living
- Proper use of inhaled medications
- Control of anxiety, panic, depression
- Oxygen needs, safety, monitoring, portability
- Secretion clearance techniques, devices
- Nutrition counseling
- Home exercise program and guidelines
- Disease progression, end of life planning

Dyspnea Screening / Monitoring

MMRC Dyspnea Scale

- 0: I only get breathless with strenuous exercise
- 1: I get short of breath when hurrying on level ground or walking up a slight hill
- 2: On level ground, I walk slower than people of the same age because of breathlessness, or have to stop for breath when walking at my own pace
- 3: I stop for breath after walking about 100 yards or after a few minutes on level ground
- 4: I am too breathless to leave the house or I am breathless when dressing

Modified Medical Research Council (MMRC)

Modified Borg Scale

- 0 No Breathlessness at all
- 1 Very Slight
- 2 Slight Breathlessness
- 3 Moderate
- 4 Somewhat Severe
- 5 Severe Breathlessness
- 6
- 7 Very severe breathlessness
- 8
- 9 Very very severe
- 10 Maximum

Training Zone

Keep "shortness of breath"
3 – 4 with exercise

Quality of Life Questionnaires

- St George's Respiratory Questionnaire (SGRQ)
  sgrq@sgul.ac.uk ttp://www.healthstatus.sgul.ac.uk/downloads/sgrq_scoring_sheet.htm
- Chronic Respiratory Disease Questionnaire (CRQ)
  1-877-836-9235, Fax: 905-540-8019 Email: orcip@mcmastr.ca
- Medical Outcomes Study Short Form 36 (SF-36)
  http//www.qualitymetric.com/WhatWeDo/GenericHealthSurveys/tabid/184/Default.aspx

Functional Capacity Testing

- 6 Minute Walk Test
  - Self-paced, reliable, correlates with VO_2 peak in moderate COPD
    http://www.thoracic.org/statements/resources/pfet/sixminute.pdf
- Incremental Shuttle Walk Test
  - Externally paced, reliable, correlates with VO_2 peak in mod COPD
    www.pulmonaryrehab.com.au/PDFs/ResourcesPatientAssessment_ISWT.doc
- Cardiopulmonary Exercise Test
  - Direct measure of O_2, CO_2, minute ventilation, tidal volume, respiratory rate on breath-by-breath basis
    ATS/ACCP Statement: Cardiopulmonary Exercise Testing (2003) and Lavoilette (2008).

Outcomes of Pulmonary Rehabilitation Randomized Controlled Trials

- Increase in sub-maximal exercise[1, 3, 4, 5, 7, 9]
- Improvement in dyspnea[1, 2, 3, 4, 5]
- Improvement in health status[4, 7, 8, 9]
- Fewer hospital days and primary care visits[7]
- Enhanced psychological well being,[10, 11] quality of life,[10, 11] depression,[7] anxiety[7,13,14] cognitive function[4]

[1] R Goldstein, et al. Lancet 1994; 344:1394-1397
[2] J Reardon, et al. CHEST 1994;105:1046-1052.
[3] A Ries, Ann Intern Med 1995;122:823-832.
[4] P Wijkstra,et al. Eur Respir J 1996;9:104-110.
[5] J Strijbos, et al. CHEST 1996;109:366-372
[6] K Benndstrup, et al. Eur Respir J 1997;10:2801-2806:
[7] T Griffiths, et al Lancet 2000;355: 362-368
[8] J Finnerty, et al. CHEST 2001;119:1701-1710.
[9] T Troosters, et al. Am J Med 2000;109:207-212
[10] Devine, Patient Educ Couns 1996; 29:167-178.
[11] Wempe J, Patient Educ Couns 2004; 52:237-241.
[12] Emery C. Health Psychol 1998;17:232-240.
[13] Paz-Diaz H, Am J Phys Med Rehabil 2007;86:30-36
[14] Kayahan B. Respiratory Med (2006)100, 1050-1057

Oxygen For Hypoxemia

- Oxygen improves survival, exercise capacity, sleep quality and cognitive performance in hypoxemia
- Therapeutic goal: keep SpO_2 > 90% during rest, sleep and exercise http://www.thoracic.org/clinical/copd-guidelines/index.php
- Promote portable oxygen systems for ambulation
- Address air travel with hypoxemia
  - Ambient oxygen concentration - 21% at sea level
  - Ambient oxygen concentration - 15% in aircraft

Portable liquid O_2

Portable O_2 concentrators

Stationary concentrator

Clinical Resources

- Global Initiative for COPD (GOLD) http://www.goldcopd.com
- ACCP / AACVPR Evidence based guidelines
  http://chestjournal.chestpubs.org/content/131/5_suppl/4S.full.pdf+html
- American Thoracic Society / ERS PR statement
  http://www.thoracic.org/statements/resources/respiratory-disease-adults/atserspr0606.pdf
- American Thoracic Society / ERS COPD Guidelines
  http://www.thoracic.org/sections/copd/index.html
- ATS Spriometry standards, interpretation, 6 MWT
  http://www.thoracic.org/statements/index.php
- National Lung Health Education Program: spirometry resources http://www.nlhep.org/
- Pulmonary Rehabilitation Tool Kit
  http://www.pulmonaryrehab.com.au/index.asp?page=63
- COPD Action plan
  http://www.copdx.org.au/checklist/documents/copdactionplan.pdf

Patient Resources

- American Thoracic Society: thoracic.org/sections/education/ patient-education
- American College of Chest Physicians: http://www.chestnet.org/patients/guides/
- Travel: aeromedix.com breathineasy.com/
- Oxygen portableoxygen.org, homeoxygen.org
- Multi-lingual pulmonary information http://www.european-lung-foundation.org/index.php?id=2114
- Multilingual COPD information ttp://www.nlm.nih.gov/medlineplus/languages/copdchronicobstructivepulmonarydisease.html

Pulmonary Rehabilitation – Where East Meets West

- Haeso cheonsik 'cough and dyspnea'
  - Could be COPD, asthma, heart failure, other diseases
  - Considered part of normal aging process

Kim DS, et al. Prevalence of COPD in Korea; a population-based spirometry survey. Am J Respir crit Care Med 2005; 172:842-847.

- COPD is not a well know term by public or medical community Shim Y. Epidemiological Survey of COPD and aphya-1 antitrypsin deficiency in Korea Resirology 2001;6:S9-11.
- 36% of severe – very severe COPD patients do not have a physician diagnosis of COPD Kim DS, et al. Prevalence of COPD in Korea; a population-based spirometry survey. Am J Respir crit Care Med 2005; 172:842-847.

Pulmonary Rehabilitation – Where East Meets West

- Need for multifaceted approach to improve disease prevention and effective management:
  - Improve awareness of COPD prevalence
  - Facilitate accurate diagnosis of COPD
  - Health care policies to reduce risk factors for COPD
  - Wider use of evidence based guidelines

    W C Tan, T :P Ng, COPD in Asia Where East Meets West CHEST vol 133, Issue 2, Feb 2008
- *What is My Role as a Clinician?*
  - Assess and monitor:
    - Risk factor exposure
    - Symptom, activity level and changes
    - Accurate diagnosis based on spirometry
    - Medication adherence and inhaler technique
    - Exacerbations