

The modern management of COPD

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Introduction

- ◎ Diagnosis
- ◎ Managing stable COPD
- ◎ Managing exacerbations of COPD
- ◎ Admission avoidance
- ◎ Key priorities for implementation
 - Diagnosis
 - Smoking cessation
 - Promote effective inhaled therapy
 - Provide pulmonary rehabilitation
 - Use of NIV
 - Manage exacerbations
 - Multidisciplinary working



Aetiology

- **Cigarette smoking – most with 20 pack years**
- Chronic mucus hypersecretion
- Passive smoking
- Air pollution
- **Proteinase-inhibitor deficiency**
- Chronic bronchopulmonary infection
- **Occupation**
- Growth and nutrition
- Socioeconomic status
- Gender
- Atopy and airway hyper-responsiveness

Pathogenesis/Aetiology

- 3 distinct pathological lesions
 - Emphysema – alveolar region
 - Mucous gland hyperplasia – large airways
 - Inflammation and fibrosis – small airways
- Present to varying degrees in different patients
- All may contribute to airflow limitation



INFLAMMATION IN COPD

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graph TD; A[INFLAMMATION IN COPD] --> B[Small airway disease]; A --> C[Parenchymal destruction]; B --> D[AIRFLOW LIMITATION]; C --> D;
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Small airway disease

Airway inflammation
Airway remodeling

Parenchymal destruction

Loss of alveolar attachments
Decrease of elastic recoil

AIRFLOW LIMITATION

Diagnosis – step 1

- Consider if
 - > 35yrs **AND**
 - smoker or exsmoker **AND**
 - Typical symptoms **AND**
 - Do not have the typical clinical features of asthma



Diagnosis of COPD

SYMPTOMS

cough
sputum
shortness of breath

EXPOSURE TO RISK FACTORS

tobacco
occupation
indoor/outdoor pollution

```
graph TD; A[SYMPTOMS  
cough  
sputum  
shortness of breath] --> D[SPIROMETRY]; B[EXPOSURE TO RISK FACTORS  
tobacco  
occupation  
indoor/outdoor pollution] --> D;
```

SPIROMETRY

Diagnosis – step 2

- Initial diagnostic evaluation
 - Post bronchodilator spirometry
 - Chest x ray to exclude other pathology
 - Full blood count to exclude anaemia or polycythaemia
 - BMI
 - **Assess severity**



Severity assessment 1–

NICE clinical guideline 2010

- Severity of airflow obstruction using spirometry:
- **Post bronchodilator $FEV_1/FVC < 0.7$**
 - $FEV_1 \geq 80\%$ Stage 1 - Mild
 - FEV_1 50-79% Stage 2 – Moderate
 - FEV_1 30-49% Stage 3 – Severe
 - $FEV_1 < 30\%$ Stage 4 – Very severe



Severity assessment 2

- Frequency of exacerbations
- Prognostic factors
 - Breathlessness wrt MRC dyspnoea scale
 - Gas transfer – TLCO
 - Health status
 - Exercise capacity
 - BMI
 - PaO₂
 - Cor pulmonale

Severity assessment 3

- BODE index
 - BMI
 - Airflow obstruction
 - Dyspnoea
 - Exercise capacity
- Investigate disproportionate symptoms
 - CT thorax
 - Full lung function including gas transfer



BODE index for COPD survival prediction (1)

- Post bronchodilator FEV1% predicted
 - $\geq 65\%$ 0 points
 - 50-64% 1 point
 - 36-49% 2 points
 - $\leq 35\%$ 3 points
- 6 minute walk distance
 - ≥ 350 m 0 points
 - 250-349m 1 point
 - 150-249m 2 points
 - ≤ 149 m 3 points

BODE index for COPD survival prediction

(2)

- MMRC dyspnoea scale
 - 0 Dyspnoeic on strenuous exercise 0 points
 - 1 Dyspnoeic on walking a slight hill 0 points
 - 2 Dyspnoeic on walking on level ground 1 point
 - 3 Must stop for sob after walking for 100yds 2 points
 - 4 Cannot leave the house, sob dressing 3 points
- Body mass index
 - > 21 0 points
 - ≤ 21 1 point



BODE index for COPD survival prediction (3) – 4 year survival interpretation

- 0-2 points 80%
- 3-4 points 67%
- 5-6 points 57%
- 7-10 points 18%



COPD and Co-Morbidities

COPD has significant extrapulmonary (systemic) effects including:

- Weight loss
- Nutritional abnormalities
- Skeletal muscle dysfunction



Diagnosis

- Reassess in view of response to treatment
 - **Not COPD** if FEV_1 and FEV_1/FVC return to normal
 - Asthma may be present
 - If there is a $> 400\text{ml}$ response to bronchodilators
 - Serial peak flow measurements $\geq 20\%$ variability
 - If there is a $> 400\text{ml}$ response to 30mg Prednisolone for 14 days



Differential Diagnosis

- Asthma
 - Diurnal variability
 - Night time awakening
 - Domiciliary peak flow measurements
- Bronchiectasis
 - Purulent sputum production
 - Infective exacerbations
- Large airway obstruction e.g. carcinoma of bronchus
- Congestive cardiac failure



Differential Diagnosis: COPD and Asthma

COPD

- Onset in mid-life
- Symptoms slowly progressive
- Long smoking history
- Dyspnea during exercise
- Largely irreversible airflow limitation

ASTHMA

- Onset early in life (often childhood)
- Symptoms vary from day to day
- Symptoms at night/early morning
- Allergy, rhinitis, and/or eczema also present
- Family history of asthma
- Largely reversible airflow limitation



Managing stable COPD

- Smoking cessation
- Inhaled therapies
- Pulmonary Rehabilitation
- Oral therapy
- Oxygen therapy
- Assess effectiveness of treatments wrt
 - Improvement in symptoms and Activities of daily living
 - Exercise capacity
 - Reduction in frequency of exacerbations
 - Longitudinal measurements of spirometry, SaO₂, BMI



Inhaled therapies

- SABA
- SAMA
- LABA
- LAMA
- LABA + ICS
- Combinations of the above



Inhaled therapies

- Breathlessness and exercise limitation
- Exacerbation frequency
- LABA + ICS if
 - ≥ 2 exacerbations/yr + $FEV_1 < 50\%$ or
 - Persistent symptoms/ exacerbations despite trying either LABA or LAMA
- Final step - use LAMA+LABA+ICS



Inhaled therapies – Delivery systems

- Inhalers
- Spacers
- Nebulisers
 - If distressing or disabling breathlessness despite maximum therapy with inhalers
 - Assess ability to use the nebuliser
 - Facemask/ mouthpiece
 - Continue only if improvement in symptoms, daily living activities, exercise capacity or lung function




Oral therapy

- Corticosteroids – not recommended
- Theophylline
 - after trials of short acting and long acting bronchodilators OR if unable to use inhaled treatment
 - Reduce dose if using macrolide or fluoroquinolone antibiotics or other drugs that interact
 - Care when prescribing to elderly – pharmacokinetics, comorbidities and drug interactions
- Mucolytics



Oxygen therapy

- LTOT

- Screen SaO_2 patients with severe airflow obstruction ie $\text{FEV}_1 < 50\%$ or signs of cor pulmonale
 - If stable COPD, receiving optimum medical management and $\text{SaO}_2 < 92\%$ then LTOT abg assessment
 - Two Abg samples on air - 3 weeks apart when stable
 - Prescribe LTOT for 15 hrs/day via concentrator if
 - $\text{PaO}_2 < 7.3 \text{ kPa}$ or
 - $\text{PaO}_2 < 8 \text{ kPa}$ in the presence of pulmonary hypertension, secondary polycythaemia, nocturnal hypoxaemia
- 

Summary – Oxygen – Benefits of LTOT

At least 15 hrs per day

- Improves survival
- Reduces the incidence of polycythaemia
- Reduces progression of pulmonary hypertension
- Improves neuropsychological health
- MRC trial and the NOTT trial



Oxygen therapy

- AOT
 - For LTOT patients who want to use oxygen outside the home
 - Significant exercise desaturation + improvement in exercise capacity using AOT
 - Significant exercise desaturation AND attending Pulmonary Rehabilitation



Pulmonary Rehabilitation

- Evidence based, multidisciplinary and comprehensive intervention for patients with chronic respiratory disease
 - Lower and upper extremity exercise conditioning
 - Breathing retraining
 - Education
 - Psychosocial support
 - Smoking cessation
 - Oxygen therapy, bronchodilators, antibiotics
 - Nutritional support
- Reverses the vicious cycle of progressive deconditioning associated with inactivity



Pulmonary Rehabilitation

- Underutilised but effective treatment
- State of the art programme at Harefield Hospital
- PEPR for those with
 - recent hospitalisation due to an exacerbation
 - Can reduce 90 day readmission rate
 - MRC dyspnoea grade 3 and above
- Not suitable for those with recent MI, unstable angina, unable to walk



Outpatient pulmonary rehabilitation following acute exacerbations of COPD

Seymour et al; Thorax 2010;65:423-428

- 60 patients underwent concealed randomisation
- at the time of their hospital discharge (UC: n¼30, mean
- (SD) age 65 (10) years, forced expiratory volume in 1 s
- (FEV1) 52 (22)% predicted; PEPR: n¼30, 67(10) years,
- 52 (20)% predicted). The proportion of patients readmitted
- to hospital with an exacerbation was 33% in
- the UC group compared with 7% in those receiving
- PEPR (OR 0.15, 95% CI 0.03 to 0.72, p¼0.02).
- The proportion of patients that experienced an
- exacerbation resulting in an unplanned hospital
- attendance (either admission or review and discharge
- from the emergency department) was 57% in the
- UC group and 27% in those receiving PEPR (OR 0.28,
- 95% CI 0.10 to 0.82, p¼0.02).

Pulmonary Rehabilitation - benefits

- Improves exercise tolerance
- Reduces the perceived intensity of breathlessness
- Can improve health-related quality of life
- Reduces the number of hospitalisations and days in the hospital
- Reduces anxiety and depression associated with COPD
- Strength and endurance training of the upper limbs improves arm function
- Improves survival
- Respiratory muscle training is beneficial, especially combined with general exercise training
- Psychosocial intervention is helpful



COPD and Co-Morbidities

COPD patients are at increased risk for:

- Myocardial infarction, angina
- Osteoporosis
- Respiratory infection
- Depression
- Diabetes
- Lung cancer



Exacerbations - Aetiology

- Infections

- Rhinoviruses
- Parainfluenza
- Coronavirus
- Adenovirus
- RSV
- *H.influenzae*
- *S.pneumoniae*
- *M.catarrhalis*
- *S.aureus*

P.aeruginosa

C.pneumoniae

Pollutants

NO₂

Particulates

SO₂

Ozone

Unidentified 30%



Managing exacerbations

- Early intervention at home – reserve meds
 - Oral corticosteroids
 - Prednisolone 30 mg od for 7-14 days
 - Antibiotics if sputum purulent or signs pneumonia
 - Aminopenicillin, Macrolide or Tetracycline
 - Adjust bronchodilator therapy
 - Increase frequency
 - Consider nebulised bronchodilators



Managing exacerbations

- Home or hospital treatment ?
- Criteria for admission
 - $\text{SaO}_2 < 90\%$
 - Confusion or impaired level of consciousness
 - Rapid rate of onset or Severe breathlessness
 - Unable to cope or poor social circumstances
 - Worsening peripheral oedema or significant co-morbidity
- Arrange review



Indications for hospitalisation of patients with a COPD exacerbation

- Presence of high-risk co-morbid conditions, including pneumonia, cardiac arrhythmia, congestive heart failure, diabetes mellitus, renal or liver failure
- Inadequate response of symptoms to outpatient management
- Marked increase in dyspnoea
- Inability to eat or sleep due to symptoms
- Worsening hypoxaemia
- Worsening hypercapnia
- Changes in mental status
- Inability of the patient to care for her/himself
- Uncertain diagnosis
- Inadequate home care



Admission avoidance 1

- Pulmonary rehabilitation – including PEPR
 - PR immediately following an acute COPD exacerbation reduces the risk of re-exacerbation requiring hospital attendance in following 3 months
 - Exercise capacity and quadriceps strength improved & predict reduced healthcare utilisation
- Early intervention with reserve rescue medication at home
- Exclude and treat co-morbidity eg bronchiectasis



Admission avoidance 2

- Medication
 - LAMA
 - LABA + ICS
 - Pulse oximetry screening for severe patients, facilitating home oxygen therapy
- Admission avoidance team
 - Nurse supervision of home exacerb.treatment
 - COPD community clinic
 - Therapy support



Hospital treatment of exacerbations

- Emergency oxygen prescribing, management of respiratory failure - abgs
- Iv Theophylline?
- **Assess for NIV in hypercapnic respiratory failure**
AND further treatment plan in NIV fails
- Suitability for intubation on ICU
- Monitor recovery and change to inhalers when stable
- Hospital at home or assisted discharge scheme
- Pre-discharge check

Exacerbations - consequences

- 34% re-admitted within 3 months
- 63% re-admitted within 12 months, increased chance
 - 3 or more admissions in previous year
 - FEV₁ % predicted
 - PaO₂
 - Lower levels of physical activity
 - Need for an anticholinergic bronchodilator
- Symptoms and PEFr recover slowly after exacerb.
 - Median recovery symptoms 7 days, PEFr 6 days
 - PEFr recovery not complete in 24.8% at 35 days and 7.1% at 91 days
 - Frequent exacerbators had a more rapid lung function decline and worse HRQL on SGRQ

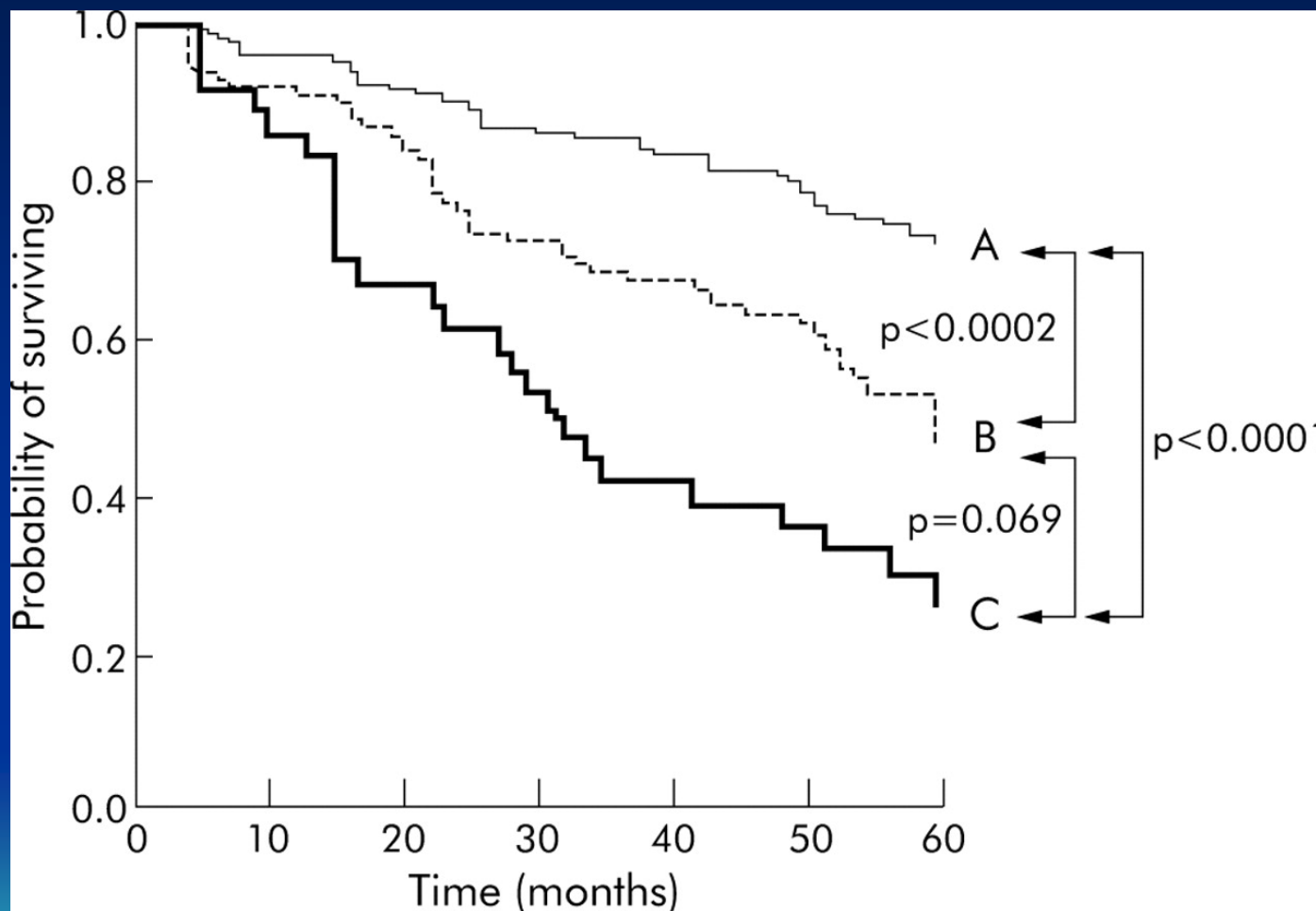


Consequences of Acute Exacerbations

- Accelerated decline in FEV₁
 - Cut off 2.92 /yr [Donaldson et al Thorax 2002]
- Negative impact on symptoms and HQRL
 - 0-2 vs 3-8, mean difference of 15.1 on SGRQ [Seemungal et al 1998 AJRCCM]
- Increased health resource utilization and direct costs
 - Hospitalisations 46% total UK healthcare expenditure for COPD [Calverley et al Thorax 1998]
- Increased mortality with exacerbation



Figure 1 Kaplan-Meier survival curves by frequency of exacerbations in patients with COPD: group A, patients with no acute exacerbations of COPD; group B, patients with 1-2 acute exacerbations of COPD requiring hospital management; group C, patients with ≥ 3 acute exacerbations of COPD.



Soler-Cataluna, J J et al. Thorax 2005;60:925-931

Key priorities for implementation

- Diagnosis
- Smoking cessation
- Promote effective inhaled therapy
- Provide pulmonary rehabilitation
- Use of NIV
- Manage exacerbations
- Multidisciplinary working

