Chronic Obstructive Pulmonary Disease (COPD)

AKA Chronic obstructive airways disease (COAD), chronic airways limitation (CAL).

Definition A slowly progressive disorder characterised by airflow obstruction that does not change markedly over several months and is not fully reversible by bronchodilators. Airflow obstruction is defined as FEV_1<80% predicted and FEV_1/FVC<0.7.

Classification

Chronic Bronchitis – productive cough without other cause for 3 months/year for 2^+ consecutive years. May have reversible (asthma) component. 8x as frequent as emphysema.
Emphysema – abnormal airspace enlargement and destruction of airspaces and alveolar walls beyond terminal bronchioles without obvious fibrosis. May be centriacinar (smoking) or panacinar (αAT deficiency).
Acute Exacerbation – ↑dyspnoea, ↑sputum purulence, ↑sputum volume

Epidemiology/Risk Factors

- Smoking – 95% cases. Affects 15% of 1 pack/day and 25% of 2 pack/day smokers.
- Occupational exposure – cadmium, gold, coal
- Genetic – 1% cases from homozygous α1 anti-trypsin deficiency (rare in Asians).
- Air pollution – minor risk
- ?Childhood infections may play a role in later development.

Pathophysiology

- V/Q mismatch
- ↑airways resistance, FRC, gas trapping, and work of breathing
- ↓flow rates, and max. alveolar ventilation.

Clinical Features

History - history of smoking and respiratory symptoms (SOBOE, chronic cough, regular sputum production, wheezing, chest tightness or frequent episodes of chest infection), weight loss, fatigue, and ankle oedema. Recent changes to cough, sputum, fever, chest pain, Rx.
Examination – May be normal or show:

- Breathlessness ± accessory muscle use, prolonged expiration, or purse lip breathing
- Wheeze or quiet breath sounds
- Cyanosis/plethora, ↑JVP, or peripheral oedema
- Cachexia, hyperinflated chest, ↓liver/cardiac dullness to percussion, ↓crico-sternal dist
- Tar staining of fingers

Differential Diagnoses

Asthma, LVF, FB, bronchiectasis/CF, allergic fibrosing alveolitis, pneumoconiosis, asbestosis or other restrictive conditions, TB, lung cancer, carcinoid, PE, anaemia, LRTI

Complications

- Infective exacerbations – viral, bacterial
- Hypoxaemia, hypercapnea and respiratory failure
- Pulmonary hypertension
- Cor pulmonale
- Polycythaemia
- Others: Bullae→Pneumothorax, PE, steroid SE, SVT

Investigations

- Spirometry – FEV1<80% predicted, FEV1/FVC<0.7. Post bronchodilator FEV1 grades severity (60-80% pred=Mild, FEV1 40-59% pred=Moderate, <40% pred=Severe)
    - NB. PEFR often underestimates air flow obstruction. Spirometry predicts prognosis; but not disability and quality of life.
- Pulse oximetry
- CXR – may show hyperinflation, flat hemidiaphragms, reduced peripheral vascular markings, and bullae. May exclude other serious lung pathology, such as lung cancer or reason for presentation – infection, pneumothorax, etc.
- FBC (anaemia or polycythaemia) & UEC (K^+). ??BNP to help DDx of cardiac failure.
- ABG – if Hx of CO_2 retention, marked resp symptoms. May show ↑A-a gradient, ↑PCO_2, ↓PO_2, resp failure, acute/chronic met. alkalosis/resp. acidosis.
- ECG – small amplitude complexes, RVH, P pulmonale, MAT, AF.
- Echo – if cor pulmonale suspected
- CT – may be considered for detection of extent of disease, lung ca, PE.
- Serum alpha1-antitrypsin – if non-smoker, family history, or early onset

Acute Exacerbation Management

Controversy over exact role of infection as high rates of sputum bacterial colonization.
Usual sputum pathogens: H. influenzae (22%), Pseud. aeruginosa (15%), pneumococcus (10%), and Moraxella catarrhalis (9%). Mycoplasma or Chlamydia pneumoniae (1-10%). Viruses (20⁺%).
Non-infectious agents are responsible for some exacerbations, e.g. NO_2, SO_2, O_3, particulates.
The cause of the exacerbation may be unidentifiable in up to 30% of exacerbations.
Oxygen: Use lowest FiO_2 to achieved desired effect. Use 1-2L/min NP or 24-28% Venturi mask. Aim for PO_2 of ≥60mmHg/SaO_2≥90%. Watch for ↑PCO_2
High-dose short acting inhaled bronchodilators (β2-agonist & anticholinergic)
Oral steroids: Prednisolone 30 mg daily for seven to 14 days.
Antibiotics: Only if sputum is purulent or ↑volume, fever, ↑WCC, or CXR consolidation. Consider 5-10d of co-amoxiclav; doxycycline, clarithromycin or azithromycin PO or ceftriaxone if IV req.
Non-invasive ventilation (NIV) CPAP±PS or BiPAP 15/5mmHg is 1st line treatment of persistent hypercapnic ventilatory failure during exacerbations with medical therapy. Beware ↓BP.
Chest Physiotherapy considered for selected patients as little evidence of benefit.
Respiratory stimulants: doxapram only used if NIV unavailable or considered inappropriate. (Intravenous theophylline very rarely used)
Invasive ventilation and intensive care: if all else fails. High mortality (20-30%)
Example settings:

- *Ventilator Mode:* Volume Assist Control or SIMV modes
- *Lung protection:* TV 6-8ml/kg (aim Plateau Pressure<30cmH_2O)
- *Comfort:* Insp Flow rate 60-80ml/min
- *Ventilation:* RR 16-18 (adjust to keep pH7.3-7.45)
- *Oxygenation:* FiO_2 100% & PEEP 5cmH_2O (drop FiO_2 to 30-40% if ABG adequate and increase PEEP in 2-3cmH_20 per 10% increase in FiO_2 up to max PEEP of 20-24cmH_2O)

Disposition

Admission recommended if:

- Severe breathlessness, cyanosis
- Confusion, impaired consciousness
- Worsening peripheral oedema or significant comorbidity is present
- On long-term oxygen therapy
- Unable to cope at home, lives alone, or confined to bed
- General condition is poor or is deteriorating

Maintenance Management of COPD

Prevention - smoking cessation is a priority and reduces the rate of decline of FEV1, protective masks and proper ventilation in high risk occupations.

Education/Support

- Compliance - ~50% underuse their maintenance Rx, ~50% overuse with exacerbation.
- Check MDI ± spacer technique
- Dietician referral (low BMI is poor prognostic sign)
- Vaccination – pneumococcal, annual influenza
- Pulmonary Rehabilitation
    - Multidisciplinary programme tailored to a patient.
    - Includes ventilatory muscle training, exercise programmes, and psychosocial, behavioural, and educational components.

Stable COPD

- PRN short-acting bronchodilator (β2-agonist or anticholinergic).
- If still symptomatic, use one of the following 2 options:
    - Combined therapy: short-acting β2-agonist + a short-acting anticholinergic.
    - OR a long-acting bronchodilator (β2-agonist or anticholinergic).
- If still symptomatic, consider a trial of combination of a long-acting bronchodilator and inhaled corticosteroid. Discontinue if no benefit after 4 weeks.
- If still symptomatic, consider adding slow release theophylline.

COPD with frequent exacerbations COPD

- One or more long-acting bronchodilators (β2-agonist and/or anticholinergic).
- If still troubled by freq exacerbations and FEV1 <50% add inhaled corticosteroids

Home Oxygen

- Improves survival in people with severe COPD and chronic hypoxaemia.
- Indications
    - Continuous (≥15hr/day) – PO_2<55mmHg in air awake at rest OR PO_2<60mmHg if Hb>170g/L, pulm ↑BP or RVF.
    - Intermittent – not much evidence for benefit except in certain circs:
        - Air travel if resting PO_2<70mmHg
        - Exercise hypoxaemia
        - Nocturnal SaO2<88%
- Contraindications – continued smoking, PO_2≥60mmHg, poor compliance, inadequate Rx.
- Low flow rates <4L/min
- Dangers – mild hypercapnea, fire risk
- Gov. funding if meet criteria and prescribed by approved respiratory physicians/cardiologists.
- Systems – concentrators, cylinders, liquid oxygen

Drugs Notes

No drugs found to alter progression of disease.

Short-acting β2-agonists e.g. salbutamol

- Bronchodilate by smooth muscle relaxation. Also. ↓hyperinflation
- ↑FEV1 & ↓SOB & fatigue.
- Regular or an as-required basis.
- MDI ± spacer preferred delivery modality. Nebulisers 2nd line.
- SE: tremor

Short-acting anticholinergics e.g. ipratropium bromide

- Block muscarinic bronchoconstriction and mucus secretion. Also ↓hyperinflation.
- They also ↑FEV1.
- Slower onset and longer action than short-acting β2-agonists, so less good for PRN use
- SE: urinary retention if existing BPH & bladder outflow obstruction in elderly men, dry, acute closed-angle glaucoma with nebulised ipratropium.

Long-acting β2-agonists (salmeterol, eformeterol) & long-acting anticholinergics (tiotropium)

- Similar to their short-acting equivalents but lasting 12-24hrs.

Methylxanthines - theophylline

- Exact mechanism unknown, but assumed to relax airway smooth muscle. Also ↑diaphragmatic strength, ↑mucociliary clearance, and ↑cardiac output.
- Narrow therapeutic index - toxicity and drug interaction – check levels.
- Rarely used.

Corticosteroids

- Inhaled steroids considered if severe COPD (FEV1 <50%) and frequent (>2/yr) exacerbations.
- No effect on the rate of decline of FEV1 or symptom scores.
- Use spacer to reduce systemic absorption of inhaled corticosteroids.
- SE: oropharyngeal candidiasis, skin bruising and ?osteoporosis, but not cataracts or fractures.
- Oral short courses (<2wks) for acute exacerbations, but no evidence for maintenance use.

Combination therapy

- E.g. β2-agonist/anticholinergic,β2-agonist/theophylline, Anticholinergic/theophylline, Long-acting β2-agonist/inhaled corticosteroid
- Discontinue unless benefit after 4wks. (symptoms + Spirometry)

Rx not currently recommended: Mucolytics, prophylactic antibiotics, antitussives, anti-oxidants

Surgical

Occasionally patients still breathless despite maximal medical therapy may be candidates for bullectomy (if there is a single large bulla>33% of hemithorax), lung volume reduction surgery (upper lobe predominant emphysema), or lung transplantation (wide spread emphysema)

Prognosis

High morbidity up to 12% of hospital admissions may be due to COPD.

Inpatient mortality for exacerbations of COPD is 3-4% & as may be >20% for ICU

Readmission rate in 3mo post-discharge is >30%

True mortality rate due to COPD ~5%. Predictors: ↑age, severity of airflow obstruction, severity of hypoxaemia, presence of hypercapnia

Five-year survival from diagnosis is 25-75% depending on severity of disease.