**Acute asthma**

### Definition of acute asthma
- Chronic inflammatory disease of the airways characterised by localised type 1 hypersensitive reaction and variable reversible airway obstruction

### Epidemiology of acute asthma
- Asthma affects 10% of children and 5% of adults

### Aetiology of acute asthma
- Genetic factors
  - Family history
- Environmental factors
  - House dust mite
  - Pollen
  - Pets
  - Cigarette smoke
- Precipitating factors
  - Cold
  - Viral infection
  - Drugs
    - Beta blockers
    - Non-steroidal anti-inflammatory drugs (NSAIDs)
  - Exercise
  - Emotion

### Risk factors for acute asthma
- Eczema
- Allergic rhinitis
- Urticaria

### Pathophysiology of acute asthma
- Sensitisation phase
  - Immune system encounters allergen and makes immunoglobulin E (IgE) against it
  - No clinical features occur
- Early phase
  - Allergen cross-links IgE on surface of mast cells
  - Causes localised degranulation and release of histamine which mediates airway obstruction via stimulation of mucus hypersecretion, bronchoconstriction and airway oedema
- Late phase
  - Inflammatory cell infiltrates (lymphocytes, basophils and eosinophils) perpetuate airway obstruction and lead to bronchial hyper-responsiveness

### Presentations of acute asthma
- General and chronic symptoms
  - Cough
  - Dyspnoea
- Wheeze
- Chest tightness
- Symptoms precipitated by allergen exposure, cold air, exercise, emotion
- Diurnal variation in symptom severity
- PMH and/or FH of atopy
- Reduced peak expiratory flow rate (PEFR)
- Improvement with treatment

### Stratification of acute asthma

- **Moderate**
  - Worsening symptoms
  - No features of acute severe asthma
  - PEFR >50% of best/predicted

- **Acute severe**
  - Inability to complete sentences in a single breath
  - PEFR <50% of best/predicted
  - Respiratory rate (RR) >/= 25
  - Heart rate (HR) >/= 110

- **Life-threatening**
  - Poor respiratory effort
  - Cyanosis
  - Silent chest
  - Hypotension
  - Arrhythmia
  - Exhaustion
  - Reduced conscious level
  - PEFR <33% of best/predicted
  - Peripheral oxygen saturations ($S_pO_2$) <92%
  - Arterial partial pressure of oxygen ($P_aO_2$) <8 kPa
  - Normal arterial partial pressure of carbon dioxide ($P_aCO_2$) = 4.6-6.0 kPa

- **Near-fatal**
  - Raised $P_aCO_2$ and/or requiring positive pressure ventilation with raised inflation pressures

### Differential diagnosis of acute asthma

- Acute exacerbation of chronic obstructive pulmonary disease (COPD)
- Anaphylaxis
- Foreign body inhalation
- Bronchiolitis (children only)
- Croup (children only)
- Epiglottitis
- Laryngospasm

### Investigation of acute asthma:

- Peak flow (PEFR)
- Arterial blood gas (ABG)
- Full blood count
- Urea & electrolytes
- Chest radiograph (CXR): look for pneumothorax
Initial management of acute asthma

- Assess the patient from an ABCDE perspective and determine severity of attack (see above)
- Obtain senior help and inform intensive care unit (ICU) early if any features of life-threatening asthma are present
- Sit patient upright
- Maintain a patent airway: use manoeuvres, adjuncts, supraglottic or definitive airways as indicated and suction any sputum or secretions
- Deliver high flow oxygen 15L/min via reservoir mask and titrate to achieve $S_O^2$ 94-98%
- Give salbutamol 5 mg and ipratropium bromide 0.5 mg via oxygen-driven nebuliser
- Attach monitoring
  - Pulse oximetry
  - Non-invasive blood pressure
  - Three-lead cardiac monitoring
- Request 12 lead ECG and portable CXR
- Obtain intravenous (IV) access and take bloods including venous blood gas (VBG) in case ABG unsuccessful
- Perform ABG sampling
  - Markers of severity:
    - Low pH
    - $P_{CO_2} >4.6$ kPa
    - $P_{O_2} <8$ kPa
- Request CXR if there is:
  - Suspected pneumothorax or consolidation
  - Life-threatening asthma
  - Failure to respond to initial therapy
  - Requirement for ventilation
- Repeat salbutamol 5 mg via oxygen-driven nebuliser if inadequate response and give prednisolone 40 mg orally (PO) or hydrocortisone 100 mg IV if unable to swallow
- Consider ‘back-to-back’ salbutamol nebulisers or continuous salbutamol nebuliser 5-10 mg/h if inadequate response to initial therapy
- Consider magnesium sulphate 1.2-2.0 g IV over 20 minutes in life-threatening or near-fatal asthma or in acute severe asthma with an inadequate response to initial therapy
- Consider aminophylline 5 mg/kg IV loading dose over 20 minutes followed by 0.5 mg/kg/h IV maintenance dose in life-threatening or near-fatal asthma with an inadequate response to initial therapy

Further management of acute asthma

- Admission criteria
  - Life-threatening asthma
  - Near-fatal asthma
  - Acute severe asthma persisting despite initial therapy
- Indications for ICU referral
  - Requirement for ventilation
  - Poor respiratory effort
  - Drowsiness
  - Confusion
  - Deteriorating PEFR
  - Persisting or worsening hypoxia
  - Hypercarbia
  - Acidosis
- Coma
- Respiratory arrest

- Discharge criteria from emergency department
  - PEFR >75% of best/predicted 1 hour after initial therapy
  - Give prednisolone 40 mg once daily for five days
  - Check inhaler technique and ensure sufficient, in-date inhaled bronchodilator
  - Arrange follow up with GP in two days

### Complications of acute asthma
- Pneumothorax
- Respiratory failure
- Respiratory arrest
- Cardiac arrest

### Common questions concerning acute asthma

- List four characteristic clinical features of asthma
  - Cough
  - Dyspnoea
  - Wheeze
  - Chest tightness
- List the features that characterise a moderate asthma attack
  - Worsening symptoms
  - No features of acute severe asthma
  - PEFR >50% of best/predicted
- List the features that characterise an acute severe asthma attack
  - Inability to complete sentences in a single breath
  - PEFR <50% of best/predicted
  - RR >/= 25
  - HR >/= 110
- List the features that characterise a life-threatening asthma attack
  - Poor respiratory effort
  - Cyanosis
  - Silent chest
  - Hypotension
  - Arrhythmia
  - Exhaustion
  - Reduced conscious level
  - PEFR <33% of best/predicted
  - $S_O_2 < 92%$
  - $P_aO_2 < 8 kPa$
  - Normal $P_aCO_2 = 4.6-6.0 kPa$
- What initial therapy would you give for acute asthma?
  - Give salbutamol 5 mg and ipratropium bromide 0.5 mg via oxygen-driven nebuliser
- Should patients display an inadequate response to initial therapy, what further treatments can be given?
  - Repeat salbutamol 5 mg via oxygen-driven nebuliser if inadequate response and give prednisolone 40 mg orally (PO) or hydrocortisone 100 mg IV if unable to swallow
  - Consider ‘back-to-back’ salbutamol nebulisers or continuous salbutamol nebuliser 5-10 mg/h if inadequate response
  - Consider magnesium sulphate 1.2-2.0 g IV over 20 minutes in life-threatening or near-fatal
asthma or in acute severe asthma with an inadequate response to initial therapy
  o Consider aminophylline 5 mg/kg IV loading dose over 20 minutes followed by 0.5 mg/kg/h IV maintenance dose in life-threatening or near-fatal asthma with an inadequate response to initial therapy

- What features would concern you on an ABG
  o Low pH
  o $P_aCO_2 > 4.6$ kPa
  o $P_aO_2 < 8$ kPa

- List the indications for requesting a CXR
  o Suspected pneumothorax or consolidation
  o Life-threatening asthma
  o Failure to respond to initial therapy
  o Requirement for ventilation

- What criteria would mandate admission for acute asthma?
  o Life-threatening asthma
  o Near-fatal asthma
  o Acute severe asthma persisting despite initial therapy

- What criteria must be achieved to consider discharge following acute asthma?
  o PEFR >75% of best/predicted 1 hour after initial therapy

- What advice would you give on discharge?
  o Give prednisolone 40 mg once daily for five days
  o Check inhaler technique and ensure sufficient, in-date inhaled bronchodilator
  o Arrange follow up with GP in two days