

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) \geq 25
 - Heart rate (HR) \geq 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_pO_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
 - $P_aCO_2 > 4.6$ kPa
 - $P_aO_2 < 8$ 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 \geq 25
 - HR \geq 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_pO_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
- 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
 - Low pH
 - $P_a\text{CO}_2 > 4.6$ kPa
 - $P_a\text{O}_2 < 8$ kPa
- List the indications for requesting a CXR
 - Suspected pneumothorax or consolidation
 - Life-threatening asthma
 - Failure to respond to initial therapy
 - Requirement for ventilation
- What criteria would mandate admission for acute asthma?
 - Life-threatening asthma
 - Near-fatal asthma
 - Acute severe asthma persisting despite initial therapy
- What criteria must be achieved to consider discharge following acute asthma?
 - PEFr $> 75\%$ of best/predicted 1 hour after initial therapy
- What advice would you give on discharge?
 - 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