15.4 CONDITIONS WITH PREDOMINANT WHEEZE

15.4.1 ASTHMA ATTACK, ACUTE

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DESCRIPTION

Acute exacerbation of wheezing that is unresponsive to bronchodilator therapy that is usually effective in a child who had been previously diagnosed with asthma.

DIAGNOSTIC CRITERIA

Clinical signs include:

- » intense wheezing,
- » hyperinflation,
- » tachypnoea,
- » hypoxaemia,
- » restlessness,
- » difficulty or inability to talk or feed,
- » decreased air entry,
- » dyspnoea,
- » tachycardia,
- » anxiety,
- » palpable pulsus paradoxus,
- » reduced peak flow rate.

The following are danger signs in acute, severe asthma and require referral:

- » restlessness,
- » disturbance in level of consciousness,
- » rising P_aCO_2,
- » silent chest with auscultation,
- » PEFR < 60% of predicted value,
- » decreasing oxygen saturation < 85%,
- » palpable pulsus paradoxus,
- » chest pain (air leaks).

Classification of Severity of Acute Asthma Exacerbations

	Mild	Moderate	Severe
Oxygen saturation ***(performed off oxygen)***	> 95%	92–95%	< 92%
PEFR*	70–90%	50–70%	< 50%
Arterial P_aCO_2	< 35 mmHg < 3.7 kPa	< 40 mmHg < 5.3 kPa	> 40 mmHg > 5.3 kPa
Pulsus paradoxus	< 10 mmHg < 1.3 kPa	10–20 mmHg 1.3–2.7 kPa may be palpable	20–40 mmHg 2.7–5.3 kPa palpable
Wheezing	expiratory	expiratory and inspiratory	breath sounds soft
Respiratory rate	< 40/minute	> 40/minute	> 40/minute

	Mild	Moderate	Severe
Additional signs		» speaks normally » difficulty with feeding » chest indrawing	» unable to speak » confusion » cyanosis » use of accessory muscles
Management	• Short-acting ß$_2$-agonist, e.g. salbutamol, inhalation **PLUS** • Prednisone, oral	• Oxygen, • Short-acting ß$_2$-agonist, e.g. salbutamol, inhalation • ± Ipratropium bromide, inhalation • Prednisone, oral	• Oxygen, • Short-acting ß$_2$-agonist, e.g. salbutamol, inhalation stat • Ipratropium bromide, inhalation, • Hydrocortisone, IV If no response: ± $MgSO_4$, IV bolus stat **OR** ± Salbutamol, IV bolus stat **AND** Consider ICU care

*Peak expiratory flow rate (PEFR) – as percentage of predicted value.

GENERAL AND SUPPORTIVE MEASURES

» Admit child to a high care unit, if available.
» Monitor:
  > heart rate,
  > respiratory rate,
  > PEFR,
  > pulse oximetry.
  > blood pressure,
  > acid-base status,
  > blood gases,
» Ensure adequate hydration:
  > Encourage intake of normal maintenance volume of oral fluids; avoid overhydration.
» If unable to drink, give 0.45% sodium chloride/5% dextrose IV. Patients with prolonged severe asthma may become dehydrated as a result of poor intake or vomiting. It is, however, inadvisable to overhydrate patients with acute asthma: do not exceed the recommended IV fluid volume in children, i.e. 50 mL/kg/24 hours.
» Monitor potassium levels in a patient on continuous ß$_2$-agonist.

Note:

» Physiotherapy, antihistamines, antibiotics and sedation are not beneficial in the acute setting.

» Agitation and restlessness are signs of severe hypoxia.

MEDICINE TREATMENT

Mild exacerbation of asthma

- Bronchodilator, i.e. short-acting ß2-agonist.
  - Salbutamol, inhalation, using a metered-dose inhaler with a spacer device.
    - 200–400 mcg (2–4 puffs of 100 mcg/puff) repeated every 20–30 minutes depending on clinical response.

  OR
  - Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulised at 20 minute intervals for 3 doses.
    - Maximum dose: 5 mg/dose.
    - 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

PLUS

- Prednisone, oral, 1–2 mg/kg, daily immediately up to a maximum of:
  - 20 mg: Children < 2 years for 5 days.
  - 30 mg: Children 2–5 years for 5 days.
  - 40 mg: Children 6–12 years for 5 days.

Moderate or severe asthma

Step 1:

To maintain arterial oxygen saturation ≥ 95%:

- Oxygen, at least 4–6 L/minute by face mask **or** 1–2 L/minute by nasal cannula.

PLUS

- Short-acting $ß_2$-agonist:

  Severe disease:
  - Salbutamol, inhalation, using a metered-dose inhaler with a spacer device, 10 puffs (100 mcg/puff) = 1 mg per administration, repeated every 20–30 minutes depending on clinical response.

  Moderate severity:
  - Salbutamol, 400–600 mcg (4–6 puffs of 100 mcg/puff) repeated every 20–30 minutes depending on clinical response.

OR

- Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulised at 20 minute intervals for 3 doses.
  - Maximum dose: 5 mg/dose.
  - 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

PLUS

- Ipratropium bromide, solution, 0.25 mg, nebulised immediately.
  - If severe, follow with 0.25 mg every 20–30 minutes for 4 doses over 2 hours.
  - Maintenance dose: 0.25 mg 6 hourly.
  - 0.25 mg (2 mL) ipratropium bromide in 2 mL sodium chloride 0.9%.

- Ipratropium bromide may be mixed with a ß2-agonist.

PLUS

- Prednisone, oral, 1–2 mg/kg, immediately up to a maximum of:
  - 20 mg: Children < 2 years for 5 days.
  - 30 mg: Children 2–5 years for 5 days.
  - 40 mg: Children 6–12 years for 5 days.

Step 2:

Assess response to treatment in step 1 by using the following table:

	Responder	Non-responder
PEFR	Improvement > 20% OR > 80% (best/predicted)	Improvement < 20% OR < 80% (best/predicted)
Respiratory rate	< 40/minute	> 40/minute
Retraction	absent	present
Speech	normal	impaired
Feeding	normal	impaired

Responder: patient who maintains an adequate response for at least 1 hour.
Non-responder: patient who fails to respond adequately to treatment in step 1.

Proceed to step 3.

Step 3:

Responder:

Review current treatment, possible precipitating or aggravating factors and commence:

- Prednisone, oral, 2 mg/kg as a single daily dose for 5 days.
  - To a maximum of:
    - 20 mg: Children < 2 years for 5 days.
    - 30 mg: Children 2–5 years for 5 days.
    - 40 mg: Children 6–12 years for 5 days.

PLUS

- Short-acting ß2-agonist:
  - Salbutamol, inhalation, 200 mcg (2 puffs of 100 mcg/puff) as required using a metered-dose inhaler with a spacer device.

Review maintenance asthma therapy at follow-up.

Non-responder:

Intensify treatment as follows:

Continue

- Short-acting ß2-agonist:
  - Salbutamol, solution, 0.15–0.3 mg/kg/dose nebulised at 20 minute intervals for 3 doses.
    - Maximum dose: 5 mg/dose.

- 5 mg salbutamol in 4 mL sodium chloride 0.9% delivered at a flow of 5 L/minute with oxygen.

AND

- Ipratropium bromide, solution, 0.25 mg, nebulised immediately.
  - If severe, follow with 0.25 mg every 20–30 minutes for 4 doses over 2 hours.
  - Maintenance dose: 0.25 mg 6 hourly.
  - 0.25 mg (2 mL) ipratropium bromide in 2 mL sodium chloride 0.9%.
  - Ipratropium bromide may be mixed with a $ß_2$-agonist.

PLUS

Continue corticosteroid:

- Prednisone, oral, 2 mg/kg as a single daily dose.
  - To a maximum of:
    - 20 mg: Children < 2 years for 5 days.
    - 30 mg: Children 2–5 years for 5 days.
    - 40 mg: Children 6–12 years for 5 days.

OR

- Hydrocortisone, IV, 2 mg/kg/dose 6 hourly.

Consult paediatrician for use of:

- Magnesium sulphate, IV bolus, 25–75 mg/kg administered over 20 minutes.

OR

- Salbutamol, IV, 15 mcg/kg as a single dose administered over 10 minutes.

AND

- Need for intensive care.

Step 4: *(Assess response to treatment in Step 3.)*

If non-responsive, admit to intensive care unit for consideration of:

- Magnesium sulphate, IV bolus, 25–75 mg/kg administered over 20 minutes (if not already given).

AND

- Salbutamol, IV.
  - Loading dose: 15 mcg/kg (do not give if stat dose already given).
  - Follow with: 1 mcg/kg/minute.
  - If necessary, increase dose by 1 mcg/kg every 15 minutes.
  - Maximum dose: 5 mcg/kg/minute.
  - Monitor electrolytes and side effects.

No further response

In cases of life threatening asthma in the intensive care unit:

- Aminophylline, IV, 5 mg/kg, loading dose administered over 20–30 minutes. Omit loading dose in children receiving maintenance oral theophylline.
  - Follow with: 1 mg/kg/hour continuous infusion.
  - ECG monitoring is mandatory.

REFERRAL

» Acute exacerbation not responding to treatment.

15.4.2 ASTHMA, CHRONIC

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DESCRIPTION

Asthma is a chronic inflammatory airways disease in which many cells and cellular elements play a role. Susceptible individuals present with recurrent episodes of early morning wheezing, breathlessness, chest tightness and cough.

There is widespread variable airflow obstruction that is reversible either spontaneously or with treatment. A variety of stimuli, e.g. allergens, viral infections, weather changes, emotional upsets or other irritants precipitate inflammation that is associated with increased bronchial hyper-responsiveness.

DIAGNOSTIC CRITERIA

» Chronic, persistent/recurrent cough and/or wheezing that responds to a bronchodilator.
» Objective evidence of reversible airway obstruction, as measured by > 15% improvement of the peak flow or > 12% improvement in the forced expiratory volume in 1 second (FEV_1) 20 minutes after administration of an inhaled bronchodilator, confirms the diagnosis.
» A family history of atopy, night or exercise-induced coughing and/or wheezing.

Control of asthma

The severity of asthma can vary with time and regular reassessments (at least every 3 months) are necessary.

On treatment, chronic asthma is classified as:

» controlled,
» partially controlled, or
» uncontrolled.