Acute Asthma Management Guideline for Infants Greater than 2 Years Old

Reference:	1613v3
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Purpose

This guideline covers transfers of paediatric patients over the age of 2 years with asthma. It includes the initial management of patient greater than 2 years of age with acute severe or life threatening asthma, which includes guidance on intubation and ventilation if required.

Intended Audience

All Embrace Medical and Nursing Staff.

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ABBREVIATIONS

PEF	Peak Expiratory Flow
IV	Intravenous
PIP	Peak inspiratory pressure
PEEP	Positive end expiratory pressure
I:E	Inspiratory time:expiratory time ratio
ETT	Endotracheal tube
MV	Minute Ventilation

1. OBJECTIVES

This guideline is intended for the management of patients presenting with acute severe or life-threatening asthma over the age of 2 years.

It is directed at medical and nursing staff providing the initial care of patients presenting with acute severe or life-threatening asthma and those staff who may be involved in stabilising the patient in the event of transfer to an intensive care unit for on-going care.

The aim of this guidance is to reduce the need for intubation and ventilation by maximising medical management. The one-page guideline outlines the medical management in a step-wise fashion with some advice on intubation and ventilation in the unlikely event that this is required.

2. BACKGROUND INFORMATION

Asthma is one of the commonest chronic paediatric conditions that presents to hospital. The definition of acute severe asthma is an exacerbation not responding to standard doses of β2 agonists and glucocorticosteroids. The clinical severity of an acute exacerbation is based upon clinical judgement of the signs and symptoms observed and is subdivided into moderate, severe and life-threatening exacerbations.

Optimal therapy is targeted at reducing bronchoconstriction, airway inflammation and mucus plugging, with the aim of treatment to correct hypoxia and reverse airflow obstruction[1].

This is usually achieved through medical management although on occasions mechanical ventilation may be required, which is not without its risks, in particular that of air leak. Optimising medical therapy to improve symptoms is paramount in reducing the need for mechanical ventilation and this is usually successful. However intubation may be required if there is significant respiratory or cardiovascular compromise or evidence of exhaustion, and should be performed by the most experienced person present.

3. GUIDELINE

Initial Assessment

The initial assessment of any patient presenting with an acute exacerbation of asthma should follow the ABC approach with particular focus on heart rate, respiratory rate and effort, air entry, oxygen saturation and neurological status to determine the degree of severity of the exacerbation.

Life threatening asthma[2]
SpO2 <92%
Silent chest, Cyanosis,
PEF <33% best or predicted
Poor respiratory effort
Hypotension
Exhaustion
Confusion

Acute severe asthma[2]
SpO2 <92%
Can't complete sentences in one breath or too breathless to talk or feed
PEF 33-50% best or predicted
Respiratory Rate: >40 breaths/min (2-5 years), >30 breaths/min (>5 years)
Heart Rate: >140 (2-5 years), >125 (>5 years)

Moderate Asthma exacerbation[2]
SpO2 ≥92%
Able to talk in sentences
PEF ≥50% best or predicted
Respiratory rate: ≤ 40/min (2-5 years), ≤ 30/min (>5 years)
Heart rate: ≤140/min (2-5 years), ≤125/min (>5 years)

Initial Management[2]

As soon as the patient has been assessed, initial management should be initiated and tailored according to the response to treatment.

- **High flow oxygen** via non-rebreathe face mask to maintain oxygen saturations > 94%
- **Nebulised Salbutamol** 2.5 mg (<5 years), 5 mg (>5 years).
  Repeat these every 20 – 30 minutes according to the response of the patient.
- **Nebulised Ipratropium Bromide** 250 micrograms**.**
  Repeat these every 20 – 30 minutes for the first 2 hours after which they can be given 4-6 hourly according to clinical status.
- Give **Oral Prednisolone** within one hour of presentation - 20 mg (2 – 5 years), 40 mg (>5 years). IV Hydrocortisone 4 mg/kg (maximum dose 100mg) to be given if oral steroids not tolerated.
- Consider adding 150mg of magnesium sulphate to each nebulised salbutamol and ipratropium in the first hour in children with a short duration of acute severe asthma symptoms presenting with SpO_2 <92%

Second Line Treatment

If there is no or limited response to the above treatment then second line intravenous therapy should be initiated.

- **IV Magnesium Sulphate 10%** 40 mg/kg (max 2 gram) over 20 minutes. 0.4ml/kg, which can be infused peripherally.
- **Be aware** of the risk of hypotension. Target range of serum magnesium 1.5 – 2.5 mmmol/L
  (For children who respond poorly to first-line treatments consider the addition of iv magnesium sulphate as first line treatment)

- **Consider early addition of a single IV Salbutamol bolus 15micrograms/kg (maximum 250micrograms) over 10 minutes in a severe attack where the child has not responded to initial inhaled therapy.** ; Concentration of 10mg/50 ml diluent @ 0.3ml/kg/hr = 1 microgram/kg/min. Can be given NEAT (1mg/ml) centrally.
- **Be aware** of the risk of hypokalaemia and lactic acidosis with repeated use of salbutamol (nebuliser and intravenous preparation). The latter may present with increasing tachypnoea.
- **Consider a continuous intravenous infusion of salbutamol for severe refractory asthma. 1-2micrograms/kg/min with doses up to 5microgram/kg/min on PICU. Requires ECG monitoring.**

- **IV Aminophylline loading dose** 5 mg/kg over 20 minutes; followed by **infusion**: 2 years – 12 years (1 mg/kg/hr); > 12 years (500 – 700 micrograms/kg/hr).
  Concentration: 500 mg/500ml diluent @ 1ml/kg/hour = 1mg/kg/hour
- **Do not** give a loading dose if patient is on a maintenance oral aminophylline/theophylline but check therapeutic levels (theophylline target level 10 – 20 mg/L)

Intubation and Ventilation

Intubation and ventilation of patients with severe acute asthma is high risk. There is a risk of increasing bronchospasm, hypotension (have fluid boluses pre-prepared) and barotrauma. It is important to ensure maximal medical therapy is in place before intubation as this will often negate the need for ventilation. If there continues to be clinical deterioration despite maximal medical therapy then non-invasive ventilation, if available, may be an option to consider prior to intubation.

The indications for intubation include:

- Persistent hypoxia +/- rising hypercapnia despite maximal medical treatment
- Increasing respiratory compromise despite maximal medical therapy
- Depressed level of consciousness or progressive agitation
- Respiratory or cardiorespiratory arrest

Procedure:

The most experienced person available should intubate

- Utilise an intubation checklist
- Use IV Ketamine 2 mg/kg AND IV Rocuronium (1 mg/kg) (refer to Embrace drug chart for further guidance)
- **Caution** with Propofol, Atracurium or Morphine (potential histamine release; hypotension).
- **Consider** inhalation agents as alternative
- Use either a cuffed ETT or tight fitting ETT
- Use Ketamine or Fentanyl AND Midazolam infusions for maintenance of anaesthesia / sedation (refer to Embrace drug chart for dosages)
- Use Rocuronium or Vecuronium infusion or boluses for maintenance of muscle relaxation

Ventilation principles:

- Use pressure controlled mode: high pressures may be needed – limit PIP < 35; start with PEEP 5 – 7 (higher PEEP may be required)
- Consider slow rate 5 - 15 breaths per minute. Adjust to ensure adequate emptying
- Inspiratory:Expiratory ratio of at least 1:2. Adjust to ensure adequate emptying
- May need to allow permissive hypercapnia
- Minimise equipment dead space

4. MONITORING ARRANGEMENTS

Audit and critical incident review

5. REFERENCES

1. Koninckx M, Buyssa C, de Hogg M. Management of status asthmaticus in children. *Paediatric Respiratory Reviews* 2013 **14 (2)**: 78 - 85

2. British Guideline on the Management of Asthma. *BTS, SIGN.* July 2019

3. Deho A et al. Emergency management of children with acute severe asthma requiring transfer to intensive care. *Emerg Med J* 2010; **7:** 834-837 doi:10.1136/emj.2009.082149.

6. APPENDIX 1 Copy of one-page guideline

Embrace Asthma Management Guideline > 2 YEARS OF AGE

Initial Treatment:	**Notes**
▪ **High flow oxygen** to maintain saturations > 94% ▪ **Nebulised Salbutamol** 2.5 mg (<5 years), 5 mg (>5 years) [1] ▪ **Nebulised Ipratropium Bromide** 250 micrograms[2] **mixed with salbutamol nebule** ▪ Consider **Nebulised Magnesium Sulphate** 150mg mixed with Salbutamol and Ipratropium for three doses[3] ▪ Give **Oral Prednisolone** within one hour of presentation – 20 mg (2 – 5 years), 40 mg (>5 years) [4]	[1] Can be repeated every 20-30 minutes [2] Every 20 – 30 minutes for first 2 hours. [3] If severe acute attack with presenting O_2 saturations <92% [4] IV Hydrocortisone 4 mg/kg (max 100 mg) if oral steroids not tolerated. If on maintenance steroid tablet give 2mg/kg up to 60mg.
Second line treatment:	**Notes**
▪ For those who respond poorly to first-line treatments, consider the addition of **IV Magnesium Sulphate 10% as first-line iv treatment.** 40 mg/kg (max 2 gram) over 20 minutes [1] *0.4ml/kg (max 20ml) - can be infused peripherally* ▪ Consider early **IV Salbutamol bolus**-15 micrograms/kg (max 250 micrograms) over 10 minutes if no response to initial inhaled therapy; may be followed by **infusion** of 1 – 2 (up to 5) micrograms/kg/minute[2] *10 mg/50 ml diluent @ 0.3ml/kg/hr = 1 microgram/kg/min** *Can be given NEAT centrally* *NEAT (1mg/ml) @ 0.06ml/kg/hour = 1 microgram/kg/min* ▪ **IV Aminophylline loading dose** 5 mg/kg over 20 minutes[3] followed by **infusion**: 2 years – 12 years (1 mg/kg/hr); > 12 years (500 – 700 micrograms/kg/hr) *500 mg/500ml diluent @ 1ml/kg/hour = 1mg/kg/hour*	[1]**Be aware** rare risk of hypotension. Target range of serum magnesium 1.5 – 2.5 mmol/L. [2] **Risk**: Hypokalaemia, Lactic acidosis (increasing tachypnoea) [3]**Do not** give loading dose if on oral Theophylline. Therapeutic levels 10 – 20 mg/L

Intubation and Ventilation:

Indications:

- Persistent hypoxia +/- rising hypercapnia despite maximal medical treatment
- Respiratory or cardiorespiratory arrest
- Increasing respiratory compromise despite maximal medical therapy
- Depressed level of consciousness or progressive agitation.

Procedure[1]:

- Pre oxygenate adequately (3 minutes).
- Use IV Ketamine 2 mg/kg AND IV Rocuronium (1 mg/kg) or IV Suxamethonium (1-2 mg/kg) for induction [2]
- Use cuffed ETT or tight fitting ETT
- Use Ketamine or Fentanyl AND Midazolam infusion for maintenance of anaesthesia / sedation [3]
- Use Rocuronium / Vecuronium infusion or boluses for maintenance of paralysis [3]

Ventilation principles:

- Use pressure controlled mode: high pressures may be needed – limit PIP < 35; start with PEEP 5 – 7 [4]
- Consider slow rate 5 - 15 breaths per minute [5]
- I:E ratio of at least 1:2
- May need to allow permissive hypercapnia
- Minimise equipment dead space

Caution: **intubation high risk** – ensure maximal medical therapy first and consider NIPPV first if available

Risks of Intubation

Worsening bronchospasm

Hypotension: have fluid boluses ready

Barotrauma

[1] The most experienced person available should intubate

[2] **Caution** with Propofol, Atracurium or Morphine (potential histamine release; hypotension). **Consider** inhalation agents as alternative

[3] Refer to Embrace drug chart for dosing

[4] Higher PEEP may be required

[5] Adjust rate to ensure adequate emptying and acceptable MV