

3 RESPIRATORY SYSTEM

WHO MODEL FORMULARY 2004 NOTES:

TREATMENT OF ACUTE SEVERE ASTHMA:

SIGNS	TREATMENT
<p>Persistent dyspnoea poorly relieved by bronchodilators</p> <p>Exhaustion</p> <p>High pulse rate: Adult > 110 beats/minute, Child > 5 yo > 120/minute, < 5 yo > 130/minute.</p> <p>Very low peak expiratory flow.</p> <p>As asthma becomes more severe, wheezing may be absent.</p>	<p>Oxygen 40-60% if available</p> <p>Nebulized salbutamol if available, if not salbutamol 100 micrograms by aerosol inhalation, repeated 10-20 times, with spacing device if available.</p> <p>Corticosteroid, Adults prednisolone 30-60mg by mouth <i>or</i> hydrocortisone 200mg (preferably as sodium succinate) intravenously; Children prednisolone 1-2mg/kg by mouth <i>or</i> hydrocortisone 100mg intravenously. If vomiting occurs consider parenteral route for the first dose.</p> <p>Nebulized ipratropium if response is still inadequate</p> <p>Most patients do not benefit from the addition of IV aminophylline or IV beta₂-agonist; both cause more adverse effects than nebulized beta₂-agonists. Nevertheless, an occasional patient who has not been taking theophylline may benefit from a slow IV infusion of aminophylline [not on Mercy Ships list].</p>

COMMENT/CAUTIONS:

- **Treat promptly and energetically** (do not delay for investigations; do not sedate; consider possibility of pneumothorax), with hospital admission where resuscitation facilities are immediately available.
- When symptoms improved, continue corticosteroid treatment by mouth for 3-5 days according to local protocol and patient age, step up usual treatment (see following pages for chronic asthma treatment guidelines), then follow-up.
- Poorly controlled asthma in pregnant women can have an adverse effect on the fetus, resulting in perinatal mortality, increased prematurity and low birth-weight. Optimal control of asthma in pregnancy is justified (prefer inhalation route), treat acute exacerbations aggressively to avoid fetal hypoxia.

TREATMENT OF CHRONIC ASTHMA:
INFANTS AND YOUNG CHILDREN UNDER 5 YEARS OLD
Preferred treatments are in bold print

TREATMENT STEPS	LONG TERM PREVENTIVE DAILY MEDICATIONS	QUICK RELIEF
STEP 4 Severe Persistent	Inhaled corticosteroid , beclomethasone dipropionate MDI with spacer and face mask > 1mg daily <i>or</i> nebulized beclometasone > 1mg twice daily. Consider short course of soluble prednisolone tablets, regular inhaled long-acting beta ₂ -agonist <i>or</i> modified release theophylline. <i>Also</i> , nebulized beta ₂ -agonist	Inhaled short-acting bronchodilator: inhaled beta₂-agonist <i>or</i> ipratropium bromide as needed for symptoms, not to exceed 3-4 times daily.
STEP 3 Moderate Persistent	Inhaled corticosteroid , beclomethasone MDI with spacer and face mask 400-800 micrograms daily <i>or</i> nebulized beclometasone < 1mg twice daily. Consider short course of soluble prednisolone tablets, regular inhaled long-acting beta ₂ -agonist <i>or</i> modified release theophylline	Inhaled short-acting bronchodilator: inhaled beta₂-agonist <i>or</i> ipratropium bromide as needed for symptoms, not to exceed 3-4 times daily.
STEP 2 Mild Persistent	Either inhaled corticosteroid beclomethasone 400-800 micrograms daily <i>or</i> cromoglicate (use MDI with spacer and face mask <i>or</i> use a nebulizer)	Inhaled short-acting bronchodilator: inhaled beta₂-agonist <i>or</i> ipratropium bromide as needed for symptoms, max 3-4 times daily.
STEP 1 Intermittent	None needed	Inhaled short-acting bronchodilator: inhaled beta₂-agonist <i>or</i> ipratropium bromide as needed for symptoms, but not more than once daily. Intensity of treatment will depend on attack severity

STEP DOWN: review treatment every 3-6 months. If control is sustained for at least 3 months, a gradual stepwise reduction in treatment may be possible.

STEP UP: if control is not achieved, consider step up. But first: review patient medication technique, compliance and environmental control.

[Mercy Ships note: Aminophylline, theophylline and cromoglicate not on our list].

TREATMENT OF CHRONIC ASTHMA:
ADULTS AND CHILDREN OVER 5 YEARS OLD
Preferred treatments are in bold print

TREATMENT STEPS	LONG TERM PREVENTIVE DAILY MEDICATIONS	QUICK RELIEF
STEP 4 Severe Persistent	Inhaled corticosteroid , beclomethasone dipropionate 0.8-2mg daily PLUS long-acting bronchodilator: <i>either long-acting inhaled beta₂-agonist, and/or modified release theophylline, and/or long-acting beta₂-agonist tablets or syrup</i> PLUS corticosteroid tab or syrup long term	Short-acting bronchodilator: inhaled beta₂-agonist as needed for symptoms
STEP 3 Moderate Persistent	Inhaled corticosteroid , beclomethasone 0.8-2mg daily <i>PLUS</i> if needed long-acting bronchodilator: <i>either long-acting inhaled beta₂-agonist, and/or modified release theophylline, or long-acting beta₂-agonist tab or syrup</i>	Short-acting bronchodilator: inhaled beta₂-agonist as needed for symptoms, not to exceed 3-4 times daily
STEP 2 Mild Persistent	Either inhaled corticosteroid beclomethasone 100-400 micrograms twice daily, sodium cromoglicate <i>or</i> modified-release theophylline	Short-acting bronchodilator: inhaled beta₂-agonist as needed for symptoms, max 3-4 times daily
STEP 1 Intermittent	None needed Consider inhaled beta ₂ -agonist or cromoglicate before exercise or exposure to allergen	Short-acting bronchodilator: inhaled beta₂-agonist as needed for symptoms (up to once daily) Intensity of treatment will depend on severity of attack.

STEP DOWN: review treatment every 3-6 months. If control is sustained for at least 3 months, a gradual stepwise reduction in treatment may be possible.

STEP UP: if control is not achieved, consider step up. But first: review patient medication technique, compliance and environmental control.

[Mercy Ships note: Aminophylline, theophylline and cromoglicate not on our list].

3.01 ANTI-ASTHMATICS

3.01a BETA₂-AGONISTS

GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Salbutamol Sulfate Inhaler 100micrograms/dose (Ventolin) [Albuterol]	MSL EML	Relief of acute bronchospasm, or prophylaxis of exercise-induced bronchospasm: <i>by aerosol inhalation</i> Adult 100-200 micrograms (1-2 puffs), up to 3-4 times daily in chronic asthma (as adjunct in stepped treatment, refer to current asthma treatment guidelines); Child 100 micrograms (1 puff) increased to 200 micrograms (2 puffs), up to 4 times daily if needed.
Salbutamol Sulfate Respirator Solution 0.5% (5mg/ml), Nebules 1mg & 2.5mg (Ventolin) [Albuterol]	EML	<i>By inhalation of nebulized solution</i> Adult & Child > 18 months, 2.5-5mg up to 4 times daily during acute severe asthma. Child < 18 months clinical efficacy uncertain (transient hypoxaemia may occur – consider oxygen supplementation). Dilute 0.5% (5mg/ml) solution with 3ml of NS before administration.

COMMENT/CAUTIONS:

- If dosing is needed more than once daily in beta₂-agonists alone regimen, consider adjunct therapy. Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.
- Inadequate response may be due to poor inhalation technique. See Appendix I for **inhaler usage instructions** and choice of **inhaler devices for children**.
- An **aerochamber** or **spacer device** may be useful. If multi-dose inhalers (MDIs) and spacers have been tried, dry powder devices such as turbuhalers or accuhalers may be considered for patients with coordination difficulties.
- **Adverse effects** (minimal with inhaled preparations): tachycardia, tremor, nervousness, hypokalaemia, muscle cramp, and impaired glucose tolerance. Monitor blood glucose if IV administration – ketoacidosis reported.

3.01b OTHER BRONCHODILATORS

GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Ipratropium Bromide Inhaler 20micrograms/dose, 200 doses (Atrovent Metered Aerosol)	EML	Chronic asthma or obstructive pulmonary disease: <i>by aerosol inhalation</i> Adult 20-40 micrograms (1-2 puffs) 3-4 times daily, max 80 micrograms (4 puffs) 4 times daily; Child < 6 yo 20 micrograms (1 puff) 3 times daily; 6-12 yo 20-40 micrograms (1-2 puffs) 3 times daily.
Ipratropium Bromide Nebuliser Solution 0.0125% (250 micrograms/2ml) & 0.025% (500micrograms/2ml) (Atrovent)		<i>By inhalation of nebulized solution</i> Adult 100-500 micrograms up to 4 times daily; Child 3-14 yo 100-500 micrograms up to 3 times daily. Use undiluted or diluted in NS.

COMMENT/CAUTIONS:

- **Ipratropium** is useful for bronchitis or emphysema, and in the elderly and in young children. It can provide short-term relief in chronic asthma but short-acting beta₂-agonists work more quickly.
- Inadequate response may be due to poor inhalation technique. See Appendix I for **inhaler usage instructions** and choice of **inhaler devices for children**.
- Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.

3.02 CORTICOSTEROIDS

GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Beclomethasone Dipropionate Inhaler 50 micrograms/dose, 200 doses (Becotide 50)	EML	Chronic asthma: <i>by aerosol inhalation</i> Adult 200 micrograms (4 puffs) twice daily <i>or</i> 100 micrograms (2 puffs) 3-4 times daily, max 400 micrograms (8 puffs) twice daily in severe cases then reduce dose; Child 50-100 micrograms (1-2 puffs) 2-4 times daily <i>or</i> 100-200 micrograms (2-4 puffs) twice daily.

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GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Beclomethasone Dipropionate Inhaler 250micrograms/dose, 200 doses (Becloforte)	D EML	Chronic asthma: <i>by aerosol inhalation</i> Adult 500 micrograms (2 puffs) twice daily <i>or</i> 250 micrograms (1puff) 4 times daily, max 500 micrograms (2 puffs) 4 times daily.
Budesonide Inhaler 50micrograms/dose, or Turbuhaler/Inhaler 200micrograms/dose (Pulmicort/Inflammid)		Chronic asthma: <i>by aerosol inhalation</i> Adult 200 micrograms twice daily, reduced if well-controlled to 200 micrograms daily, in severe asthma increased to max 1.6mg/DAY in divided doses; Child 50 micrograms twice daily, max 800 micrograms/DAY in divided doses.
Hydrocortisone Inj 100mg/2ml or 100mg vial (as Sodium Succinate) (Solu-Cortef)	MSL EML	<i>By IM, slow IV inj or IV infusion:</i> Adult 100-500mg; Child < 1yo 25mg, 1-5 yo 50mg, 6-12 yo 100mg; given every 6-8 hours as needed. For IM/IV inj reconstitute vial with 2ml of NS/WFI, inject slow IV over 3-5 minutes; for IV infusion further dilute 100mg with 100ml of D5/NS and infuse over 20-30 minutes.
Prednisolone Tablet 5mg & 25mg	EML	For acute severe asthma: <i>by mouth</i> Adult 30-60mg for 5 days; Child 1-2mg/kg daily (1-4 yo max 20mg, 5-15 yo max 40mg), for 3 days.

COMMENT/CAUTIONS:

- REGULAR DOSING IS ESSENTIAL. Consider aerochamber or spacer devices to minimise side effects and increase dosing efficiency. Administering bronchodilator before corticosteroid inhalation may enhance dosing.
- **Adverse effects:** hoarseness, candidiasis of mouth and throat (reduce by using spacer device, rinsing or wiping mouth with water after inhalation); glaucoma, paradoxical bronchospasm. Suppression of adrenal cortex may occur at **beclomethasone** doses of over 1500micrograms daily.
- Inadequate response may be due to poor inhalation technique. See Appendix I for **inhaler usage instructions** and choice of **inhaler devices for children**.
- Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.

WHO MODEL FORMULARY 2004 NOTES:

Anaphylactic shock and conditions such as angioedema are medical emergencies that can result in cardiovascular collapse and/or death. They require prompt treatment of possible laryngeal oedema, bronchospasm or hypotension. Atopic individuals are particularly susceptible. Insect stings and certain foods including eggs, fish, cow's milk protein, peanuts and nuts are a risk for sensitized persons. Therapeutic substances particularly associated with anaphylaxis include blood products, vaccines, hyposensitizing (allergen) preparations, antibiotics (especially penicillins), iron injections, heparin, and neuromuscular blocking drugs. Acetylsalicylic acid and other nonsteroidal anti-inflammatory drugs (NSAIDs) may cause bronchoconstriction in leukotriene-sensitive patients. In the case of drug allergy, anaphylaxis is more likely to occur after parenteral administration. Resuscitation facilities should always be available when injecting a drug associated with a risk of anaphylactic reactions.

STEPS IN THE MANAGEMENT OF ANAPHYLAXIS

Sympathomimetic: Epinephrine (adrenaline) 1 in 1000 (1mg/ml) *by IM inj* Adult & Adolescent 500 micrograms (0.5ml); Infant < 6 months 50 micrograms (0.05ml); Child 6 months-6 yo 120 micrograms (0.12ml), 6-12 yo 250 micrograms (0.25ml). Repeat dose several times if necessary at 5-minute intervals, according to blood pressure, pulse and respiratory function.

If circulation inadequate, epinephrine (adrenaline) 1 in 10000 (0.1mg/ml) *by slow IV inj* given at a rate of 1ml/minute; Adult 500 micrograms (5ml), Child 10micrograms/kg (0.1ml/kg), given over several minutes.

Vital functions: Maintain an open airway; give oxygen *by mask*, restore blood pressure (lay patient flat, raise feet).

Antihistamine: e.g. chlorphenamine *by IV inj* over 1 minute, Adult 10-20mg, repeated if required (max total dose 40mg in 24 hours).

Corticosteroids: e.g. hydrocortisone *by slow IV inj* Adult 100-300mg; Child < 1yo 25mg; 1-5yo 50mg; 6-12yo 100mg.

Intravenous fluids: start sodium chloride infusion (500-1000ml during first hour).

If patient has asthma-like symptoms, give salbutamol 2.5-5mg *by nebulization or aminophylline* [not on Mercy Ships list] 5mg/kg *by slow IV inj* over 20 minutes.

3.03 ANTIHISTAMINES & ANTIALLERGICS

WHO MODEL FORMULARY 2004 NOTES:

The H₁-receptor antagonists are generally referred to as antihistamines. They inhibit the wheal, pruritus, sneezing and nasal secretion responses that characterize allergy. Antihistamines thus relieve the symptoms of allergic reactions, such as urticaria, allergic rhinitis, and allergic conjunctivitis; they also control pruritus in skin disorders, such as eczema. Antihistamines are used to treat drug allergies, food allergies, insect stings and some of the symptoms of anaphylaxis and angioedema. Drug treatment and other supportive care should not be delayed in critically ill patients (see notes above on anaphylaxis). Specific precipitants should be sought and if identified, further exposure avoided and desensitization considered.

Drowsiness and sedation are particular disadvantages of the older antihistamines and the patient should be warned against driving or operating machinery. Other central nervous depressants, including alcohol, barbiturates, hypnotics, opioid analgesics, anxiolytics and neuroleptics, may enhance the sedative effects of antihistamines. Since antihistamines interfere with skin tests for allergy, they should be stopped at least one week before conducting a skin test.

Chlorphenamine is a typical, older sedative antihistamine. Newer antihistamines do not cause significant sedation. In practice, all antihistamines are equally effective in relieving the symptoms of allergic reactions and differ mainly in the intensity of sedative and anticholinergic (more correctly antimuscarinic) effects. Selection of an antihistamine should thus be based on the intended therapeutic use, adverse reaction profile, and cost.

Corticosteroids, such as **dexamethasone**, **hydrocortisone**, or **prednisolone**, suppress or prevent almost all symptoms of inflammation associated with allergy. The route of administration depends on the particular type of allergic condition. For example, for a mild allergic skin reaction, the best therapy may be the use of a corticosteroid ointment or cream. If the skin reaction does not respond to topical corticosteroid therapy, it may be necessary to give a corticosteroid orally. Corticosteroids may be used topically to reduce inflammation in allergic rhinitis but should only be used systemically when symptoms are disabling.

Allergic reactions of limited duration and with mild symptoms, such as urticaria or allergic rhinitis, usually require no treatment. If on the other hand, symptoms become persistent, antihistamines constitute the mainstay of treatment. However, oral corticosteroids may be required for a few days in an acute attack of urticaria or for severe skin reactions. Oral corticosteroids are also used to relieve severe exacerbations in chronic urticaria, but long-term use should be avoided. For further information on corticosteroids, see section 7.01.

GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Loratadine Tab 10mg & Syrup 5mg/5ml, 100ml (Clarityne)	EML	Allergy: <i>by mouth</i> Adult & Child > 6 yo (or > 30kg) 10mg daily; Child 2-5 yo (or <30kg) 5mg daily.
Promethazine HCl Tab 25mg & Syrup 5mg/5ml (Phenergan) Antihistamine	EML	Allergy: <i>by mouth</i> Adult 25-50mg daily in divided doses or single dose at night; < 2 yo not recommended, 2-5 yo 5-15mg daily, 5-10 yo 10-25mg daily, in 1-2 divided doses. Premedication: <i>by mouth</i> Child < 2 yo not recommended, 2-5 yo 15-20mg, 5-10 yo 20-25mg. Motion sickness: <i>by mouth</i> Adult 25mg half to one hour before travel/sail, repeated 8-12 hours after as needed, then 25mg twice daily on succeeding days of travel/sailing as needed; 5-10 yo half adult dose. <i>May cause drowsiness.</i>
Promethazine HCl Inj 25mg/ml (Phenergan)	EML	Allergy/premedication: <i>by IM inj</i> Adult 25-50mg, max 100mg; Child 5-10 yo 6.25-12.5mg. <i>By slow IV inj</i> in emergencies Adult 25-50mg, max 100mg (max rate 25mg/minute). Inject IM undiluted deep into a large muscle mass over 1-2 minutes. Inject slow IV undiluted or dilute 25mg in 10ml WFI, over 1-2 minutes.

COMMENT/CAUTIONS:

- **Antihistamines** may cause drowsiness, advice patients not to drive or operate machinery if affected. They potentiate the effects of alcohol.
- **Caution:** Sedating antihistamines have significant antimuscarinic activity, use with care in prostatic hypertrophy, urinary retention, glaucoma and pyloroduodenal obstruction. Adjust dose in hepatic/renal impairment.
- **Adverse effects:** Drowsiness (less in newer antihistamines e.g. loratadine; rarely paradoxical stimulation with high doses or in children and elderly), hypotension, headache, palpitations, psychomotor impairment, urinary retention, dry mouth, blurred vision, gastrointestinal disturbances; liver dysfunction; blood disorders; hypersensitivity reactions, sweating and tremor.
- **Anaphylaxis:** refer above for WHO recommendations in treatment.

3.04 COUGH & COLD PREPARATIONS

GENERIC (TRADE) NAME	CAT.	INDICATION/DOSE
Cough/Cold Preparations (various, not Benadryl)	D	See individual product leaflets for detail. NOTE: some multi-ingredient preparations may contain paracetamol/acetaminophen (risk of overdose if taken concomitantly with other paracetamol preparations). See pharmacist/crew Dr if uncertain.
Diphenhydramine Expectorant Paediatric (Benadryl 1:2)	D	<i>By mouth</i> , Child 2-6 yo 6.25mg every 4-6 hours, max 37.5mg/DAY; 6-12 yo 12.5mg every 4-6 hours, max 75mg/DAY.
Diphenhydramine Expectorant Adult (Benadryl)	D	<i>By mouth</i> Adult 5-10ml, Child 1-5 yo 2.5ml, 6-12 yo 5ml, usual 3-4 times daily for chesty cough.
Pholcodine Linctus 5mg/5ml (Pavachol-D)	MSL EML	Unproductive, persistent, dry & painful cough: <i>By mouth</i> Adult 5-10mg 3-4 times daily; Child 5-12 yo 2.5-5mg 3-4 times daily.

COMMENT/CAUTIONS:

- **Pholcodine** may cause constipation, monitor chronic use also for abuse.
- DRUG-INDUCED DRY COUGHS: All therapeutic aerosols may cause coughs by local irritant effect, ACE inhibitors can also produce the adverse effect of persistent dry cough. Other factors may include occupational or environmental exposure to irritant aerosolised chemicals or dust particles. Consider asthma, gastro-oesophageal reflux disease and 'post-nasal drip'.
- Common Cold: Prevention of the spread of rhinovirus colds is most effective through **hand-washing** and not touching the nose or eyes. Sneeze or cough into a facial tissue and discard it immediately (rhinoviruses survive up to 3 hours outside the nasal passages on inanimate objects and skin). Symptomatic treatments include antihistamines for rhinitis, oral or topical decongestants for nasal congestion, analgesics for muscular aches and gargles and sprays for sore throats.

NOTE. For Systemic & Topical Nasal Decongestants, Throat and Mouth Preparations, see Chapter 10 Ear, Nose and Throat.