Acute Management of Anaphylaxis

These guidelines for the acute management of severe allergic reactions (anaphylaxis) are intended for medical practitioners, nurses and other health professionals who provide first responder emergency care. The appendix includes additional information for health professionals working in emergency departments, ambulance services, and rural or regional areas, who provide emergency care.

Anaphylaxis definitions

- Any acute onset illness with typical skin features (urticarial rash or erythema/flushing, and/or angioedema), plus involvement of respiratory and/or cardiovascular and/or persistent severe gastrointestinal symptoms; or
- Any acute onset of hypotension or bronchospasm or upper airway obstruction where anaphylaxis is considered possible, even if typical skin features are not present.

Signs and symptoms of allergic reactions

Mild or moderate reactions (may not always occur before anaphylaxis):
- Swelling of lips, face, eyes
- Hives or welts
- Tingling mouth
- Abdominal pain, vomiting (these are signs of anaphylaxis for insect sting or injected drug (medication) allergy)

Anaphylaxis – Indicated by any one of the following signs:
- Difficult/noisy breathing
- Swelling of tongue
- Swelling/tightness in throat
- Difficulty talking and/or hoarse voice
- Wheeze or persistent cough (unlike the cough in asthma, the onset of coughing during anaphylaxis is usually sudden)
- Persistent dizziness or collapse
- Pale and floppy (young children)
- Abdominal pain, vomiting (for insect stings or injected drug (medication) allergy).

Immediate actions for anaphylaxis

1. **Remove allergen** (if still present).
2. **Call for assistance.**
3. **Lay patient flat. Do not allow them to stand or walk. Do not hold infants upright.**
   - If breathing is difficult, allow them to sit.
4. **Adrenaline (epinephrine) is the first line treatment for anaphylaxis.** Give intramuscular injection (IMI) adrenaline into outer mid-thigh without delay using an adrenaline autoinjector if available OR adrenaline ampoule/syringe.
5. **Give oxygen** (if available).
6. **Call ambulance** to transport patient if not already in a hospital setting.
7. If required at any time, commence CPR (cardiopulmonary resuscitation).

ALWAYS give adrenaline FIRST, then asthma reliever if someone with known asthma and allergy to food, insects or medication has SUDDEN BREATHING DIFFICULTY (including wheeze, persistent cough or hoarse voice) even if there are no skin symptoms.
Anaphylaxis triggers and reaction times
The most common triggers of anaphylaxis are foods, insect stings and drugs (medications). Less common triggers include latex and ticks.

Anaphylaxis usually occurs within one to two hours of ingestion in food allergy. The onset of a reaction may occur rapidly (within 30 minutes) or may be delayed several hours (for example, in mammalian meat allergy and food dependent exercise induced anaphylaxis, where symptoms usually occur during exercise).

Anaphylaxis to stings and injected medications (including radiocontrast agents and vaccines) usually occurs within 5-30 minutes but may be delayed. Anaphylaxis to oral medications can also occur but is less common than to injected medications.

Adrenaline administration and dosages

Adrenaline is the first line treatment for anaphylaxis and acts to reduce airway mucosal oedema, induce bronchodilation, induce vasoconstriction and increase strength of cardiac contraction.

Give INTRAMUSCULAR INJECTION (IMI) OF ADRENALINE (1:1000) into outer mid-thigh (0.01mg per kg up to 0.5mg per dose) without delay using an adrenaline autoinjector if available OR adrenaline ampoule and syringe, as follows:

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight (kg)</th>
<th>Vol. adrenaline 1:1000</th>
<th>Adrenaline autoinjector</th>
</tr>
</thead>
<tbody>
<tr>
<td>~&lt;1</td>
<td>&lt;7.5k</td>
<td>0.1 mL</td>
<td>Not available</td>
</tr>
<tr>
<td>~1-2</td>
<td>10</td>
<td>0.1 mL</td>
<td>7.5-20 kg (~&lt;5yrs)</td>
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<tr>
<td>~2-3</td>
<td>15</td>
<td>0.15 mL</td>
<td>0.15mg device</td>
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<tr>
<td>~4-6</td>
<td>20</td>
<td>0.2 mL</td>
<td>(e.g. EpiPen Jr)</td>
</tr>
<tr>
<td>~7-10</td>
<td>30</td>
<td>0.3 mL</td>
<td>&gt;20kg (~&gt;5yrs)</td>
</tr>
<tr>
<td>~10-12</td>
<td>40</td>
<td>0.4 mL</td>
<td>0.3mg device</td>
</tr>
<tr>
<td>~&gt;12 and adults</td>
<td>&gt;50</td>
<td>0.5 mL</td>
<td>(e.g. EpiPen)</td>
</tr>
</tbody>
</table>

Note:

- If multiple doses are required for a severe reaction (e.g. 2-3 doses administered at 5 minute intervals), consider adrenaline infusion if skills and equipment are available.
- For emergency treatment of anaphylaxis, ampoules of adrenaline 1:1000 should be used for both IM doses and infusion if required (adrenaline 1:10 000 should not be used).

Anaphylaxis treatment for infants

Whilst 10-20kg was the previous weight guide for a 0.15mg adrenaline autoinjector device, a 0.15mg device may now also be prescribed for an infant weighting 7.5-10kg by health professionals who have made a considered assessment. Use of a 0.15mg device for treatment of infants weighing 7.5kg or more poses less risk, particularly when used without medical training, than use of an adrenaline ampoule and syringe.

Infants with anaphylaxis may retain pallor despite 2-3 doses of adrenaline, and this can resolve without further doses. More than 2-3 doses of adrenaline in infants may cause hypertension and tachycardia, which is often misinterpreted as an ongoing cardiovascular compromise or anaphylaxis. Blood pressure measurement can provide a guide to the effectiveness of treatment, to check if additional doses of adrenaline are required.

Management of anaphylaxis in pregnancy
Management of anaphylaxis in pregnant women is the same as for non-pregnant women. Adrenaline should be the first line treatment for anaphylaxis in pregnancy, and prompt administration of adrenaline (1:1000 IM adrenaline 0.01mg per kg up to 0.5mg per dose) should not be withheld due to a fear of causing reduced placental perfusion. The left lateral position is recommended for patients who are pregnant to reduce the risk of compression of the inferior vena cava by the pregnant uterus and thus impairing venous return to the heart. Refer to ASCIA Guidelines for further information: www.allergy.org.au/hp/papers/acute-management-of-anaphylaxis-in-pregnancy

Positioning of patient

- **Fatality can occur within minutes if a patient stands, walks or sits suddenly.**
- **Patients must NOT walk or stand, even if they appear to have recovered.**
  A wheelchair, stretcher or trolley bed should be used to transfer the patient:
  - To the ambulance.
  - From the ambulance to the treatment room bed.
  - From the treatment room bed to and from the toilet.
- Laying the patient flat will improve venous blood return to the heart. By contrast, placing the patient in an upright position, can impair blood returning to the heart, resulting in insufficient blood for the heart to circulate and low blood pressure.
- The correct way to hold an infant is horizontally, as shown in this image. They must not be held upright over a shoulder.
- The left lateral (recovery) position is recommended for patients who are pregnant (shown in this image). This reduces the risk of compression of the inferior vena cava by the pregnant uterus and improves venous return to the heart.
- If vomiting, lay the patient on their side in the recovery position.
- Patients with mostly respiratory symptoms may prefer to sit, which may help support breathing and improve ventilation. The patient should sit with their legs outstretched in front of them (not in a chair). BEWARE that even sitting may trigger hypotension. Monitor closely. Immediately lay the patient flat again if there is any alteration in conscious state or drop in blood pressure.
- Do not allow the patient to stand or walk until they are haemodynamically stable, which is usually a minimum of 1 hour after 1 dose of adrenaline and 4 hours if more than 1 dose of adrenaline.

Supportive management - when skills and equipment are available

- Check pulse, blood pressure, ECG, pulse oximetry, conscious state.
- Give high flow oxygen if available and airway support if needed.
- Obtain IV access in adults and tachycardic and/or hypotensive children. The first sign of cardiovascular compromise in children is ongoing tachycardia. Hypotension can occur later, when it can then be difficult to get IV access, resulting in a significantly prolonged recovery process.
- If hypotensive, give IV normal saline 20mL/kg rapidly and consider additional wide bore IV access.

See Appendix for additional information.

Additional measures - IV adrenaline infusion in clinical setting

If there is an inadequate response after 2-3 adrenaline doses, or deterioration of the patient, start IV adrenaline infusion, given by staff trained in its use or in liaison with an emergency/critical care specialist.

IV adrenaline infusions should be used with a dedicated line, infusion pump and anti-reflux valves wherever possible.

**CAUTION:** IV boluses of adrenaline are NOT recommended without specialised training as they may increase the risk of cardiac arrhythmia.

See Appendix for additional information.
Additional measures to consider if IV adrenaline infusion is ineffective

| For upper airway obstruction | • Nebulised adrenaline (5mL e.g. 5 ampoules of 1:1000).
|                            | • Consider need for advanced airway management if skills and equipment are available.
| For persistent hypotension/shock | • Give normal saline (maximum of 50mL/kg in first 30 minutes).
|                               | • Glucagon
|                               | • In adults, selective vasoconstrictors only after advice from an emergency medicine/critical care specialist.
|                               | See Appendix for dosage and additional information.
| For persistent wheeze | Bronchodilators: Salbutamol 8-12 puffs of 100µg (spacer) or 5mg (nebuliser).
|                       | Note: Bronchodilators must not be used as first line medication for anaphylaxis as they do not prevent or relieve upper airway obstruction, hypotension or shock.
|                       | Corticosteroids: Oral prednisolone 1 mg/kg (maximum of 50 mg) or intravenous hydrocortisone 5 mg/kg (maximum of 200 mg).
|                       | Note: Steroids must not be used as a first line medication in place of adrenaline.

Antihistamines and corticosteroids

Antihistamines:
- Antihistamines have no role in treating or preventing respiratory or cardiovascular symptoms of anaphylaxis.
- Do not use oral sedating antihistamines as side effects (drowsiness or lethargy) may mimic some signs of anaphylaxis.
- **Injectable promethazine should not be used** in anaphylaxis as it can worsen hypotension and cause muscle necrosis.

Corticosteroids:
- The benefit of corticosteroids in anaphylaxis is unproven.

**Observe patient for at least 4 hours after last dose of adrenaline**

Relapse, protracted and/or biphasic reactions may occur. Overnight observation is strongly recommended if they:
- Had a severe or protracted anaphylaxis (e.g. required repeated doses of adrenaline or IV fluid resuscitation), OR
- Have a history of severe/protracted anaphylaxis, OR
- Have other concomitant illness (e.g. severe asthma, history of arrhythmia, systemic mastocytosis), OR
- Live alone or are remote from medical care, OR
- Present for medical care late in the evening.

True biphasic reactions are estimated to occur following 3-20% of anaphylactic reactions.

**Follow up treatment including advice for hospital discharge**

Adrenaline autoinjector
- If there is a risk of re-exposure (e.g. stings, foods, unknown cause) then prescribe and if possible dispense an adrenaline injector before discharge, pending specialist review.
- Teach the patient how to use the adrenaline autoinjector using a trainer device and provide them with an ASCIA Action Plan for Anaphylaxis - see ASCIA website [www.allergy.org.au/anaphylaxis](http://www.allergy.org.au/anaphylaxis)
- Refer patient to Allergy & Anaphylaxis Australia [www.allergyfacts.org.au](http://www.allergyfacts.org.au) for information on daily management and support whilst they await clinical immunology/allergy specialist review.
Clinical immunology/allergy specialist referral

- Refer ALL patients who present with anaphylaxis for specialist review.
- The clinical immunology/allergy specialist will:
  - Identify/confirm cause.
  - Educate about avoidance/prevention strategies and management of comorbidities.
  - Provide ASCIA Action Plan for Anaphylaxis - preparation for future reactions.
  - Initiate allergen immunotherapy where available (for some insect venoms).
  - Refer to other relevant health professionals as required (e.g. dietitian).

Documentation of episodes

Patients should be advised to document episodes of anaphylaxis. This facilitates identification of avoidable causes (e.g. food, medication, herbal remedies, bites and stings, co-factors like exercise) in the 6-8 hours preceding the onset of symptoms.

The ASCIA allergic reactions event record and clinical history forms can be used to collect and document this information.

www.allergy.org.au/hp/anaphylaxis/anaphylaxis-event-record

Preparation: Equipment required for acute management of anaphylaxis

The equipment on your emergency trolley should include:

- Adrenaline 1:1000 (consider adrenaline autoinjector availability, particularly in rural locations, for initial administration by nursing staff)
- 1mL syringes; 22-25G needles (25mm length) are recommended for IM injections for all ages*
  (consistent with Australian Immunisation Handbook).
- Oxygen
- Airway equipment, including rebreather oxygen masks, nebuliser masks and suction
- Defibrillator
- Manual blood pressure cuff
- IV access equipment (including large bore cannulae)
- At least 3 litres of normal saline
- A hands-free phone in resuscitation room, to allow health care providers in remote locations to receive instructions by phone whilst keeping hands free for resuscitation.

*Exceptions are preterm/very small infants (23-25G needle length 16mm) and very large/obese adults (22-25G and needle length up to 38mm).

Acknowledgements

The information in these guidelines is consistent with the Australian Prescriber Anaphylaxis Management wall chart www.nps.org.au/australian-prescriber/articles/anaphylaxis-emergency-management-for-health-professionals

These guidelines are also based on the following international guidelines:

- International Liaison Committee on Resuscitation (ILCOR) and Australian and New Zealand Committee on Resuscitation (ANZCOR) guidelines
- American Academy of Allergy, Asthma and Immunology (AAAAI) anaphylaxis parameter
- World Allergy Organisation (WAO) anaphylaxis guidelines

Management of anaphylaxis in the community, including schools and early childhood education/care, is facilitated by regular training and the use of an ASCIA Action Plan for Anaphylaxis. The instructions in this plan are consistent with the information in these guidelines. To access ASCIA Action Plans and other anaphylaxis resources, including e-training courses, go to www.allergy.org.au/anaphylaxis
Appendix: Advanced Acute Management of Anaphylaxis

This additional information is intended for health professionals working in emergency departments, ambulance services, and rural or regional areas, who provide emergency care.

Supportive management (when skills and equipment available)

- Monitor pulse, blood pressure, respiratory rate, pulse oximetry, conscious state.
- Give high flow oxygen (6-8 L/min) and airway support if needed.
- Supplemental oxygen should be given to all patients with respiratory distress, reduced conscious level and those requiring repeated doses of adrenaline.
- Supplemental oxygen should be considered in patients who have asthma, other chronic respiratory disease, or cardiovascular disease.
- Obtain intravenous (IV) access in adults and in hypotensive children.
- If hypotensive:
  - Give intravenous normal saline (20 mL/kg rapidly under pressure), and repeat bolus if hypotension persists.
  - Consider additional wide bore (14 or 16 gauge for adults) intravenous access.

During severe anaphylaxis with hypotension, marked fluid extravasation into the tissues can occur: DO NOT FORGET FLUID RESUSCITATION.

Assess circulation to reduce risk of overtreatment

- Monitor for signs of overtreatment (especially if respiratory distress or hypotension were absent initially) – including pulmonary oedema, hypertension.
- In this setting (anaphylaxis) it is recommended that if possible a simple palpable systolic blood pressure (SBP) should be measured:
  - Attach a manual BP cuff of an appropriate size and find the brachial or radial pulse.
  - Determine the pressure at which this pulse disappears/reappears (the "palpable" systolic BP).
  - This is a reliable measure of initial severity and response to treatment
  - Measurement of palpable SBP may be more difficult in children.

Note: If a patient is nauseous, shaky, vomiting, or tachycardic but has a normal or elevated SBP, this may be adrenaline toxicity rather than worsening anaphylaxis.

Additional measures - IV adrenaline infusion

IV adrenaline infusions should only be given by, or in liaison with, an emergency medicine/critical care specialist.

If your centre has a protocol for IV adrenaline infusion for critical care, this should be utilised and titrated to response with close cardio-respiratory monitoring.

If there is not an established protocol for your centre, two protocols for IV adrenaline infusion are provided, one for pre-hospital settings and a second for emergency departments/tertiary hospital settings only.

It is important to note that the two infusion protocols have different concentrations and different rates of IV fluid infusion, resulting in the same initial rate of adrenaline infusion.

It is vital that IV adrenaline infusions should be used with the following equipment wherever possible:

- Dedicated line.
- Infusion pump.
- Anti-reflux valves in intravenous line.
Additional measures - IV adrenaline infusion for pre-hospital settings

If there is inadequate response to IMI adrenaline or deterioration, start an intravenous adrenaline infusion. IV adrenaline infusions should only be given by, or in liaison with, an emergency medicine/critical care specialist.

The protocol for 1000 mL normal saline is as follows:

• Mix 1 mL of 1:1000 adrenaline in 1000 mL of normal saline.
• Start infusion at ~5 mL/kg/hour (~0.1 microgram/kg/minute).
• If you do not have an infusion pump, a standard giving set administers ~20 drops per mL; therefore, start at ~2 drops per second for an adult.
• Titrate rate up or down according to response and side effects.
• Monitor continuously – ECG and pulse oximetry and frequent non-invasive blood pressure measurements as a minimum to maximise benefit and minimise risk of overtreatment and adrenaline toxicity.

Note:
• This protocol is intended for temporary use, when no infusion pump is available.
• Most anaphylactic reactions settle with only 1 mg adrenaline in 1 litre.
• Indefinite continuation of low concentration infusion increases risk of fluid overload.
• Caution - Intravenous boluses of adrenaline are NOT recommended due to risk of cardiac ischaemia or arrhythmia UNLESS the patient is in cardiac arrest.

Additional measures: IV adrenaline infusion for emergency departments/ tertiary hospitals only

This infusion will facilitate a more rapid delivery through a peripheral line and should only be used in emergency departments and tertiary hospital settings.

The protocol for 100 mL normal saline is as follows:

• Mix 1 mL of 1:1000 adrenaline in 100 mL normal saline.
  – Initial rate adjusted accordingly to 0.5 mL/kg/hour (~0.1 microgram/kg/minute).
  – Should only be given by infusion pump.
• Monitor continuously – ECG and pulse oximetry and frequent non-invasive blood pressure measurements as a minimum to maximise benefit and minimise risk of overtreatment and adrenaline toxicity.

Additional measures to consider if IV adrenaline infusion is ineffective

For persistent hypotension/shock:

• Give normal saline (maximum of 50mL/kg in first 30 minutes).
• In patients with cardiogenic shock (especially if taking beta blockers) consider an intravenous glucagon bolus of:
  – 1-2mg in adults
  – 20-30 microgram/kg up to 1mg in children
  This may be repeated or followed by an infusion of 1-2mg/hour in adults.
• In adults, selective vasoconstrictors metaraminol (2-10mg) or vasopressin (10-40 units) only after advice from an emergency medicine/critical care specialist. Beware of side effects including arrhythmias, severe hypotension and pulmonary oedema.

In children, metaraminol 10 micrograms/kg/dose can be used. Noradrenaline infusion may be used in the critical care setting, only with invasive blood pressure monitoring.
Advanced airway management

- Oxygenation is more important than intubation.
- Always call for help from the most experienced person available.
- If airway support is required, first use the skills you are most familiar with (e.g. jaw thrust, Guedel or nasopharyngeal airway, bag-valve-mask with high flow oxygen attached). This will save most patients, even those with apparent airway swelling (these patients have often stopped breathing due to circulatory collapse rather than airway obstruction and can be adequately ventilated with basic life support procedures).
- DO NOT make prolonged attempts at intubation - remember the patient is not getting any oxygen while you are intubating.

If unable to maintain an airway and the patient's oxygen saturations are falling, further approaches to the airway (e.g. cricothyrotomy) should be considered in accordance with established difficult airway management protocols. Specific training is required to perform these procedures.

Special situation: Overwhelming anaphylaxis (cardiac arrest)

Key points:

- Massive vasodilatation and fluid extravasation.
- Unlikely that IMI adrenaline will be absorbed in this situation due to poor peripheral circulation.
- Even if absorbed, IMI adrenaline on its own may be insufficient to overcome vasodilatation and extravasation.
- Need both IV adrenaline bolus (cardiac arrest protocol, 1 mg every 2-3 minutes) AND aggressive fluid resuscitation in addition to CPR (Normal Saline 20mL/kg stat, through a large bore IV under pressure, repeat if no response).
- Do not give up too soon - this is a situation when prolonged CPR should be considered, because the patient arrested rapidly with previously normal tissue oxygenation, and has a potentially reversible cause.