Queensland Paediatric Guideline

Emergency

Allergy and anaphylaxis – Emergency management in children

Purpose

This document provides clinical guidance for all staff involved in the care and management of a child presenting to an Emergency Department (ED) in Queensland with symptoms suggestive of an acute allergic reaction or anaphylaxis.

This guideline has been developed by senior ED clinicians and Paediatricians across Queensland, with input from Immunologists, Queensland Children's Hospital, Brisbane. It has been endorsed for use statewide by the Queensland Emergency Care of Children Working Group in partnership with the Queensland Emergency Department Strategic Advisory Panel and the Healthcare Improvement Unit, Clinical Excellence Queensland.

Key points

- Anaphylaxis is a rapidly evolving generalised multi-system allergic reaction to an allergen or trigger characterised by respiratory and/or cardiovascular features that can be fatal.
- Anaphylaxis is under-recognised as symptoms may have resolved prior to ED presentation.
- IM Adrenaline IM into the thigh is the first-line treatment for anaphylaxis.
- Caregivers of a child who has suffered anaphylaxis must receive two Adrenaline autoinjectors along with education on use and an individualised action plan on discharge from ED.
- Adrenaline autoinjectors must be prescribed (and if possible dispensed) to all children who have suffered any allergic reaction (mild, moderate or severe) secondary to nut exposure as subsequent exposures may lead to more severe reactions (including anaphylaxis) and are less predictable compared to other foods.

Introduction

An allergic reaction is an immunologically-mediated adverse reaction which occurs when a person's immune system reacts to a substance (allergen) in the environment which would normally be innocuous. Allergens can enter the body via a number of different portals, including inhalation, ingestion, contact with skin and injection (parenteral medication or insect stings and bites).

Up to 40% of children in Australia and New Zealand are affected by allergic disorders at some time during their life, with 20% having current symptoms. Allergic diseases have approximately doubled in western countries over the last 25 years. The most common allergic conditions in children are food allergies, eczema, asthma and hayfever (allergic rhinitis).[1]

Most allergic reactions do not cause major problems, even though for many people they may be a source of extreme irritation and discomfort. A small number of people may experience a severe allergic reaction called anaphylaxis.

Anaphylaxis is an acute systemic allergic reaction in response to an allergen or trigger. It is caused by an IgE-mediated release of histamine, leukotrienes and prostaglandins from tissue mast cells and peripheral blood basophils.[1,2] This reaction is multisystem in nature with systemic cardiovascular and/or respiratory symptoms and involvement of other systems such as the skin and gastrointestinal tract. Anaphylaxis may also be accompanied by signs of general allergic reaction.[1,3] Urticaria / skin symptoms may be transient or subtle. Emergency departments tend to miss the diagnosis of anaphylaxis if the symptoms have resolved or if there is not a previous history of anaphylaxis.[4]

Non-immunologic anaphylaxis or 'anaphylactoid' reaction is an acute systemic reaction which is clinically identical to anaphylaxis. This occurs as a result of direct mast cell stimulation in response to a trigger and requires the same treatment.[3,5]

Food allergies are the most common cause of anaphylaxis in children. Common allergens include peanuts, tree nuts, wheat, sesame, egg, cow's milk, fish, shellfish and on rare occasions spices, fruit and soy.[5] Other causative agents include drugs, insects, latex, allergen therapy and, less commonly, exercise, cold and immunisations. In up to 30% of reactions, a cause cannot be identified.[1]

The prevalence of anaphylaxis in the paediatric population is estimated to be 1 in 1000.[6] Admission rates for anaphylaxis are increasing in Australia with food allergies affecting 4 - 8% of children less than five years of age.[1] Deaths from anaphylaxis are relatively rare but they are increasing in Australia with 324 deaths recorded between 1997 and 2013.[7]

Risk factors for fatal anaphylaxis include:[1,8]

- asthma
- delayed administration of adrenaline
- age (teenagers and adults are at higher risk)
- nut allergy

Assessment

Emergency care should always involve a rapid primary survey with evaluation of (and immediate management of concerns with) airway, breathing, circulation and disability (ABCD). Consider pre-hospital treatment.

History

History taking should include specific information on allergic symptoms prior to hospital presentation with particular emphasis on cardiovascular or respiratory symptoms.

Once the patient is stabilised, the allergen trigger for the event should be identified (if possible).
Questioning should identify:

- all foods and medications consumed several hours before the reaction
- any possible stings or bites
- current medications such as beta-blockers (as may affect response to treatment)
- co-morbid diseases such as asthma (as can affect the severity of the reaction)

Examination

Clinical features of generalised allergic reaction and anaphylaxis	
Generalised allergic reaction	Anaphylaxis
Characterised by: • one or more of the following cutaneous features: ○ generalised pruritus ○ urticaria / angioedema ○ erythema **AND/OR** • one or more of the following gastrointestinal features: ○ abdominal pain ○ vomiting ○ loose stools **AND** • no respiratory or cardiovascular signs or symptoms	Rapidly evolving generalised multi-system allergic reaction characterised by: • one or more of the following respiratory features: ○ difficulty / noisy breathing ○ swelling of tongue ○ swelling / tightness in throat ○ difficulty talking and/or hoarse voice ○ wheeze or persistent cough **AND/OR** • one or more of the following cardiovascular features: ○ loss of consciousness ○ collapse ○ pallor and floppiness (in young children) ○ hypotension May also involve other systems such as the skin or gastrointestinal tract.

Source: The Australian Society of Clinical Immunology and Allergy[1]

Anaphylaxis requires **ONLY ONE** respiratory or cardiovascular component to make a diagnosis.

Differential diagnosis

Differential diagnoses for symptoms of anaphylaxis	
Clinical presentation	**Differential diagnoses**
Swelling of lips and tongue	Idiopathic or hereditary angioedema
Cardio-vascular compromise including hypotension	All forms of shock
Stridor, drooling or respiratory distress	Upper airway obstruction causes including foreign body, epiglottitis, and croup
Flushing of the face, headache, heart palpitations, itching, blurred vision, cramps and diarrhoea within minutes to an hour of consuming contaminated fish	Scombroid poisoning (histamine poisoning from fish) - easily confused as seafood is a common cause of anaphylaxis

Investigations

Investigations are not routinely recommended. Histamine levels fall too rapidly to be clinically useful. Occasionally tryptase levels collected within three hours of symptom onset may be useful but should only be collected on advice from Immunologist/Allergist.

The use of other laboratory and radiological tests should be guided by patient co-morbidities and circumstances, including incidental trauma.[9]

Management

Refer to Appendix 1 for a summary of the emergency management of children with an acute allergic reaction.

ALERT – Some insect bites or stings can result in severe abdominal pain and vomiting. This represents a severe allergic reaction and should be managed as for anaphylaxis.

Anaphylaxis is often under-diagnosed due to the variable nature and duration of symptoms.

Given the potential for rapid deterioration administer Adrenaline IM immediately into the thigh if anaphylaxis is suspected.

Anaphylaxis

Initial management includes rapid triage and clinical assessment of the patient's airway patency, breathing (ventilation and oxygenation) and circulation. Intervention and stabilisation should occur immediately. Continuous cardiac and oxygen saturation monitoring is recommended. Children with less severe generalised allergic symptoms may initially appear stable but have the potential for rapid deterioration.[9]

Adrenaline

- Adrenaline IM into the thigh is the recommended first-line treatment of anaphylaxis
- effective for all the symptoms and signs of anaphylaxis[2]
- associated with a decreased fatality rate if administered promptly[10]

Studies have demonstrated that peak plasma levels are achieved significantly faster after IM injection into the thigh compared with SC injection into the arm.[11,12]

Nebulised Adrenaline may help relieve upper airway obstruction and/or bronchospasm but should only be administered **in addition to** Adrenaline IM.

ALERT – Adrenaline IV should be reserved for the following children:

- immediately life-threatening profound shock
- circulatory compromise and continuing to deteriorate after Adrenaline IM
- ongoing rebound of anaphylaxis despite recurrent Adrenaline IM

Where Adrenaline IV is indicated, a continuous low dose Adrenaline infusion is the safest and most effective form of administration.[13] Significant adverse events including fatal cardiac arrhythmia and cardiac infarction have been reported when Adrenaline IV is administered too rapidly, inadequately diluted or in excessive dose.[14] An Adrenaline IV bolus is not recommended.

Adrenaline dosing for the treatment of anaphylaxis in children	
Adrenaline (IM)	10 microgram/kg (maximum 0.5 mg) ~ 0.01 mL/kg of 1:1000 solution (undiluted) Repeat as necessary every five minutes
Adrenaline (NEB)	5 mL of undiluted 1:1000 Adrenaline nebulised with oxygen
Adrenaline (IV infusion)	<u>With Smart Pump Drug Errors Reducing System:</u> 1 mL of 1:1000 Adrenaline solution (contains 1 mg) in 50 mL of Sodium Chloride 0.9% Start infusion at 0.1 microgram/kg/min <u>Without Smart Pump Drug Errors Reducing System:</u> 1 mL of 1:1000 Adrenaline solution in (contains 1 mg) in 50 mL of Sodium Chloride 0.9% Start infusion at 0.3 mL/kg/hour (0.1 microgram/kg/min)

Seek urgent paediatric critical care advice (onsite or via Retrieval Services Queensland (RSQ)) for a child requiring more than two doses of Adrenaline IM or prior to administering Adrenaline IV.

Airway

Children suffering from anaphylaxis who have respiratory distress without circulatory instability should be initially nursed in a sitting up position.

While the vast majority of children respond well to Adrenaline IM, airway swelling can occur rapidly. Preparation for early intubation including a range of ETT sizes (with several sizes smaller than usual) is recommended. In anaphylaxis, the airway should always be considered potentially "difficult" and caution should be exercised when opting for heavy sedation or long-acting paralytic agents.[9] Laryngeal mask airway (LMA) may not be effective due to oropharyngeal angioedema and bronchospasm.

Seek senior emergency/paediatric advice as per local practices for a child with airway concerns following administration of Adrenaline IM.

Contact the most senior resources available onsite (critical care/anaesthetic/ENT) prior to intubating a child with anaphylaxis.

Breathing

- high flow supplemental oxygen via non-rebreather mask is recommended

Circulation

- children with circulatory compromise should be nursed lying down
- elevate the lower extremities to conserve circulating volume
- IV access with two large-bore (age-appropriate) cannula, or intraosseous access, is recommended for children with severe symptoms at risk of circulatory compromise

Fluid resuscitation for the management of shocked children	
Bolus dose (IV or IO)	Sodium Chloride 0.9% administered rapidly in 20 mL/kg bolus. Repeat in 20 mL/kg boluses as clinically indicated.

Seek urgent paediatric critical care advice (onsite or via RSQ) for a child in shock who is not responding to Adrenaline and fluids.

Inhaled bronchodilators

- may help relieve bronchospasm if lower airway obstruction (wheeze) is a concern[18]

- should only be used as an adjunct to first-line treatment for anaphylaxis

Corticosteroids

While corticosteroids are commonly recommended as second-line treatment internationally, little evidence supports their use in anaphylaxis. No randomised controlled trials (in adults or children) were identified in a Cochrane Systematic Review of glucocorticoids for the treatment of anaphylaxis.[15] The primary action of glucocorticoids is down-regulation of the late-phase eosinophilic inflammatory response, as opposed to the early-phase response. Short-term glucocorticoid treatment is seldom associated with adverse effects.[16] The proposed rationale for corticosteroid administration is to prevent biphasic or protracted reactions.[2] However, in two paediatric studies of biphasic reactions the administration of steroids did not appear to be preventative.[2] Steroids are not recommended unless there is a component of asthma aggravation with the anaphylaxis which should be treated concurrently as per the Asthma Guideline.

Antihistamines

- not recommended in acute anaphylaxis as there is no evidence to support use[17]

Generalised and local allergic reaction

Antihistamines

- H_1 antagonists are recommended to treat allergy symptoms including urticaria, angioedema and itchiness
- two-to-four-day-course taken orally is recommended to alleviate persistent symptoms after a severe allergic reaction

ALERT – Sedating antihistamines including promethazine (Phenergan) or dexchlorpheniramine maleate (Polaramine) are **NOT** recommended as may cause significant side effects such as respiratory depression, especially in younger children.

Antihistamine dosing for the treatment of allergic reaction in children		
Antihistamine	**Age**	**Dose**
Cetirizine (Oral) (Zyrtec)	1-2 years	2.5 mg twice daily
	2-6 years	5 mg once daily or 2.5mg twice daily
	6-12 years	10 mg once daily or 5mg twice daily
	12-18 years	10 mg once daily
Or Fexofenadine (Oral) (Telfast)	6 months to less than 2 years	15 mg twice daily
	2 to 11 years	30 mg twice daily
	12 years and older	60 mg twice daily
Or Loratadine (Oral)* (Claratyne)	1 to 2 years	2.5 mg once daily
	Over 2 years	Weight less than 30kg: 5 mg once daily Weight 30kg and over: 10 mg once daily
Or Desloratadine (Oral)* (Aerius)	6 months to less than 1 year	1mg daily
	1 to 5 years	1.25 mg daily
	6 to 11 years	2.5 mg daily
	12 years and older	5 mg daily

* Loratadine and Desloratadine are not available within QH Hospitals but available in the community

Escalation and advice outside of ED

Child is critically unwell or rapidly deteriorating child

Includes the following children (as a guide)

- ongoing airway, breathing or circulation involvement
- requiring more than two doses of Adrenaline IM
- requiring Adrenaline IV
- in shock
- physiological triggers based on age (see below)

Less than 1 year	1-4 years	5-11 years	Over 12 years
• RR >50 • HR <90 or >170 • sBP <65 • SpO2 <93% in oxygen or <85% in air • GCS ≤12	• RR >40 • HR <80 or >160 • sBP <70 • SpO2 <93% in oxygen or <85% in air • GCS ≤12	• RR >40 • HR <70 or >150 • sBP <75 • SpO2 <93% in oxygen or <85% in air • GCS ≤12	• RR >30 • HR <50 or >130 • sBP <85 • SpO2 <93% in oxygen or <85% in air • GCS ≤12

Reason for contact	Who to contact
For immediate onsite assistance including airway management (anticipate difficult airway)	The most senior resources available onsite at the time as per local practices. Options may include: • paediatric critical care • critical care • ENT • anaesthetics • paediatrics • Senior Medical Officer (or similar)
Paediatric critical care advice and assistance	Onsite or via Retrieval Services Queensland (RSQ). If no onsite paediatric critical care service contact RSQ on **1300 799 127**: • for access to paediatric critical care telephone advice • to coordinate the retrieval of a critically unwell child RSQ (access via QH intranet) **Notify early of child potentially requiring transfer.** **Consider early involvement of local paediatric/critical care service.** In the event of retrieval, inform your local paediatric service.

Non-critical child

May include children with:
• generalised allergic reaction • anaphylaxis

Reason for contact	Who to contact
Advice (including management, disposition or follow-up)	Follow local practices. Options: • onsite/local paediatric service • Queensland Children's Hospital experts via Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) (24-hour service) • local and regional paediatric videoconference support via Telehealth Emergency Management Support Unit TEMSU (access via QH intranet) on 1800 11 44 14 (24-hour service)
Referral	First point of call is the onsite/local paediatric service

Inter-hospital transfers

Do I need a critical transfer?	• discuss with onsite/local paediatric service • view Queensland Paediatric Transport Triage Tool
Request a non-critical inter-hospital transfer	• contact onsite/local paediatric service • contact RSQ on 1300 799 127 for aeromedical transfers • contact Children's Advice and Transport Coordination Hub (CATCH) on 13 CATCH (13 22 82) for transfers to Queensland Children's Hospital

Non-critical transfer forms	• QH Inter-hospital transfer request form (access via QH intranet)
	• aeromedical stepdown (access via QH intranet)
	• commercial aeromedical transfers:
	  ○ Qantas
	  ○ Virgin
	  ○ Jetstar

When to consider discharge from ED

Children with a localised or general allergic reaction

Children with a localised allergic reaction may be safely discharged.

Children with a general allergic reaction may be safely discharged provided symptoms have not progressed and are improving within one hour of observation.

On discharge

- parents / carers should be educated on allergic reactions and instructed to return immediately if symptoms recur
- Adrenaline autoinjectors must be prescribed (and if possible dispensed) to all children who have suffered any allergic reaction (mild, moderate or severe) secondary to nut exposure as subsequent exposures may lead to more severe reactions (including anaphylaxis) and are less predictable compared to other foods

Follow-up

- with GP within a week.

For children with a generalised allergic reaction, consider referral to a local Immunologist (via ED or GP) on discharge. Refer to the ASCIA website (https://allergy.org.au/) for registered local Immunologists. Refer to local Paediatrician if no local Immunology service.

Children with anaphylaxis

Consider discharge for children who meet the following criteria:

- resolution of respiratory and CVS symptoms
- an observation period of four hours following administration of Adrenaline IM.

Prior to discharge, consider other factors including the time of day, parents/carers comprehension and compliance, access to transport should return be required and distance to the local hospital.

On discharge

- caregivers **must** receive:
  - two Adrenaline autoinjectors (AAI) or ampoules according to weight (see table below)
  - education on how and when to administer the AAI or Adrenaline ampoules (refer to ASCIA website)
  - an individualised Action Plan (see Action Plan for Anaphylaxis on ASCIA website)
  - general information regarding allergies and anaphylaxis management (see ASCIA website)
- the child and their caregiver/s should be encouraged to document the circumstances leading up to an episode of anaphylaxis (up to six to eight hours prior to symptoms)

Weight of child	Adrenaline recommended on discharge
Less than 8.5 kg	Adrenaline ampoules 1:1000
8.5-20 kg	Epipen Jr autoinjector
Greater than 20 kg	Epipen autoinjector

Follow-up

- refer (via ED or GP) to Immunologist/Allergy specialist if available locally, otherwise refer to local Paediatrician
- if allergen known to be food related, consider referral to local dietician

When to consider admission

Facilities without a Short Stay Unit (SSU)

Admission is recommended for children with anaphylaxis who:

- have persistent symptoms four hours after treatment
- required more than two Adrenaline doses (due to possibility of recurrent symptoms)

Facilities with a Short Stay Unit (SSU)

Consider admission to a SSU for children who are responding to treatment but require a period of observation prior to meeting the criteria for discharge.

When to consider admission to inpatient ward from SSU

Admission to an inpatient service is recommended for children who require more than two Adrenaline doses (due to possibility of recurrent symptoms) or who are failing to improve after 12 hours of care.

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Guideline approval

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Disclaimer

This guideline is intended as a guide and provided for information purposes only. The information has been prepared using a multidisciplinary approach with reference to the best information and evidence available at the time of preparation. No assurance is given that the information is entirely complete, current, or accurate in every respect. We recommend hospitals follow their usual practice for endorsement locally including presenting it to their local Medicines Advisory Committee (or equivalent) prior to use.

The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances may be appropriate.

This guideline does not address all elements of standard practice and accepts that individual clinicians are responsible for:

- Providing care within the context of locally available resources, expertise, and scope of practice
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management
- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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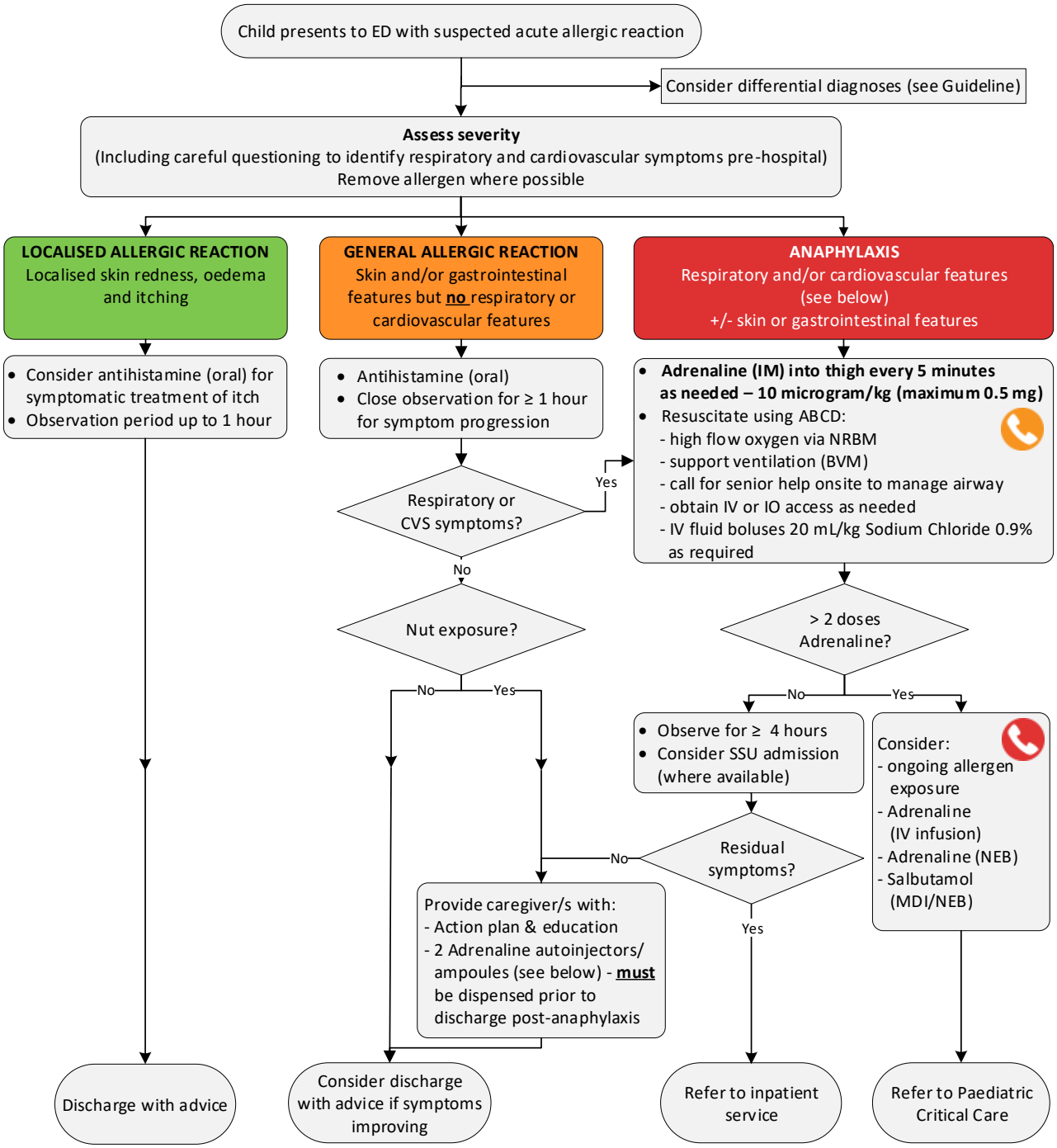

Respiratory features	Cardiovascular features
- difficulty/noisy breathing - swelling of the tongue - swelling/tightness in throat - difficulty talking +/- hoarse voice - wheeze or persistent cough	- loss of consciousness - collapse - pallor and floppiness in young child - hypotension

Note:
- A single respiratory or cardiovascular feature constitutes an anaphylaxis diagnosis.
- Manage insect bites or stings with severe abdominal pain and vomiting as for anaphylaxis.
- See over page for description of gastrointestinal and cutaneous features.

Adrenaline given on discharge	
Weight of child	Adrenaline
< 8.5 kg	Adrenaline ampoules 1:1000
8.5-20 kg	Epipen Jr autoinjector
> 20 kg	Epipen autoinjector

Seek senior emergency/paediatric advice as per local practice

Seek urgent paediatric critical care advice (onsite or via Retrieval Services Queensland (RSQ) on 1300 799 127)

Allergy and anaphylaxis – Emergency management in children – Medications

Clinical features of a generalised allergic reaction*	
Gastrointestinal	**Cutaneous**
• abdominal pain • vomiting • loose stools	• generalised pruritus • urticaria/angioedema • erythema

*May also be present in anaphylaxis

Adrenaline dosing for the treatment of anaphylaxis in children	
Adrenaline (IM)	10 microgram/kg (maximum 0.5 mg) ~ 0.01 mL/kg of 1:1000 solution (undiluted)
Adrenaline (NEB)	5 mL of undiluted 1:1000 Adrenaline nebulised with oxygen
Adrenaline (IV infusion)	With Smart Pump Drug Errors Reducing System: 1 mL of 1:1000 Adrenaline solution (contains 1 mg) in 50 mL of Sodium Chloride 0.9%. Start infusion at 0.1 microgram/kg/min. Without Smart Pump Drug Errors Reducing System: 1 mL of 1:1000 Adrenaline solution in (contains 1 mg) in 50 mL of Sodium Chloride 0.9%. Start infusion at 0.3 mL/kg/hour (0.1 microgram/kg/min).

ALERT – Adrenaline IV should be reserved for the following children:

- immediately life-threatening profound shock
- circulatory compromise and continuing to deteriorate after Adrenaline IM
- ongoing rebound of anaphylaxis despite recurrent Adrenaline IM

Antihistamine dosing for the treatment of allergic reaction in children		
Antihistamine	**Age**	**Dose**
Cetirizine (Oral) (Zyrtec)	1-2 years	2.5 mg twice daily
	2-6 years	5 mg once daily or 2.5 mg twice daily
	6-12 years	10 mg once daily or 5 mg twice daily
	12-18 years	10 mg once daily
Or Fexofenadine (Oral) (Telfast)	6 months to less than 2 years	15 mg twice daily
	2 to 11 years	30 mg twice daily
	12 years and older	60 mg twice daily
Or Loratadine (Oral)* (Claratyne)	1 to 2 years	2.5 mg once daily
	Over 2 years	Weight less than 30kg: 5 mg once daily Weight 30kg and over: 10 mg once daily
Or Desloratadine (Oral)* (Aerius)	6 months to less than 1 year	1 mg daily
	1 to 5 years	1.25 mg daily
	6 to 11 years	2.5 mg daily
	12 years and older	5 mg daily

* Loratadine and Desloratadine are not available within QH Hospitals but available in the community