

Anaphylaxis

Definition / Supporting Information

Anaphylaxis is an acute severe, life-threatening, generalised or systemic hypersensitivity reaction, in pre-sensitised individuals, leading to a systemic response caused by the release of immune and inflammatory mediators from basophils and mast cells.

This is characterised by rapidly developing life-threatening airway (pharyngeal or laryngeal oedema) and/or breathing (bronchospasm with tachypnoea) and / or circulation (hypotension and/or tachycardia) problems usually associated with skin and mucosal changes [[NICE clinical guideline CG134](#)].

At least 2 organ systems are involved, such as the skin, the upper and lower airways, and the cardiovascular, neurological, and gastrointestinal (GI) systems, in this order of priority or in combination. Allergy to medicines, food, immunotherapy, or insect stings is the most frequent cause. Similar symptoms caused by non-immunological mechanisms are termed anaphylactoid reactions.

See Anaphylaxis algorithm (PDF), Resuscitation Council UK.

Keywords / also known as: allergic reaction, insect sting, food allergy, latex allergy, antibiotic reaction

Essential History

Evaluation should progress only after the ABCs (airway, breathing, and circulation) of resuscitation have been addressed.

The lack of any consistent clinical manifestation and a range of possible presentations cause diagnostic difficulty. Skin manifestations are not inevitable and non-specific presentations include vomiting, floppiness and lethargy.

Clues from the clinical history should point to the allergen exposure. Clinicians should gather details about similar reactions in the past as well as known allergies and hypersensitivities. Document all the acute clinical features of the suspected anaphylactic reaction as defined above [[Royal College of Emergency Medicine guideline](#)].

Ask about:

- Food ingestion
 - Common allergens
 - Nuts (peanut, walnut, almond, brazil, hazel)
 - Milk

- Eggs
- Fish
- Shellfish
- Contact with insects
 - Hymenoptera (eg, bee or wasp) stings and ant stings are common in differing geographical locations
- Any recent medication
 - Antibiotics, most commonly penicillin
 - Non-steroidal anti-inflammatory agents, aspirin
 - Anaesthetic agents
- Recent investigation requiring contrast medium
- Contact with Latex
- Timing of exposure to allergen
 - Location and environment of where the event occurred:
 - Indoors (eg, home, work, school, restaurant, hospital)
 - Outdoors (eg, pet shop, zoo, farm)
 - Triggers for anaphylactic reaction may include changes in temperature; heat or cold
 - Record the time of onset of the reaction and exposure to possible allergen
 - The time of onset of an anaphylactic reaction depends on the type of trigger
 - Intravenous triggers cause the most rapid onset of reaction; deaths caused by intravenous medication occur most commonly within five minutes
 - Insect stings cause collapse from shock after 10–15 minutes
 - Fatal food reactions after oral ingestion of triggers cause respiratory arrest after 30–35 minutes
 - Record the circumstances immediately before the onset of symptoms to help to identify the possible trigger
- Recent exercise (exercise-induced anaphylaxis)
 - Some cases occur only after ingestion of foods that cross-react with pollens (eg, melons that cross-react with ragweed, apples that cross-react with birch)
 - Some patients have exercise-induced anaphylaxis after non-specific food ingestion combined with exercise, the commonest exercise / food reactions are to wheat. In such cases wheat alone or exercise alone do not necessarily cause any symptoms while the combination can be life-threatening
 - Some cases occur only after ingestion of foods that cross-react with pollens (eg, melons that cross-react with ragweed, apples that cross-react with birch)

- Record risk factors
 - Age
 - Food-associated, exercise-induced anaphylaxis is more common in young people
 - Atopy
 - A history of atopy and asthma has been shown to be a risk for more severe anaphylaxis in food allergies
 - Previous anaphylaxis or allergy
 - Individuals with previous anaphylactic reactions are at higher risk for recurrence. The severity of a previous reaction does not necessarily predict the severity of a subsequent reaction
 - Exposure to a common sensitiser (eg, latex)
- Exposure history to latex and latex sensitivity occurs in a significant percentage of health care workers, in about 75% of patients with spina bifida, and in patients undergoing multiple surgeries

‘Red Flag’ Symptoms and Signs

Evaluation should progress only after the ABCs (airway, breathing, and circulation) of resuscitation have been addressed.

Ask about:

- Difficulty in breathing (see Dyspnoea)
- Lightheadedness
- Weakness and palpitations

Look for:

- Bronchospasm with wheezing
- Stridor or hoarseness
- Cyanosis
- Tachycardia
- Hypotension
- Decreased level of consciousness
- Urticaria
- Angio-oedema (swelling of lips / tongue) or flushing
- Acute onset
 - Onset is within minutes to a maximum of 1 hour after exposure
 - May follow a uniphasic course
 - Complete resolution of symptoms within hours of treatment, but in up to 20% of episodes there may have a biphasic course, with symptom recurrence after resolution of the initial presentation

- Recommended to observe patients after resolution of an anaphylactic episode for 24 hours for possible second-phase reactivation. Observation periods differ as there is no reliable predictor for biphasic or protracted anaphylaxis
- Respiratory manifestations
 - Rhinitis (common)
 - Breathlessness
 - Wheezing (common)
 - Inspiratory stridor or hoarseness (common)
 - Bronchospasm
- Abdominal manifestations
 - Abdominal pain (common)
 - Nausea and vomiting (common)
 - Suggests the ingestion of an allergen and may be associated with other abdominal symptoms, such as abdominal pain or diarrhoea
 - Diarrhoea
- Cardiovascular manifestations
 - Tachycardia (common)
 - Often associated with hypotension and may herald cardiovascular collapse. The pulse may be so weak that heartbeats may be missed on radial palpation. May lead to underestimation of the cardiac frequency and hence the severity of the patient's condition. The true heart rate is therefore best documented on an electrocardiogram (ECG) monitor
 - Flushing (common)
 - A frequent sign of anaphylaxis due to vasodilation
 - Pallor
 - Cyanosis
 - Palpitations
 - Hypotension
 - Sudden collapse
- Skin manifestations of systemic mediator release
 - Bilateral conjunctivitis (common)
 - Redness
 - Excessive tearing
 - Sensitivity to light
 - Grittiness
 - Swelling of the eyelids
 - Itchiness
 - Both eyes are usually affected simultaneously
 - Pruritus (common)

- Together with rash, is an early sign of urticaria
- Urticaria (common)
 - Blanching, raised, palpable wheals, which can be linear, annular (circular), or arcuate (serpiginous)
- Angio-oedema, swelling of lips / tongue, (common)
 - Circumscribed swelling of any part of the body
 - Immediate treatment is warranted if it involves the airways
- Erythematous rash
- Neurological manifestations
 - Anxiety and agitation (common)
 - Anaphylaxis may present with a complex combination of emotions (eg, fear, apprehension, worry and disorientation)
 - May be accompanied by physical sensations (eg, heart palpitations, nausea, chest pain, or shortness of breath)
 - Neuropsychological symptoms of anaphylaxis may be worsened by hypotension, and be triggered by administration of epinephrine (adrenaline)
 - Dizziness (common)
 - Common descriptions include words such as light-headed, floating, woozy, giddy, confused, helpless, or fuzzy
 - Anaphylaxis can lead to dizziness and eventually to syncope due to the hypotension
 - Disorientation and confusion (common)
 - This neuropsychological symptom of anaphylaxis may be worsened by hypotension, and triggered by administration of epinephrine (adrenaline)
 - Syncope (common)
 - Anaphylaxis can lead to syncope due to the hypotension associated with the intravascular fluid shifts to the third space
 - Visual disturbances
 - Weakness
 - Tremor
 - Seizures

Differential Diagnosis / Conditions

- Acute asthma
- Vasovagal episodes (vasodepressor reactions)
 - Hypotension
 - Pallor
 - Weakness
 - Nausea

- Bradycardia (occurs in only 5% of patients with anaphylaxis)
- Loss of consciousness
- Lack of skin and airway manifestations that are usually seen in anaphylactic reactions
- Prompt recovery after assuming recumbent position
- Panic attacks
 - Palpitations
 - Flushing
 - Shortness of breath (see Dyspnoea)
 - Gastrointestinal symptoms
 - If accompanied by vocal cord dysfunction and stridor, panic attacks may mimic anaphylaxis
- Systemic mastocytosis
 - Anaphylaxis may occur
 - Urticaria pigmentosa may suggest this diagnosis
 - Tests are not useful for managing acute episodes, which are indistinguishable from anaphylaxis
- Hypoglycaemia
 - Flushing mimicking an early allergic skin reaction
 - Flushing may be associated with:
 - Tachycardia
 - Anxiety
 - Sweating
 - Lightheadedness
- Hereditary angio-oedema
- Urticarial rash
 - Lack of skin and airway manifestations that are usually seen in anaphylactic reactions
- Septic shock
- Cardiogenic shock
- Hypovolaemic shock
- Vocal cord dysfunction syndrome
- Foreign body aspiration
- Excessive monosodium glutamate ingestion
- Red man syndrome
- Gastroenteritis (food poisoning)

Investigations

Evaluation should progress only after the ABCs (airway, breathing, and circulation) of resuscitation have been addressed.

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team):

- Pulse oximetry
- Blood pressure
- Blood sugar

To be undertaken by specialist practitioners (eg, Emergency Department / General Paediatric Team(s)) if not already done:

- Serum tryptase (see Anaphylaxis: assessment to confirm an anaphylactic episode and the decision to refer after emergency treatment for a suspected anaphylactic episode [[NICE clinical guideline 134](#)])
 - After a suspected anaphylactic reaction take timed blood samples for mast cell tryptase:
 - As soon as possible after emergency treatment has started
 - A second sample ideally within 1–2 hours (but no later than 4 hours) from the onset of symptoms
 - > 0.35 international units/L is indicative of a positive result
 - A blood sample may be required at follow-up with the specialist allergy service to measure baseline mast cell tryptase (persistent raised levels may indicate mastocytosis)
 - It is not useful for some conditions (eg, food-induced anaphylaxis with local reaction)
 - Elevation of tryptase levels may also exist in non-anaphylactic conditions, such as systemic mastocytosis
 - Available in all major labs (eg, as ImmunoCAP), and can be measured post mortem
 - To determine the baseline level of tryptase, an additional sample should be collected at least 24 hours after all symptoms have resolved
 - Not necessary when diagnosis of anaphylaxis is definite
- Skin test (3 main types)
 - Three main types are:
 - Scratch test (also called puncture or prick test)
 - Intradermal test
 - Patch test
 - > 3mm diameter and greater than control is usually indicative of a positive result

- Challenge test
 - The patient is challenged with increasing amounts of the allergen
 - Objective positive symptoms of allergy response is indicative of allergy

Treatment Approach

To be undertaken by non-specialist practitioners (eg, GP Team) or specialist practitioners (eg, Emergency Department / General Paediatric Team(s)):

- Lie the patient down in the recovery position
- Airway should be secured and oxygen administered
- Intramuscular adrenaline/epinephrine 1 in 1000 at doses of:
 - < 6 years, 0.15 mL (150 micrograms)
 - 6-12 years, 0.3 mL (300 micrograms)
 - > 12 years, 0.5 mL (500 micrograms)
 - Most important initial treatment
 - Give preferably in the outer thigh, while assessment is being made
 - There are reports of skin to muscle depth exceeding the needle length in auto-injectors particularly in obese females. Alternative sites or longer needle and syringe for injection may need to be considered if no response to the initial dose.
 - The dose may be repeated as needed every 10–15 minutes.
 - Subcutaneous or inhaled routes for adrenaline are not recommended for the treatment of an anaphylactic reaction because they are less effective.
- Obtain respiratory rate, pulse rate and blood pressure
- Second line treatment (after initial resuscitation):
 - Chlorphenamine maleate (by IM or slow IV injection):
 - < 6 months: 250 micrograms/kg
 - 6 months–6 years: 2.5 mg
 - 6-12 years: 5 mg
 - > 12 years: 10 mg
 - Hydrocortisone (by IM or IV injection):
 - < 6 months: 25 mg
 - 6 months–6 years: 50 mg
 - 6-12 years: 100 mg
 - >12 years: 200 mg
- Nebulised salbutamol can be used as a supplementary therapy to adrenaline if wheeze is persisting at doses of:
 - < 6 years: 2.5 mg
 - 6-12 years: 2.5-5 mg
 - > 12 years: 5 mg.

To be undertaken by specialist practitioners (eg, Emergency Department / General Paediatric Team(s)):

- Fluid replacement
 - If hypotension present
 - Intravenous fluid boluses should be given in aliquots of 20 mL/kg as necessary
- Intravenous vasopressors
 - In severe refractory hypotension, continuous infusions of:
 - Dopamine hydrochloride
 - Noradrenaline/norepinephrine
 - Adrenaline/epinephrine
- Glucagon
 - For patients on a β -blocker (more frequent in adults than children)
 - For refractory hypotension
- Methylene blue (methylthionium chloride)
 - For severe anaphylactic hypotension

When to Refer

See Anaphylaxis: assessment to confirm an anaphylactic episode and the decision to refer after emergency treatment for a suspected anaphylactic episode [[NICE clinical guideline 134](#)].

Refer urgently to specialist practitioners (eg, Emergency Department / General Paediatric Team(s)) if:

- Child is younger than 16 years and has had emergency treatment for suspected anaphylaxis (even if 'well' afterwards)
 - For accurate investigation, diagnosis, monitoring, and providing ongoing management of, and patient education about, suspected anaphylaxis.
 - See Food allergy in under 19s: assessment and diagnosis [[NICE clinical guideline CG116](#)]
 - A period of observation before discharge is recommended for up to 24 hours

'Safety Netting' Advice

- After an anaphylactic episode, discharge patient with an adrenaline/epinephrine auto-injector device for self-administration
 - The patient must be trained to use the device
 - The patient must understand that it should be available anywhere he / she goes
 - The patient must understand that the devices have expiry dates and should be renewed periodically

- Provide education on avoidance
 - This is particularly important for foods, insect stings, and medications
 - In cases of exercise-induced anaphylaxis, patients should be advised to avoid exercising alone
- Medic alert bracelet should be advised

Patient / Carer Information

****Please note: whilst these resources have been developed to a high standard they may not be specific to children.***

- [Adrenaline auto-injector for anaphylaxis](#) (Web page), Medicines for Children
- [Anaphylaxis](#) (Web page), the NHS website
- [Anaphylaxis](#) (Web page), Patient
- [Anaphylaxis and Severe Allergic Reaction](#) (Web page), Allergy UK
- [AllergyWise Anaphylaxis Online Training](#) (Web page), The Anaphylaxis Campaign
- [Care Allergy Pathways](#) (Video), Royal College of Paediatrics and Child Health
- [Salbutamol inhaler for asthma and wheeze](#) (Web page), Medicines for Children

Resources

National Clinical Guidance

[Allergy care pathways for children: anaphylaxis](#) (PDF), Royal College of Paediatrics and Child Health

[Anaphylaxis algorithm](#) (PDF), Resuscitation Council UK

[Anaphylaxis: assessment and referral after emergency treatment](#) (Web page), NICE clinical guideline CG134, National Institute for Health and Care Excellence

[Anaphylaxis: the facts](#) (PDF), Anaphylaxis Campaign

[Anaphylaxis: Guidelines from the European Academy of Allergy and Clinical Immunology](#) (PDF) European Academy of Allergy and Clinical Immunology (EAACI)

[Food allergy in under 19s: assessment and diagnosis](#) (Web page), NICE clinical guideline CG116, National Institute for Health and Care Excellence

Krishna MT, Ewan PW, Diwakar L et al. Diagnosis and management of hymenoptera venom allergy: British Society for Allergy and Clinical Immunology (BSACI) guidelines. *Clinical & Experimental Allergy* 2011;41(9):1201-1220 [[PubMed](#)]

Suggested Resources

**Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.*

[Itchy Sneezzy Wheezy](#) (Web page), Itchy Sneezzy Wheezy project

[Rash](#) (Web page - requires log-in), Spotting the Sick Child

[Anaphylaxis](#) (Web page), BMJ Best Practice

[Paediatric allergy, immunology and infectious diseases curriculum](#) (Website), General Medical Council

[World Allergy Organization Allergic Diseases Resource Center: anaphylaxis](#) (Website)

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