Medical emergencies: anaphylaxis

Emma Hammett[1] provides an up to date guide on anaphylactic shock and acute allergic reaction.

What is an allergic reaction?

Anaphylactic shock is an extreme allergic reaction. Allergic reactions occur because the body's immune system reacts inappropriately in response to the presence of a substance that it wrongly perceives as a threat. In order to develop an allergic response the body has to be exposed to something in order to trigger the immune response – this can be touched, inhaled, swallowed or injected – during a routine vaccination or by an insect sting.

The body doesn't react to the irritant directly, but reacts to the histamine released by cells damaged through the immune response on subsequent exposure.

Everyone makes IgE, but people with allergies produce more of it. When someone with an allergic predisposition is initially exposed to an allergen, they produce a lot of IgE antibodies that bind to the mast cells in the tissues or basophils in the blood. When the IgE line up next to each other, the reaction affects the membrane and causes the cell to break down (degranulation). The breaking down of these cells releases histamine and other chemicals. Histamine dilates blood vessels and makes them more permeable so that they lose fluid causing swelling in the tissues.

This mechanism is so sensitive that minute quantities of the allergen can cause a reaction. The released chemicals act on blood vessels to cause the swelling in the mouth and anywhere on the skin. There is a fall in blood pressure and in asthmatics the effect may be mainly on the lungs, causing a severe asthma attack which their inhaler is unable to help.

We have small amounts of histamine in our system normally and it is important for various vital functions of the body including regulating stomach acid and as a neurotransmitter in our nerve cells. However, larger amounts of histamine being released leads to symptoms such as sneezing, blocked nose, itching… the sort of symptoms often associated with hayfever and mild allergies. Antihistamine medication can work effectively at resolving these symptoms. However, antihistamine medication typically takes around 15 minutes to work.

Life threatening and systemic allergic reactions are caused by the body producing

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Emma says: 'First Aid for Life is an Award Winning and fully regulated first aid training provider and our trainers are highly experienced medical and emergency services professionals. We run practical courses for medical professionals throughout London: training in Emergency Life Support, choking, fitting, anaphylaxis and AED. Our training is always tailored to the needs of those attending and we are more than happy to cover any additional medical concerns as well. The course qualifies as verifiable CPD. We also have online first aid courses to update and refresh knowledge between the practical training.' http://www.firstaidforlife.org.uk emma@firstaidforlife.org.uk *Tel: 020 8675 4036*

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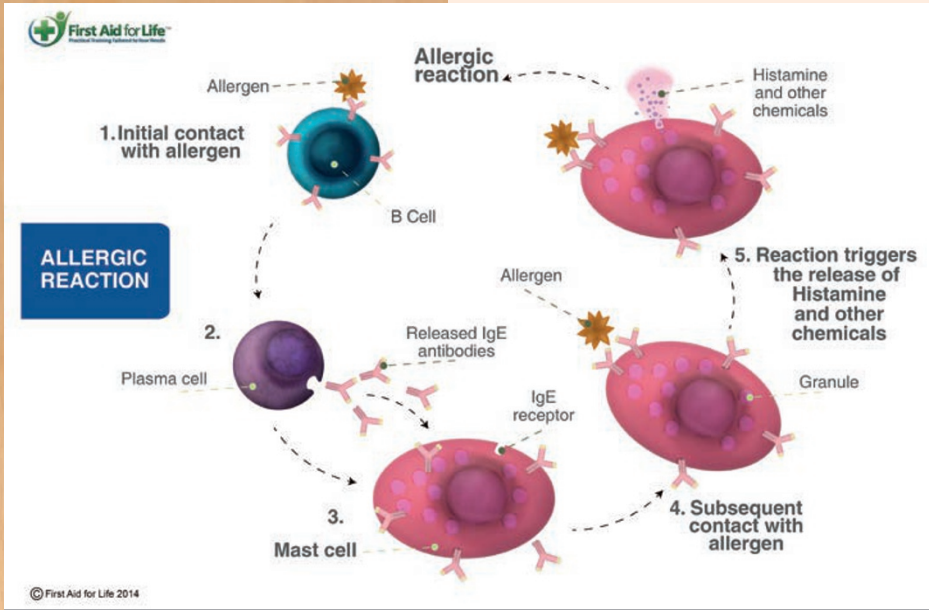
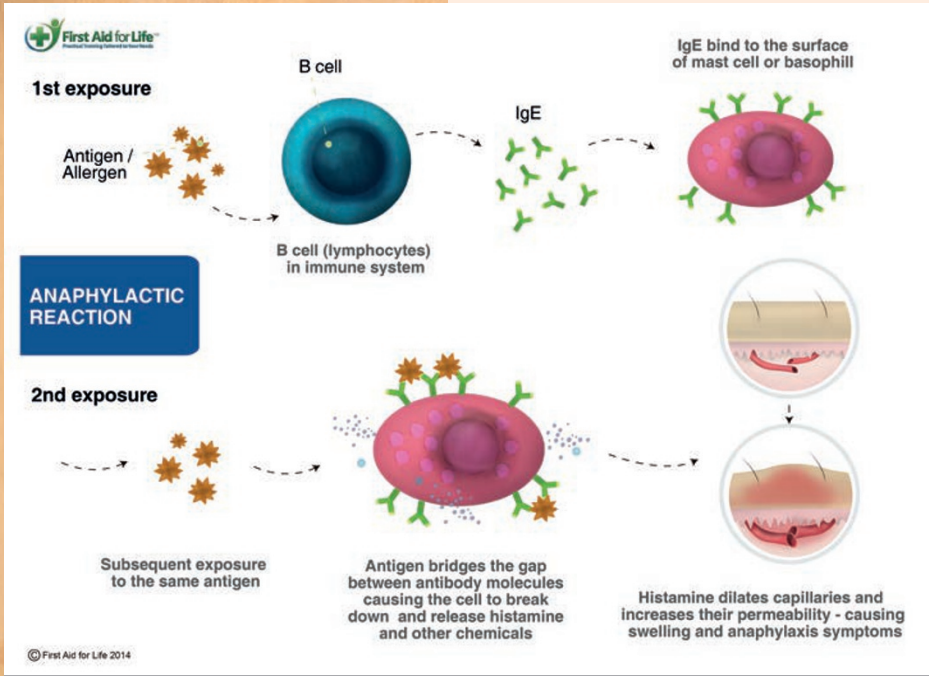


Allergic reaction

even more histamine, which dilates small blood vessels and causes them to leak, resulting in swelling in areas such as the lungs – leading to breathing problems. Sufferers may have a rash and be flushed due to the increased blood supply to the skin. Their blood pressure could drop dramatically and they may collapse.

The more times someone is exposed to the substance they react to, the quicker and more severe the reactions may be.

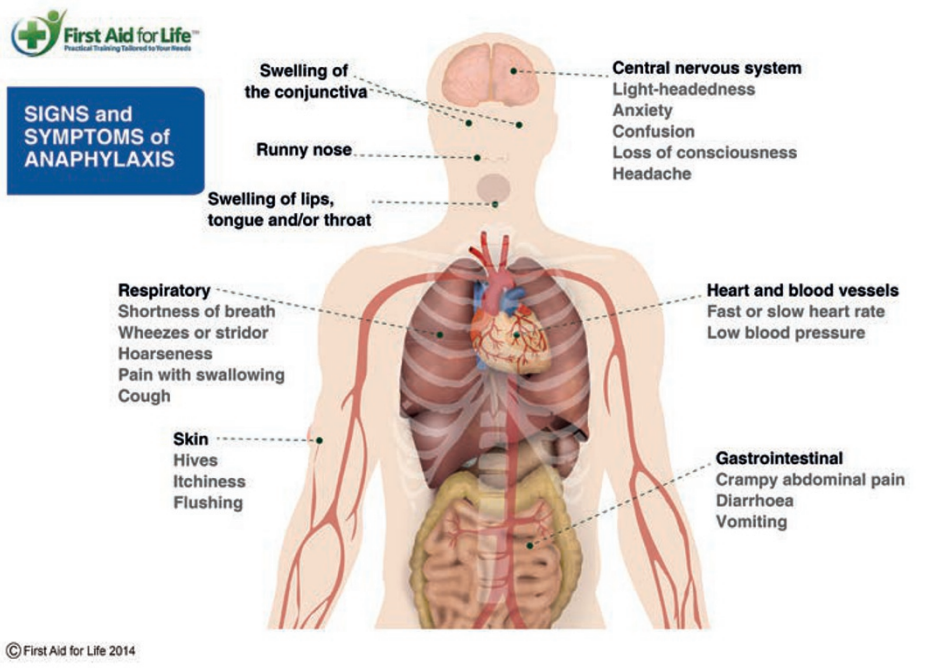
If they don't have a rash associated with the symptoms, it could still be an anaphylactic reaction. If they have a rapid onset of symptoms and may have been exposed to an allergen, treat as an anaphylactic reaction.



Anaphylactic reaction

Common anaphylaxis triggers

'PEOPLE WHO HAVE REACTED ONE WAY WHEN EXPOSED TO A PARTICULAR ALLERGEN CAN REACT COMPLETELY DIFFERENTLY ON ANOTHER OCCASION TO THE SAME THING.'



Signs and symptoms of anaphylaxis

Common triggers for reactions

Individuals can react to absolutely anything. However, most common causes include foods such as those below:

- Peanuts
- Tree nuts (eg almonds, walnuts, cashews, and Brazil nuts)
- Sesame
- Fish
- Shellfish
- Dairy products
- Eggs.

Non-food causes include:

- Wasp or bee stings
- Natural latex (rubber)
- Penicillin or any other drug or injection
- Exercise can also trigger a delayed allergic reaction following exposure to an allergen.

How to recognise an acute allergic reaction

A reaction can take many forms and people who have reacted one way when exposed to a particular allergen can react completely differently on another occasion when exposed to the same thing. It is therefore extremely difficult to predict what a reaction might look like. The above picture is a very classic reaction and easily recognisable as anaphylactic shock.

Common symptoms include:

- Generalised flushing of the skin
- A rash or hives anywhere on the body
- A feeling of anxiety or 'sense of impending doom'
- Swelling of throat and mouth and difficulty in swallowing or speaking
- Alterations in heart rate – usually a speeding up of the heart
- Severe asthma attack which isn't relieved by their inhaler
- Acute abdominal pain, violent nausea and vomiting
- A sudden feeling of weakness followed by collapse and unconsciousness.

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A patient is unlikely to experience all of the above symptoms.

How to treat anaphylaxis

The key advice is to avoid any known allergens if at all possible. If someone is having a mild allergic reaction, an antihistamine tablet or syrup can be very effective. However, the medication will take at least 15 minutes to work. If you are concerned that the reaction could be systemic (all over) and life-threatening, use an adrenaline auto-injector immediately. It is far better to give adrenaline and not to have needed it, than to give it too late.

Adrenaline auto-injectors are prescribed for those believed to be at risk. Adrenaline (also known as epinephrine) acts quickly to constrict blood vessels, relax smooth muscles in the lungs to improve breathing, stimulate the heartbeat and help to stop swelling around the face and lips.

Acute allergic reactions can be life threatening and it is crucially important that you recognise the problem and know what to do quickly in order to save someone's life.

Adrenaline is the first choice for an acute anaphylactic reaction and it works best if it is given as soon as you recognise that someone is having a reaction. You should administer the injector, or help the sufferer to administer it themselves, as quickly as possible and call for an ambulance stating clearly that the person is having an acute anaphylactic reaction.

'ACUTE ALLERGIC REACTIONS CAN BE LIFE THREATENING AND IT IS CRUCIAL THAT YOU RECOGNISE THE PROBLEM AND KNOW WHAT TO DO IN ORDER TO SAVE SOMEONE'S LIFE.'

Adrenaline should rapidly treat all of the most dangerous symptoms of anaphylaxis, including throat swelling, difficulty breathing, and low blood pressure. However, the patient is likely to need additional medication in hospital to control the reaction.

Adrenaline is metabolised very quickly – it is very important that you call an ambulance as soon as an auto-injector has been given as its effects can wear off within about 15 minutes. Another injector can be given 5-15 minutes after the first if necessary.

Phone for an ambulance.

How to use an adrenaline auto-injector

Types of auto-injectors

There are currently three makes of adrenaline auto-injectors on the market in the UK: Epipen, Jext and Emerade. They all contain adrenaline and are all given in a similar manner. Epipen is by far the most popular in the UK.

More information:
http://www.epipen.com/
http://www.jext.co.uk/
http://www.emerade.com/adrenaline-auto-injector

If you are prescribed an adrenaline auto-injector you should carry it with you at all times and register to receive a reminder when it is going out of date. If you have been prescribed two adrenaline injectors as a duo pack, you should carry both with you at all times in case a second dose is needed. Those with adrenaline injectors should teach friends and family what to do if they need to help them or someone else having an anaphylactic reaction.

Videos showing how to use adrenaline auto-injector are available on the drug company websites:

http://www.youtube.com/watch?v=CjgbwmQy2r8 – shows how to use a Jext auto-injector

http://www.youtube.com/watch?v=pgvnt8YA7r8 shows how to use an Epipen.

Hold the injector in your dominant hand; with the other hand remove the safety cap. Put the injector firmly into the upper outer part of the casualty's thigh and hold it there for ten seconds. Remove it carefully and they should begin to feel better quite quickly. If they continue to get worse, you may need to give another injection.

The auto-injector can be given through clothes.

Always phone an ambulance.

Medical professionals and anaphylaxis administration

Medical professionals are generally encouraged to draw up adrenaline rather than use auto-injectors if they feel confident

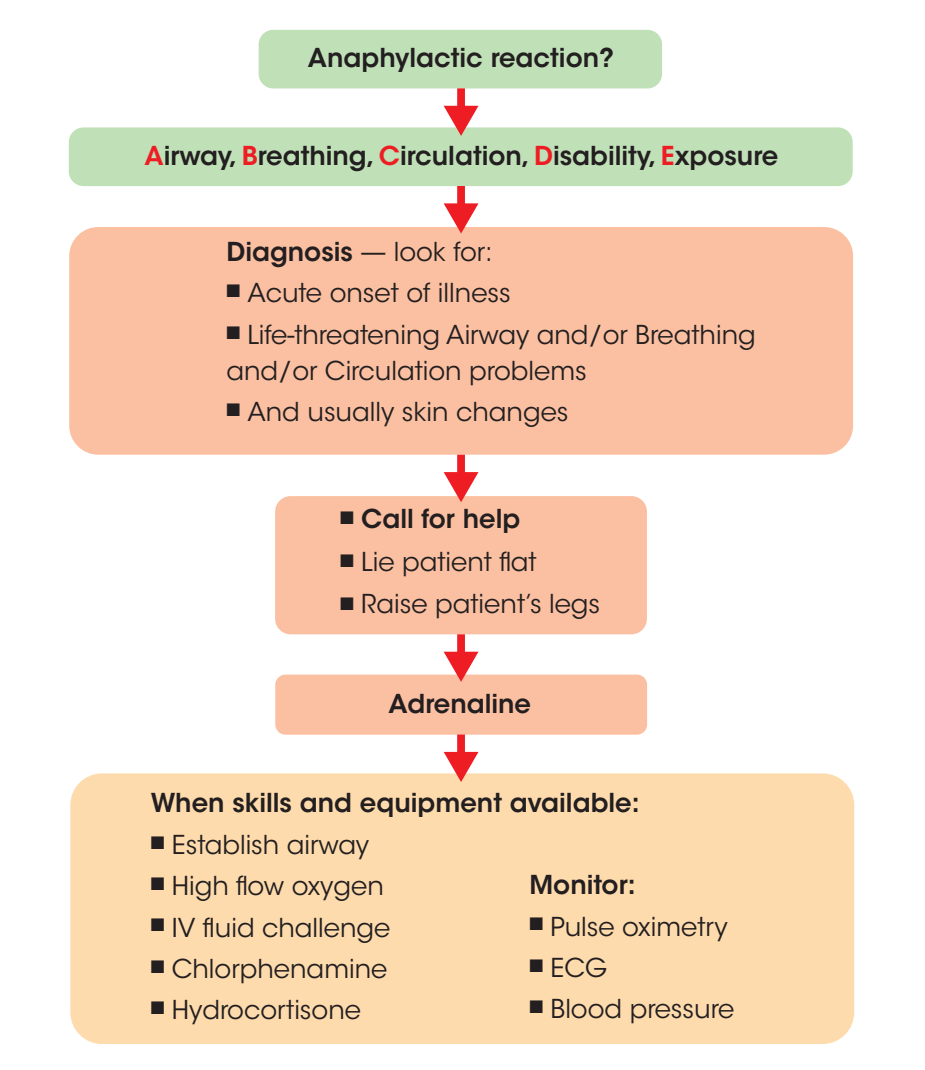

Fig. 1 Anaphylactic reaction algorithm, with thanks to the Resuscitation Council (UK)[1]

and competent to do so. The key steps for the treatment of an anaphylactic reaction are shown in the algorithm from the Resuscitation Council (UK) in Figure 1.[1]

Adrenaline dosage if drawing up

Adrenaline (give IM)
IM doses of 1:1000 adrenaline (repeat after five minutes if no better)

- Adult 500 micrograms IM (0.5 mL)
- Child more than 12 years: 500 micrograms IM (0.5 mL)
- Child 6-12 years: 300 micrograms IM (0.3 mL)
- Child less than six years: 150 micrograms IM (0.15 mL).

The incidence of acute severe anaphylaxis following a vaccination is extremely rare: about 1:1 million.

Patients with an allergy to egg or gelatine may be more likely to react to the flu vaccine and other vaccines containing derivatives of these substances.

The preferred needle length for an IM injection

A standard blue needle (25 mm and 23 G) should be used to inject intramuscular adrenaline.

The best site for an intramuscular injection of adrenaline for the treatment of an anaphylactic reaction is the anterolateral aspect of the middle third of the thigh. The needle needs to be long enough to ensure that the adrenaline is injected into muscle. The current Resuscitation Council (UK) guidance states that a 25 mm length needle is best and suitable for all ages.

In the UK, a standard blue needle (25 mm and 23 G) is therefore best. In obese patients a longer needle may be needed (38 mm length).

The standard orange needle that is most commonly available in the UK is only 16 mm in length. This shorter length needle can result in injecting the adrenaline subcutaneously. A 25 mm length orange needle is less commonly available.

The decision to use ampoules or an auto-injector

The Resuscitation Council (UK) guidance on anaphylaxis is aimed at healthcare professionals and does not recommend the use of auto-injectors by this group for several reasons such as shelf life, needle length, cost, and dose.

The decision whether to use Emerade adrenaline auto-injector (a brand of auto-injector with a 0.5 dosage and a longer needle option), or an ampoule, needle and syringe is a local decision. The decision should factor in the ease of implementation and the likelihood of anaphylaxis.

Resuscitation Council advice concerning the length of time patients should be observed following immunisation

The Department of Health guidance on this issue[2] does not state a specific time but does not recommend long periods of observation. The risk of severe life-threatening reactions after immunisation is extremely small. This rate in the UK (approximately one per million vaccine doses) is similar to that reported from other countries.[3]

Based on the information available a short period of observation (5-10 minutes) should be used to detect immediate problems. Patients (and carers) should be provided with advice on possible local and systemic reactions and what to do if they occur.

In *Immunisation against infectious disease - 'The Green Book'* (2006),[2] the Department of Health states:

[Chapter 4, Immunisation procedures]: 'Recipients of any vaccine should be observed for immediate ADRs. There is no evidence to support the practice of keeping patients under longer observation in the surgery.'

[Chapter 8, Vaccine safety and the management of adverse events following immunisation]: 'Onset of anaphylaxis is rapid, typically within minutes, and its clinical course is unpredictable with variable severity and clinical features. Due to the unpredictable nature of anaphylactic reactions it is not possible to define a particular time period over which all individuals should be observed following immunisation to ensure they do not develop anaphylaxis.'

Patient positioning for anaphylaxis

Someone suffering from acute anaphylaxis is also likely to be showing signs of clinical shock. Reassuring the casualty and positioning them appropriately can make a major difference to their treatment. They should also be kept warm and dry.

If someone is very short of breath, they should be encouraged to sit in an upright position to help their breathing; putting something under their knees to help increase their circulation can be very helpful – into the 'lazy W' position.

If they are not having difficulty breathing, but are feeling sick, dizzy and could be going into shock – they should lie down with their legs raised to help increase the circulation to their vital organs. Encourage them to turn their head to one side if they are likely to vomit. They should be covered to keep them warm and kept in this position until the paramedics arrive.

Do not get them up until they have been medically assessed.

Treat for shock if the patient is showing symptoms of shock and is not having breathing problems.

Top photo: A bee sting; Above: Adrenaline autoinjectors

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After an anaphylactic reaction

An ambulance should always be called if someone is showing the signs of anaphylaxis and they will usually be admitted overnight for observation. This is because some people have a second reaction some hours after the first.

Don't forget to replace the used adrenaline auto-injector.

Storage of auto-injectors

Auto-injectors should be quickly and easily accessible and stored in a suitable container (specifically designed containers are available from the relevant drug companies).

The container should be clearly marked with the patient's name and include an instruction leaflet on how to use the adrenaline auto-injector and the patient's personal treatment plan should also have been read by all relevant staff and be easily accessible should it be needed.

Auto-injectors should be stored at room temperature and kept away from direct sunlight.

Make sure that the expiry date is adhered to – auto-injectors have a relatively short shelf life and once they have expired the adrenaline content diminishes. If the auto-injector is registered with the appropriate drug company they will send automatic email and text alerts to warn when the adrenaline injector is about to expire.

'AFTER TREATING SOMEONE FOR AN ANAPHYLATIC REACTION DON'T FORGET TO REPLACE THE USED ADRENALINE AUTO-INJECTOR.'

Legislation concerning the administration of adrenaline in a life threatening emergency

'Medicines legislation restricts the administration of injectable medicines. Unless self-administered, they may only be administered by or in accordance with the instructions of a doctor (eg by a nurse). However, in the case of adrenaline there is an exemption to this restriction which means in an emergency, a suitably trained lay person is permitted to administer it by injection for the purpose of saving life. The use of an Epipen to treat anaphylactic shock falls into this category. Therefore, first aiders may administer an Epipen if they are dealing with a life threatening emergency in a casualty who has been prescribed and is in possession of an Epipen and where the first aider is trained to use it.' Health and Safety Executive Guidance, 25 January 2008

Useful links

The Anaphylaxis Campaign: http://www.anaphylaxis.org.uk/

First Aid for Life: http://www.firstaidforlife.org.uk

1. Resuscitation Council (UK). Emergency treatment of anaphylactic reactions. Guidelines for healthcare providers. January 2008, annotated with links to NICE guidance July 2012. Available at: https://www.resus.org.uk/anaphylaxis/emergency-treatment-of-anaphylactic-reactions/ (accessed September 2017).
2. Department of Health. *Immunisation against infectious disease - 'The Green Book'* 2006, modified 2008. Available via: https://www.gov.uk/government/collections/immunisation-against-infectious-disease-the-green-book (accessed September 2017).
3. Bohlke K, Davis R L, Marcy S M *et al.* Risk of anaphylaxis after vaccination of children and adolescents. *Pediatrics* 2003; **112:** 815-820.

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