

Management of anaphylactic shock

by Dr Adrian Morris

Anaphylaxis, or anaphylactic shock, is a sudden catastrophic allergic reaction affecting multiple organ systems. It usually occurs within minutes of exposure to the offending allergen (insect stings, nuts and medicines being most often implicated).

Causes

The most common cause of anaphylactic shock in the community is after eating an allergy-provoking food such as peanuts, tree nuts, fish and shellfish. These foods account for 90% of cases of food-induced anaphylaxis.

Even eating a minute amount of a particular food can trigger anaphylaxis. Certain individuals may be so sensitive that merely breathing in the food essence can trigger a reaction (as may occur in a restaurant when the person at another table is eating fish or by kissing someone who has recently ingested peanuts). Subsequent allergic reactions are highly unpredictable and may manifest as similar, less intense or more severe reactions.

Anaphylaxis may occur while exercising shortly after eating certain foods such as celery, shrimps, wheat, apple, hazelnut, squid and chicken. (Food-related *Exercise-Induced Anaphylaxis*).

About the author

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Allergy to venom from bee and wasp stings can cause anaphylaxis as can allergy to latex rubber or prescription antibiotics and anti-inflammatory medication.

Iatrogenic anaphylaxis occurring in hospital is common and attributed to

anaesthetic agents, antibiotics, radio-contrast media, streptokinase, tetanus toxoid, latex containing appliances and colloid infusions.

Allergic anaphylaxis mediated by IgE requires prior sensitisation, while *Non-Allergic anaphylaxis*

(previously called Non IgE or Anaphylactoid reactions) may occur on the first exposure. Both groups are clinically indistinguishable and their treatment is the same.

In about 30% of cases, an exact cause for the anaphylactic reaction may not be apparent – so called idiopathic anaphylaxis.

Table 1

Allergic anaphylaxis (IgE mediated)

Foods: Nuts, Fish and Egg.

Medication: Penicillin and sulphonamides.

Insect stings: Bee, wasp &, hornet. Latex, hormones (insulin), tetanus toxoid.

Anaesthetic agents: Thiopentone, suxamethonium, alcuronium.

Allergen desensitisation immunotherapy ('allergy shots')

Animal or human proteins: Semen, enzymes, colourants (insect derived)

Exercise associated food allergy (wheat, celery, shellfish)

Non-allergic anaphylaxis (previously anaphylactoid reactions)

Aspirin sensitivity (including NSAIs: ibuprofen, diclofenac, pyrazoles)

Opiates, ACE inhibitors, dextran, radio contrast media, streptokinase. Local anaesthetics (containing sulphites & parabens).

Idiopathic (no apparent cause) - accounts for 30% of all anaphylaxis.

Testing after anaphylaxis

Serum tryptase released during acute anaphylaxis can be measured and will help determine both severity and confirm that anaphylaxis has indeed taken place. This gives clarity when the diagnosis of anaphylaxis is in doubt such as whilst under anaesthesia, in sudden infant death or at post mortem.

Remember that serum-specific IgE may be depressed immediately after an anaphylactic reaction because it is 'used up' or tissue bound. RAST testing should therefore be deferred for a few weeks after the anaphylactic reaction; as artificially depleted levels of specific IgE may obscure the diagnosis.

Table 2:

Clinical grading of anaphylaxis: (Sampson H, Pediatrics 2003) [1]

Grade	Skin	GI Tract	Respiratory tract	Cardiovascular	Neurological
1	Localised pruritus, flushing, urticaria, angioedema	Oral pruritus or tingling			
2	Generalised pruritus, flushing, urticaria, angioedema	Any of above plus nausea and/or emesis	Nasal congestion and/or sneezing		Change in activity level
3	Any of above	Any of above plus repetitive vomiting	Any of above plus sensation of throat pruritus or tightness	Tachycardia	Change in activity level plus anxiety
4	Any of above	Any of above plus diarrhoea	Any of above plus hoarseness, "barky" cough, difficulty swallowing, dyspnoea, wheezing, cyanosis	Any of above plus dysrhythmia and/or mild hypotension	"Light headedness", feeling of "impending doom"
5	Any of above	Any of above plus loss bowel control	Any of above plus respiratory arrest	Severe bradycardia and/or hypotension or cardiac arrest	Loss of consciousness

All symptoms are not mandatory. The severity grading should relate to the organ system most affected. Symptoms in bold face are absolute indications for use of intramuscular epinephrine (adrenaline)

All patients with anaphylaxis should attend the local Emergency Unit and be monitored carefully for 4 hours as anaphylaxis may recur some hours after the initial treatment (called a *late phase or biphasic response*).

Signs of anaphylaxis

Anaphylaxis comprises a group of symptoms and signs, occurring in a generalised severe allergic reaction often with associated respiratory difficulties and circulatory collapse.

Prodromal palmar, plantar and scalp itching with agitation is rapidly followed by generalised urticaria (hives) and tissue angioedema. Skin signs are the most common initial manifestation in over 90% of anaphylactic reactions. However cutaneous manifestations may occasionally be

delayed or absent in rapidly progressive anaphylaxis. The next most common symptoms are dizziness, respiratory, gastro-intestinal, and circulatory events with collapse and loss of consciousness. The more rapid the onset of symptoms the more likely they are to be life-threatening.

Historically anaphylaxis was described as Mild, Moderate or Severe but recently Sampson devised a grading system utilising organ affected and a grading of 1 to 5. This offers a more useful algorithm for severity assessment and advising treatment.

(See Table 2.)

Treatment

Anaphylaxis must to be treated as a matter of urgency as the symptoms of respiratory obstruction and shock develop rapidly. Emergency treatment always consists of basic cardiopulmonary support and simultaneous intramuscular injection of epinephrine (adrenaline) into the anterolateral thigh.

The recommended dose in children is 0,01ml/kg of 1:1000 epinephrine up to a maximum of 0,3ml (0,3mg) per dose and for adults 0,2ml (0,2mg) to 0,5ml (0,5mg) of 1:1000 epinephrine.

Table 3:

Risk factors for life-threatening anaphylaxis

- Previous severe anaphylactic reaction
- History of increasingly severe reactions
- Co-existent asthma
- Elderly on Beta-blockers or ACE inhibitors

More likely to develop anaphylaxis

- Peanut or tree nut allergy
- Personal and family history of extreme atopy
- Systemic mastocytosis



The subcutaneous and oral routes are not recommended as absorption is too slow, and intravenous administration may cause life-threatening arrhythmias and hypertension.

This initial treatment with epinephrine should be immediately followed by administration of a fast-acting antihistamine and a short course of oral steroids to prevent a recurrence as the epinephrine wears off. Oral or intravenous steroids are not emergency therapies alone, as they will take at least two hours to exert their therapeutic effect. They do help reduce the risk of persistent or biphasic anaphylaxis.

After all cases of Sampson Grade 3 to 5 anaphylactic reactions, two preloaded epinephrine auto-injectors (Epipen) should be prescribed for self administration and a Medic Alert bracelet issued. A major drawback of the Epipen in South Africa is that the only available dose is 300ug which is suitable for an older child or small adult (30-50kg). A large adult will therefore need two simultaneous Epipen injections. Epinephrine ampoules and syringes although cheap will often be 'fumbled' by caregivers and erroneous dosages can be given in the midst of panic associated with a sudden anaphylactic reaction.

For the isolated urticarial rash associated with 'mild' anaphylaxis (Sampson Grade 1 & 2), administration of a fast-acting oral H1 antihistamine medication should suffice. But injectable epinephrine should always be available in case a moderate to severe generalised reaction (Sampson Grade 3 to 5) occurs with signs of respiratory difficulty (including

Table 4:

Treating anaphylaxis

Immediate intervention

Remove the allergen!
Provide airway and basic life support.

- **Intramuscular epinephrine** (0.01ml/kg of 1:1000) injected into anterolateral thigh muscle. Adults: 0.2ml to 0.5ml of 1:1000. Dose repeated at 5 minute intervals if necessary.

Followed by intravenous, oral or intramuscular:

- **Antihistamine: Promethazine** 0.5mg/kg in children & 25-50mg in adults.
- **Hydrocortisone** (child 4mg/kg & adults 200mg) or prednisone (child 1mg/kg & adults 50mg).

Other measures

- **Laryngeal stridor:** Nebulised epinephrine 5ml 1:1000 repeated every 10 mins. (inhaled racemic epinephrine is less effective than intramuscular route)
- **Wheeze:** Nebulised **salbutamol 2.5mg** if less 5 years, **5mg** over 5 years and adults. Consider aminophylline 5mg/kg IVI over 15minutes or salbutamol 15ug/kg
- **oxygen** 10l/min via face mask if available
- **Hypotension:** Intravenous normal saline 20ml/kg by rapid infusion
- On B-blocker therapy: Administer **Glucagon** 1-5mg IVI over 5 minutes (child: max 1mg).

Discharge treatment:

Should include 3 day course non-sedating antihistamine and prednisone.

Prescribe two emergency epinephrine auto-injectors and oral antihistamine, give written emergency treatment plan, plus issue Medic Alert bracelet.

laryngeal oedema, 'staccato' cough and/or wheeze).

Promethazine (0,5mg/kg in children and 25-50mg in adults) is quick acting and readily available in South Africa, while diphenhydramine and chlorpheniramine are also equally effective H1 antihistamines and can be prescribed via oral, slow intravenous or intramuscular routes. H2 blockers such as ranitidine and cimetidine offer no additional benefit over high dose H1 antihistamines.

Appropriate treatment of other signs such as stridor, wheeze and hypotension are

tabulated in Table 3.

Venom desensitisation immunotherapy (VIT) for bee and wasp venom anaphylaxis is highly effective, but treatment needs to be maintained for five years. Bee keepers are the most at risk group for severe life threatening anaphylaxis. Elderly patients (especially those with cardiovascular disease on beta blockers and ACE inhibitors) are more at risk for anaphylaxis while 70% of children will outgrow their venom anaphylaxis.

The risk of a severe reaction seems to decline the longer

Table 5:

Conditions confused with anaphylaxis

- Panic attacks.
- Vaso-vagal syncope (fainting),
- Globus hystericus,
- Aspiration of foreign body.
- Epileptic seizures,
- Flushing from histamine-containing foods,
- Schromboid-toxicity from fish poisoning,
- Pulmonary embolism, hypoglycaemia, arrhythmia and acute myocardial infarct may closely resemble anaphylactic reactions.

the intervals between exposures. Immunotherapy is not effective in food allergies and desensitisation as a treatment for food allergies is unpredictable and not recommended.

Final comment

The most effective method of preventing anaphylactic shock is avoidance of the causal allergen once it has been accurately identified. Intramuscular epinephrine is life-saving and should be prescribed to all individuals with documented anaphylaxis, as these reactions are so unpredictable.



References

1. Sampson H. Anaphylaxis and emergency treatment *Pediatrics* 2003;111; 1601-1608.