November 2022

Serious allergic reactions to tick bites

Tick anaphylaxis is **a potentially life-threatening** severe allergic reaction that requires **immediate treatment with adrenaline** (epinephrine).

Anaphylaxis is a medical emergency. Call an ambulance (000 in Australia), immediately after giving an adrenaline autoinjector (EpiPen®, Anapen®). See *First aid for anaphylaxis, including tick anaphylaxis*.

This factsheet provides information on topics of:

- severe allergic reactions to tick bites, including advice on first aid for:
  - tick anaphylaxis
  - mammalian meat allergy/anaphylaxis

and

- mild allergic reactions to tick bites.

This factsheet should be read alongside other factsheets:

- *Paralysis from tick bites*
- *Prevention of tick bites in Australia*
- *Management of tick bites in Australia*
- *Australian ticks and the medical problems they can cause.*

The Australian technique of killing adult ticks where they are with ether-containing sprays was developed to prevent allergic reactions to tick bites. A short video on how to safely remove a tick is available here:

Important! Watch this video about how to safely remove a tick[1]

https://www.allergy.org.au/patients/insect-allergy-bites-and-stings

Warning! Serious allergic reactions to tick bites are potentially life-threatening

Ticks are parasites that feed off human blood and they can significantly affect human health.

In Australia, most tick bites pose no medical problems if the tick is safely removed. Tick bites can lead to a variety of illnesses in patients, with the most common being allergic reactions. In some cases, people can experience severe allergic reactions (anaphylaxis) or mammalian meat allergy/anaphylaxis. In regions where tick bites are common, life-threatening allergic reactions to ticks are much more common than similarly severe reactions to bees or wasps.

[1] An allergy project supported by the National Allergy Strategy, Australasian Society of Clinical Immunology and Allergy (ASCIA), Allergy & Anaphylaxis Australia (A&AA), and Tick-induced Allergies Research and Awareness (TiARA).

Allergies caused by tick bites are the reason many people present to hospital emergency departments in regions where ticks are commonly found. For example, over a two-year period, one hospital in New South Wales recorded over 550 presentations of tick bite to its emergency department, with 34 of these resulting in anaphylaxis, and over 75% of these requiring adrenaline use.

A range of short videos, including on 'Signs and symptoms of allergic reaction', 'EpiPen® administration', and 'Anapen® administration'[2], are available here:

Important! Watch this video

https://allergyfacts.org.au/resources/videos-from-a-aa

Mammalian meat allergy (MMA) and tick anaphylaxis are the most serious tick-induced allergies; they are often severe and are largely avoidable through prevention of tick bites and safe management of tick bites (see *Prevention of tick bites in Australia* and *Management of tick bites in Australia* factsheets for information about preventing, and safely managing, tick bites). Tick-induced allergies were rarely seen in Australians until about 2003 but are becoming more common. Worldwide, Australia has the highest proportion of its population affected by MMA and tick anaphylaxis. Fatal anaphylactic reactions to tick bites have occurred but are uncommon.

The Australian paralysis tick *(Ixodes holocyclus)* is responsible for over 95% of tick bites in people in eastern Australia and for most tick-borne illnesses in Australia. The **Australian paralysis tick is capable of causing severe allergic reactions, including tick anaphylaxis and MMA.** The Australian paralysis tick is commonly found on the east coast of Australia which means that **over 50% of the Australian population are potentially exposed to this tick.** See *Australian ticks and the medical problems they can cause* factsheet for information about what the Australian paralysis tick looks like, where it is found and when people are more likely to be bitten. The Australian paralysis tick is also capable of causing paralysis in humans (see *Paralysis from tick bites* factsheet for more detail).

Tick-induced allergies are caused by tick saliva, which is a type of venom containing hundreds of different types of proteins, which is injected by the tick through the feeding process. The venom of ticks, like bees, wasps and scorpions, can cause local or systemic allergic reactions and/or paralysis. The saliva of certain species of ticks, including the Australian paralysis tick, have also been found to contain a sugar molecule called alpha-gal, which is linked to MMA following a tick bite.

[2] Videos from A&AA.

People with a known allergy to tick bites - managing a tick bite

It is vital for anyone with a known tick allergy to summon urgent medical attention as soon as they are aware of an attached tick and not attempt to remove it without medical help. For patients with known tick allergies, removing the tick must occur in a hospital or emergency department in the event of anaphylaxis occurring when the tick is removed.

People who are allergic to tick bites should carry an adrenaline (epinephrine) autoinjector (such as an EpiPen® or an Anapen®) and a mobile telephone and manage tick bites in accordance with the ASCIA Action Plan for Anaphylaxis, available at this link: https://www.allergy.org.au/hp/anaphylaxis/ascia-action-plan-for-anaphylaxis.

First aid for anaphylaxis, including tick anaphylaxis

Anaphylaxis is a medical emergency

Advice[3] on first aid and immediate actions for anaphylaxis, including tick anaphylaxis, is as follows:

- Lie the person down if possible and elevate the legs as this maximises blood flow to the head and therefore oxygen to the brain. **Do NOT allow them to stand or walk**.

- **GIVE ADRENALINE INJECTOR.** If there is an adrenaline autoinjector (EpiPen®, Anapen®) available, use it while waiting for emergency services if there is any closing over of the throat, breathing difficulty or impending loss of consciousness.

  Call 000 and explain that the reaction is life-threatening.

- If a person is living alone or is alone and suffering tick-induced anaphylaxis symptoms, s/he should open the front door, chock it open, and then lie down and put their feet up on a chair/lounge. As above, the person who is alone should call 000 and explain that the reaction is life-threatening. They should also use an adrenaline autoinjector (EpiPen®, Anapen®) if available, while waiting for emergency services if there is any closing over of their throat, breathing difficulty or impending loss of consciousness. The person should leave a note beside them noting they have been bitten by a tick, if time permits.

[3] Advice from ASCIA and TiARA.

Tick anaphylaxis

Symptoms and features of tick anaphylaxis

Symptoms of a severe allergic reaction include any sudden onset illness which evolves rapidly over minutes immediately after removing or disturbing only an adult tick. Symptoms include skin reactions such as welts or swellings, difficulty breathing, closing over of the throat, tongue swelling, impending loss of consciousness (faintness), sense of impending doom, or loss of consciousness. Anaphylaxis involves more than one body system, for example, skin, airway and breathing, the gut, and/or heart and blood circulation.

Anaphylaxis, including tick anaphylaxis, is a medical emergency. In Australia, anaphylactic reactions to tick bites have been fatal, but fatalities are uncommon. **Crucially, people who have an anaphylactic reaction to a tick bite react only when the tick is disturbed.**

The symptoms of anaphylaxis[4], including tick anaphylaxis, are **one or more** of the following, and starting within seconds to a few minutes of forcibly removing a tick, for example with household tweezers:

- Generalised itch
- Hives or welts may appear
- Swelling of lips, face, eyes or tongue
- Swelling/tightness in the throat or a sensation of throat closure
- Difficulty talking and/or hoarse voice
- A feeling of “impending doom”
- Generalised feeling of warmth
- Tingling mouth
- Difficult/noisy breathing and/or persistent cough (unlike the cough in asthma, the onset of coughing during anaphylaxis is usually sudden)
- Abdominal pain, vomiting
- Persistent dizziness or collapse
- Pale and floppy (young children).

[4] Collective advice from ASCIA and TiARA.

Other important facts about tick anaphylaxis

Tick anaphylaxis is **only seen with bites from adult ticks**. Crucially, people who have an anaphylactic reaction to a tick bite react **only when the tick is disturbed** as this may cause the tick to inject more allergen-containing saliva. As such, tick anaphylaxis is very unlikely to occur when the tick is killed where it is with ether-containing sprays before it is removed (that is freezing it where it is). See factsheet *Management of tick bites in Australia* for more information.

Tick anaphylaxis is **usually severe**. It is more likely to occur in older people (>50%, >50 years of age). Worldwide, tick anaphylaxis occurs most commonly in Australia and is becoming increasingly common here.

Where to find out more about anaphylaxis

Resources on anaphylaxis are available from:

- ASCIA, https://www.allergy.org.au/hp/anaphylaxis
- A&AA, https://allergyfacts.org.au/
- TiARA, https://www.tiara.org.au/.

Mammalian meat allergy (MMA)

Mammalian meat allergy (also called red meat allergy, alpha-gal syndrome (AGS)), is a **serious, potentially life-threatening allergic reaction** that may occur after people eat red meat, ('mammalian meats') or are exposed to other products containing alpha-gal (see *What is alpha-gal?*), and occurs after a tick bite. 'Mammalian meats' means all commonly eaten mammalian meats (such as beef, pork, lamb, kangaroo, and venison).

In people with MMA, severe allergic reactions are more common and **anaphylaxis can occur in up to 60% of patients**. See *First aid for anaphylaxis, including tick anaphylaxis* for what to do.

The allergen associated with these allergic reactions is present in the gut, saliva and blood feeding pool of certain species of ticks, including the Australian paralysis tick. More recently the tick *Ixodes* (*Endopalpiger*) *australiensis* (with no common name) has been found to cause MMA after tick bite in Western Australia. This means that 60% of the Australian population are now potentially exposed to ticks that can lead people to develop MMA if bitten. A person may not know they have been bitten by a tick, for example, if they are visiting from an area where ticks are not commonly found. Areas where ticks are very common (hyperendemic) include the Northern Beaches area of Sydney, Maleny in Queensland, Denmark in Western Australia, and generally down the eastern seaboard of Australia as far as Lakes Entrance in Victoria. Hence the need to prevent tick bites and manage tick bites appropriately.

MMA is an allergy that is becoming more prominent, and has become increasingly common in areas where ticks are commonly found in Australia and the United States and has been reported worldwide. MMA now occurs on every continent where humans are bitten by ticks.

Unlike tick anaphylaxis where anaphylaxis is only seen following the bite of an adult tick, **bites from either nymphs or adult ticks can provoke MMA.**

Symptoms and features of MMA

MMA symptoms often do not commence until a few weeks after the tick bite(s).

Adults and children with MMA have similar symptoms and clinical features. These range from angioedema (swelling of the skin and mucous membranes, such as inside the mouth and throat) or gut symptoms alone, to life-threatening anaphylaxis.

MMA symptoms after tick bites can include:

- rash
- nausea or vomiting
- drop in blood pressure
- severe stomach pain
- hives
- difficulty breathing
- dizziness or faintness.

Symptoms generally appear 3-6 hours after eating mammalian meat or exposure to products containing alpha-gal (e.g. gelatine-coated medications). However, the time between eating mammalian meat and the allergic reaction can be 2-10 hours, depending on other co-factors that a person has consumed or done (e.g. drinking alcohol or exercising). As such, the reactions are typically delayed (i.e. “middle of the night” anaphylaxis) and often severe.

Severe allergic reactions are more common. **Anaphylaxis occurs in up to 60% of patients**. See *First aid for anaphylaxis, including tick anaphylaxis* for what to do. Delayed welts (urticaria) or angioedema features and gut symptoms may occur alone.

Reactions can be different from person to person and can range from mild to severe or even life-threatening. As with any food allergen, people may not have an allergic reaction after every alpha-gal exposure.

Other important facts about MMA

As MMA is the only allergy globally where the trigger (a tick bite) is known, it, therefore, offers unparalleled opportunities for prevention[5]. Key points to note are:

- MMA does not occur without a tick bite
- not everyone bitten by a tick develops MMA
- it is not uncommon for more than one person in a family to develop MMA
- if a person is bitten by a tick and develops MMA, that person can more than double their allergy levels if they have another tick bite
- if a person develops MMA and does not have another tick bite, that person can significantly reduce their allergy levels over 18 months or two years, with some people able to tolerate mammalian meat again after 3-4 years
- if a person loses their MMA and has another tick bite, the MMA can return
- the majority of tick anaphylaxis sufferers develop sensitivity to alpha-gal and at least 30% develop MMA symptoms as well

[5] Advice from TiARA.

- in areas where ticks are commonly found in Australia, up to 25% of the community will be sensitised to alpha-gal and be unaware that they are sensitised to alpha-gal as they have no symptoms when eating mammalian meat or are not mammalian meat-eaters. The risk of reaction to mammalian products in medications still exists for these people. After two tick bites up to half of individuals may be sensitised to alpha-gal.

Two other rare conditions associated with MMA

Approximately 3-4% of people with MMA after tick bites also have the very rare disease mastocytosis. People with mastocytosis produce more mast cells in their bone marrow than normal. Mast cells are involved in inflammation seen in allergic reactions. People with mastocytosis have very severe anaphylaxis when they come into contact with allergens and other agents due to having more mast cells.

There are other cases of adults who had been bitten by ticks and who had developed acute food carbohydrate-induced enterocolitis syndrome (FCIES), which affects a very small number of individuals who react to mammalian meat. Importantly, these people do not test positive for the allergy to alpha gal. The symptoms of FCIES include:

- prolonged severe vomiting and diarrhoea
- low blood pressure
- an unhealthy pale appearance (pallor) and lethargy (lack of energy).

For people who have FCIES, dietary advice is similar to that for people with MMA.

What is alpha-gal?

Alpha-gal is a sugar molecule found in all mammals, except for humans, great apes and Old World monkeys. Alpha-gal is present in all mammalian meat and mammalian meat products eaten by humans, but is not found in fish, reptiles or birds. Alpha-gal can also be found in products made from mammals including some medications, cosmetics, vaccines, mammalian gelatines, and milk products.

In addition to allergy to mammalian meats, some people will also be allergic to mammalian milks and animal-derived gelatine, which is present in many food products and in some medications.

Things that people with MMA need to be aware of

Management of MMA includes:

- knowing what foods and drinks to avoid
- being aware of medical and therapeutic products that contain alpha-gal
- preventing tick bites
- killing the tick where it is, if bitten.

See *Prevention of tick bites in Australia* and *Management of tick bites in Australia* factsheets for more detail.

Where to find out more about MMA

- TiARA, https://www.tiara.org.au/
- A&AA, https://allergyfacts.org.au/
- ASCIA, https://www.allergy.org.au/patients/insect-allergy-bites-and-stings/tick-allergy.

Mild allergic reactions to tick bites

Mild allergic reactions to ticks include large local swelling and inflammation at the site of a tick bite, that may last for several days. Other mild or moderate reactions to tick bites include swelling of lips, face, or eyes, hives or welts, or tingling mouth.

Symptoms and features of large local reactions

Large local reactions to a tick bite appear as a large local swelling and inflammation at the site of the tick bite that typically extends from the bony joint above the bite to the bony joint below the bite and can last for several days.

The reactions commence within 4-12 hours of the tick bite, increase in size for 24-72 hours before reaching their maximum by 72 hours. The reaction can take 7-10 days to resolve. They can be physically limiting and uncomfortable but typically have no after-effects.

Treatment of large local reactions

Treatment of large local reactions consists of rest, raising the affected area above the level of the heart, applying ice to the site of the bite to help reduce swelling and pain, taking medications including antihistamines while swelling persists, and if necessary, oral cortisone, a common treatment for inflammation.

Managing a tick bite in Australia to prevent allergic reactions to ticks

See the *Management of tick bites in Australia* factsheet for information about safely managing tick bites in Australia. For information about tick bite prevention, see the *Prevention of tick bites in Australia* factsheet.