Tick Allergy

Allergic reactions to ticks range from mild (with large local swelling and inflammation at the site of a tick bite) to severe (anaphylaxis).

To prevent allergic reactions to ticks do NOT forcibly remove the tick. Disturbing the tick may cause the tick to inject more allergen-containing saliva. The options are to:

1. **Leave tick in place and seek medical assistance**; **OR**
2. **Freeze tick (using a product that rapidly freezes and kills the tick) and allow to drop off.**

Health problems associated with tick bites

Health problems associated with tick bites include:

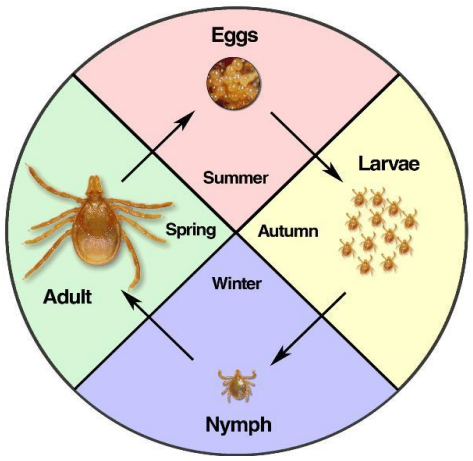
- Allergic reactions to tick bites;
- Allergic reactions to red meat and gelatin;
- Transmission of infections (less common than allergic reactions); and
- Tick paralysis (rare in humans, more likely to occur in children).

The focus of this article is allergic reactions provoked by tick bites.

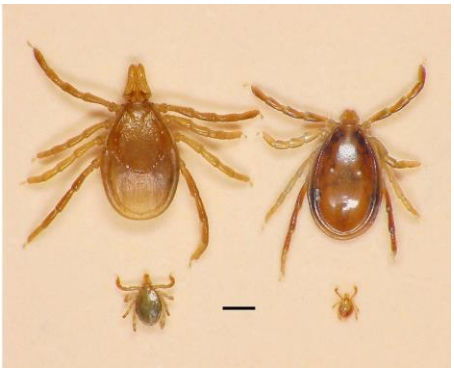
Like other arachnids (such as spiders, scorpions and house dust mites), ticks have eight legs. They pass through a number of life stages from egg to larva to nymph and then finally, the adult. Whilst adult ticks cause the majority of the health problems in humans, all stages of ticks are capable of provoking allergic reactions.

Tick larvae are very small, approximately 1mm in size and can be difficult to see, nymphs are slightly larger at approximately 2mm diameter, and adult ticks (before a blood feed) are approximately 4mm in size.

Adult ticks attach to the tips of grass blades and vegetation, and from there transfer themselves to passing animals or humans. The tick usually crawls up inside clothing and attaches strongly to their host by biting through the skin, generally lodging in the skin of the head or neck or scalp of their host. The most common reaction is local irritation, itching and swelling at the site of a tick bite, which is usually not due to allergy.



Illustrations courtesy of Stephen Doggett, Dept of Medical Entomology, University of Sydney, Westmead



Ticks are present mainly on the east coast of Australia, with known populations of ticks in several non-coastal areas (see map below). While the "tick season" is often considered to range from around February to August, when adult ticks are more prevalent, ticks are present all year round. Therefore the risk of exposure to ticks remains throughout the entire year.

Distribution map of the Australian Paralysis Tick (*Ixodes holocyclus*)

Map adapted from Roberts FHS (1970) Australian Ticks. Yeerongpilly, QLD, Australia by TAGS Inc., Bill Conroy and Norbert Fischer.

Allergic reactions to ticks

Large local swelling and inflammation at the site of a tick bite that lasts several days are usually due to a mild allergic reaction to ticks.

Severe allergic reactions (anaphylaxis) have been described to the Australian paralysis tick, *Ixodes holocyclus*. Anaphylaxis occurs when the tick is disturbed, for example, after inadvertently disturbing the tick by scratching something which can't be seen, by deliberate attempts at tick removal or by application of irritant chemicals such as methylated spirits or kerosene to the tick. Disturbing the tick may cause the tick to inject more allergen-containing saliva.

General strategies for managing reactions to ticks

Regardless of the type of reaction experienced after tick bites, the principles of management are:

- Try to reduce the risk of accidental tick bites (see below);
- Do not scratch anything you can't see if you live in a tick-endemic area;

- Know what to do if you find a tick lodged in your skin (and how best to remove it);
- Know how to manage *allergic reactions* (including anaphylaxis) to tick bites;
- Have your tick allergy confirmed by a doctor. This may require referral to a clinical immunology/allergy specialist, particularly if you are at risk of anaphylaxis;
- Be aware of the association between previous tick bites and the development of allergic reactions to mammalian meats and/or mammalian meat-derived gelatin.

Unfortunately, allergen immunotherapy (commonly known as desensitisation) is currently not available to "switch off" tick bite allergy.

Reducing the risk of tick bites

The following measures may reduce the risk of tick bites:

- Wear long-sleeved shirts and long trousers when walking in areas where ticks occur;
- Tuck shirt into trousers;
- Tuck trouser legs into long socks;
- Wear a wide-brimmed hat;
- Wear light-coloured clothes, which makes it easier to see ticks;
- Brush clothing before coming inside to remove ticks;
- Undress and check for ticks daily, checking carefully in the neck and scalp;
- An insect repellent may help, particularly ones containing DEET (e.g. RID®, Tropical RID®, Tropical Aerogard®, Bushmans®);
- Consider using permethrin-treated clothing when exposed to tick habitat (e.g. gardening in tick endemic areas); and
- In those with *recurrent dangerous allergic reactions* to tick bites, relocating to an area where ticks are not endemic is an option to consider.

What to do if you find a tick lodged in your skin and you are NOT allergic to ticks

The aim is to first kill the tick with an ether-containing spray and then remove it as soon as practical and in as safe a setting as possible. This may reduce the possibility of you becoming allergic to ticks and may also reduce the risk of you contracting a tick-borne infectious disease or developing tick paralysis.

Common advice is to insert fine forceps or tweezers between the skin and the tick mouthpiece and lever the tick out. This method, however, does not prevent anaphylaxis in tick allergic individuals and therefore ASCIA specifically advises against this method.

What to do if you find a tick lodged in your skin and you are ALLERGIC to tick bites

If you are allergic to ticks, you should carry emergency medication -adrenaline (epinephrine) autoinjector (e.g. EpiPen®) and a means of summoning medical assistance (such as a mobile telephone).

- If you know you are allergic to ticks and you are having an allergic reaction to a tick bite, follow your ASCIA Action Plan, including the use of an adrenaline autoinjector if symptoms of anaphylaxis occur.
- If you find a tick, do *NOT* forcibly remove the tick, but rather ***kill the tick first*** by using a product to rapidly freeze the tick to prevent it from injecting more allergen-containing saliva.
- In a tick allergic person, the tick should be killed and removed in a safe place (e.g. an emergency department of a hospital) until it is established that the process of killing the tick and removing it can be safely performed by the tick allergy sufferer. Once this is established, ticks may be killed and removed without necessarily attending an emergency department, depending upon the individual circumstances and after consultation with your medical specialist. Some tick allergic individuals are so highly allergic that

medical support should always be sought. Your medical specialist will advise you as to which approach will be safest for you.
- If suffering your first allergic reaction to a tick, seek urgent medical attention. The tick can then be removed under medical supervision where facilities are available to treat the allergic reaction.
- Ether-containing aerosol sprays are currently recommended for killing the tick. Aerostart® and other similar products have been used extensively to kill ticks in allergic patients. It should be noted that these products are not registered for use in humans and contains benzene but there is long term experience with these products which have been shown to be very effective in treating those with serious tick allergies.
- The use of other ether-containing sprays (e.g. Wart-Off Freeze®, Elastoplast Cold Spray®) has also been effective. These products will continue to be studied and advice updated as experience increases.
- If available, liquid nitrogen applied by a doctor should also (in theory) be effective.

It is important to note that:
- This advice is based on the clinical experience of those treating patients with tick allergy.
- Some of these products are not "registered" for use as therapeutic products for humans.
- All of these products are highly flammable, and thus should not be used near a naked flame or when smoking.
- Rapid cooling of the skin and thus skin irritation may occur.
- More information on these products may be obtained from manufacturers and distributors.
- Pending future studies of the effectiveness of various tick removal and killing methods, such advice is based on a consensus of "expert opinion" rather than derived from results of formal clinical studies.
- Freezing the tick (regardless of whether one is concerned about transmission of infection, tick paralysis or tick allergy) may also have the advantage of reducing the risk of tick sensitisation and later development of tick allergy or related allergic syndromes, as discussed below.

Confirming a diagnosis of possible tick allergy

At this time, there is no reliable skin or blood allergy test to confirm a diagnosis of tick allergy. Australian researchers have identified that the allergens causing problems are proteins in tick saliva. Diagnosis is currently largely based on the history of the reaction but some allergy test results have been associated with exposure to tick bites. Researchers have identified that the following blood allergy tests are positive in the majority of those with serious allergic reactions to tick bites, and that testing may assist in confirming the diagnosis:
- Mammalian meats Immunocap®.
- Alpha-galactose Immunocap®, a sugar molecule present in meat from mammals other than humans, great apes and Old World monkeys, as well as being found in the gut of ticks.
- Tryptase (an enzyme that is increased in those with a condition called mastocytosis, which is associated with an increased risk of allergic reactions to a number of allergic triggers including insect stings and tick bites and with more severe anaphylactic reactions to those insect stings and bites).

It is important to note that while positive red meat allergy tests are frequently seen in those with isolated tick bite allergy, routine avoidance of red meat and gelatin is *not* advised *unless* a patient has an allergic reaction to one of these foods as well. Nonetheless, patients should be aware of this possibility and informed by their doctors of the potential risk.

Tick bites and mammalian meat allergy

Australian allergic diseases physicians first described an association between tick bites and the development of mammalian meat allergy and these findings have since been confirmed by researchers in the USA and in Europe. A subgroup of these patients will also be allergic to mammalian milks and animal-derived gelatin (present in some food products, as a binding agent in some medications as well as in intravenous blood substitutes known as gelatin colloid (e.g. Haemaccel®, Gelofusine®). The target allergen associated with

these allergic reactions appears to be a sugar molecule known as alpha-galactose, present in the gut of ticks (and probably tick saliva) and all mammalian meats except for humans, great apes and Old World monkeys

(e.g. beef, pork, lamb, kangaroo, venison, buffalo) and some more exotic meats eaten in some countries (e.g. guinea pig) in South America and ethnic specialty restaurants in North America and even Australia; and probably even whale meat (e.g. in Japan) as well as gelatin.

Researchers have identified that the following *blood allergy tests* are positive in the majority of those with serious allergic reactions to mammalian meat, and that testing (which can be ordered by any doctor) may assist in confirming the diagnosis:

- Beef, lamb, pork Immunocap®.
- Alpha-galactose Immunocap® a sugar molecule present in mammalian meats (but not in humans, great apes or Old World monkeys), as well as the gut of ticks.
- Elevation of tryptase (an enzyme that is increased in those with a condition called mastocytosis, which is associated with an increased risk and severity of allergic reactions to a number of allergic and non-allergic triggers including insect stings and tick bites).
- By contrast, blood allergy testing to gelatin is usually negative (even in patients who have had clear allergic reactions to gelatin orally or by injection).

In contrast, skin allergy testing to commercially available mammalian meats is much less reliable unless performed with raw, organic mammalian meats for confirmation (and very occasionally, even using raw meats, the diagnosis may not be confirmed). Gelatin skin testing results are highly variable, with often minor reactions on skin prick testing with gelatin, whilst intradermal injection skin testing is more reliable in diagnosing gelatin allergy.

Those with allergic reactions to mammalian meats are best advised to avoid all mammalian meats (beef, lamb/mutton, pork, goat, horse meat, kangaroo, venison and probably other more exotic mammals) and artificial blood (made from beef) as well as all forms of gelatin and to wear a medical bracelet warning of potential allergy to intravenous gelatin colloid (an intravenous preparation used as a blood substitute) as well.

Further advice on dietary avoidance strategies and tick-induced allergies may be found on the TiARA website.

Weblinks

Tick-induced Allergies Research and Awareness (TiARA): www.tiara.org.au
University of Sydney Department of Medical Entomology: medent.usyd.edu.au/fact/ticks.htm

References

1. Brown AF, Hamilton DL. Tick bite anaphylaxis in Australia. J Accid Emerg Med. 1998 Mar;15(2):111-3.
2. Humphery-Smith I, Thong YH, Moorhouse D, Creevey C, Gauci M, Stone B. Reactions to argasid tick bites by island residents on the Great Barrier Reef. Med J Aust. 1991 Aug 5;155(3):181-6.
3. Van Wye JE, Hsu YP, Terr AI, Moss RB, Lane RS. Anaphylaxis from a tick bite. N Engl J Med. 1991 Mar 14;324(11):777-8.
4. Solley GO. Allergy to stinging and biting insects in Queensland. Med J Aust. 1990 Dec 3-17;153(11-12):650-4.
5. Gauci M, Loh RK, Stone BF, Thong YH. Evaluation of partially purified salivary gland allergens from the Australian paralysis tick Ixodes holocyclus in diagnosis of allergy by RIA and skin prick test. Ann Allergy. 1990 Mar; 64(3):297-9.
6. Gauci M, Loh RK, Stone BF, Thong YH. Allergic reactions to the Australian paralysis tick, Ixodes holocyclus: diagnostic evaluation by skin test and radioimmunoassay. Clin Exp Allergy. 1989 May;19(3):279-83.

7. Gauci M, Stone BF, Thong YH. Detection in allergic individuals of IgE specific for 1988;85(2):190-3.
8. Pearce RL, Grove DI. Tick infestation in soldiers who were bivouacked in the Perth region. Med J Aust. 1987 Mar 2;146(5):238-40.
9. van Nunen S, O'Connor KS, Fernando RL, Clarke LR and Boyle RX. The Association Between *Ixodes holocyclus* Tick Bite Reactions and Red Meat Allergy. Internal Medicine Journal 2007; 39(Suppl 5): A132. DOI: 10.1111/j.1445-5994.2007.01558.x
10. Commins S, Satinover S, Hosen J, Mozena J, Borish L, Lewis B, Woodfolk J, Platts-Mills T. delayed anaphylaxis, angioedema or urticaria after consumption of red meat in patients with IgE antibodies specific for galactose- alpha-1,3-galactose. Journal of Allergy and Clinical Immunology. 2009; Vol 123, Issue 2, 426-433. DOI:10.1016/j.jaci.2008.10.052
11. van Nunen SA, O'Connor KS, Clarke LR, Boyle RX and Fernando SL. An association between tick bite reactions and red meat allergy in humans. Med J Aust 2009; 190(9): 510-511. www.mja.com/journal/2009/190/9/association-between-red-meat-allergy-humans
12. van Nunen SA, Zaininger A, Clarke LR and Fernando SL. Systemic Mastocytosis and Severe Anaphylaxis provoked by an IgE-Mediated Reaction to a Food. 2009 XXVIII Congress EAACI abstract #1554b.
13. van Nunen S, Clarke L, Coyle L, Stevenson W and Fernando S. Severe Anaphylaxis Provoked by IgE-Mediated Reactions to Food (Red Meat) in Two Patients with Systemic Mastocytosis. Internal Medicine Journal 2009; (Suppl 5): A145.DOI:10/1111.j.1445-5994.2009.02033.x
14. Jacquenet S, Moneret-Vautrin DA, Bihain BE. Mammalian meat-induced anaphylaxis: clinical relevance of anti-galactose-alpha-1,3-galactose IgE confirmed by use of skin tests to cetuximab. J Allergy Clin Immunol. 2009; 124(3):603-605. DOI:10.1016.j.jaci.2009.06.014
15. van Nunen SA, Stevenson W, Fernando SL, Basten A. A novel insect, Ixodes holocyclus, provoking anaphylaxis in mastocytosis. 2010 World Congress of Internal Medicine. Internal Medicine Journal 2010;Vol 40 (Suppl1):P401,66-185. DOI:10.1111.j.1445-5994.2010.02322.x
16. van Nunen SA, Fulton R, Fernando S, Broady KW, Basten A. The Association between Tick Bite Allergy and Red meat Anaphylaxis: Pertinent Ecological Drivers. EcoHealth 2011;7, s157,s8-s170. DOI: 10.1007/s10393-010-0376-0.
17. van Nunen SA, Mastroianni M, Fulton R, Fernando S, Basten A. Clinical utility of allergen specific-IgE measurement in the diagnosis of mammalian meat/s-induced anaphylaxis associated with prior tick bites. Internal Medicine Journal 2011;41(Suppl 4):1-22. DOI:10.1111.j.1445-5994.2011.02570.x
18. Nunez R, Careballada F, Gonzalez-Quintela A, et al. Delayed mammalian meat-induced anaphylaxis due to galactose-alpha 1,3-galactose in 5 European patients. J Allergy Clin Immunol. 2011; 128(5):1122-1124. DOI:10.1016/j.jaci.2011.07.020
19. Commins SP, James HR, Kelly LA, Pochan SL, Workman LJ, Perzanowski MS, Kocan KM, Fahy JV, Nganga LW, Ronmark E, Cooper PJ, Platts-Mills TAE. The relevance of tick bites to the production of IgE antibodies to the mammalian oligosaccharide galactose-α-1,3-galactose. J Allergy Clin Immunol 2011; Vol 127, Issue 5, 1286-1293. DOI:10.1016/j.jaci.2011.02.019
20. Biedermann T, Röcken M. [Delayed appearance of symptoms in immediate hypersensitivity: type I sensitization to galactose-α-1,3-galactose]. Hautarzt. 2012 Apr;63 Suppl 1:76-9. doi: 10.1007/s00105-011-2299-2. Review. German. PubMed PMID: 22543951.
21. Sheryl van Nunen, Richard Fulton, Monica Mastroianni, Suran Fernando. Specific IgE directed against mammalian meat and alphagal in tick anaphylaxis. Internal Medicine Journal 2012;42(Suppl 4):1-16. DOI:10.1111./j.1445-5994.2012.02888.x
22. Mullins RJ, James H, Platts-Mills TAE, Commins S. The relationship between red meat allergy and sensitization to gelatin and galactose-alpha 1,3- galactose. J Allergy Clin Immunol 2012; 129 (5):1334-1342. http://dx.doi.org/10.1016/j.jaci.2012.02.038
23. Morisset M, Richard C, Astier S, Jacquenet A, Croizier F, Beaudoin V, Cordebar F, Morel-Codreanu N, Petit D, Moneret-Vautrin DA, Kanny G. Allergy 2012; Vol 67(5):699-704. DOI:10.111.j.1398-9995.2012.02799.x
24. Hamsten C, Starkhammar M, Tran TA, Johansson M, Bengtsson U, Ahlén G, Sällberg M, Grönlund H, van Hage M. Identification of galactose-α-1,3-galactose in the gastrointestinal tract of the tick Ixodes ricinus;

possible relationship with red meat allergy. Allergy. 2013 Apr;68(4):549-52. doi: 10.1111/all.12128. Epub 2013 Feb 18. PubMed PMID: 23414348.
25. van Nunen SA, Said MG, Batty G. Use of expanded search criteria in diagnosing mammalian meat allergy provoked by previous tick bite in individuals who do not live in areas where ticks are endemic EAACI-WAO Meeting June 2013, Abstract #2602.
26. Rappo TB, Cottee AM, Ratchford AM, et al. Tick bite anaphylaxis- incidence and management in an Australian Emergency Department. Emergency Medicine Australasia 2013 Aug 25 (4): 297-301. DOI:10.1111/1742-6723.12093
27. Sheryl van Nunen, Antony Basten, Nicholas Cowdery, Derek Anderson, Kevin Broady, Maria Said, Andrew Ratchford, Stephen Doggett, Edith Arns, Geoffrey Cook, Stephen Ginsborg. TiARA(Tick-induced Allergies Research and Awareness). ASCIA Annual Scientific Meeting, Perth. Internal Medicine Journal 2013;Vol 43, Issue S4:1-28. DOI:10.1111/imj.12252 August 2013.
28. Hamsten C, Tran TA, Starkhammar M, Brauner A, Commins SP, Platts-Mills TA, van Hage M. Red meat allergy in Sweden: Association with tick sensitization and B-negative blood groups. J Allergy Clin Immunol. 2013 Oct 3. doi:pii:
S0091-6749(13)01306-7. 10.1016/j.jaci.2013.07.050. [Epub ahead of print] PubMed PMID: 24094548.
29. Sheryl van Nunen, Monica Mastroianni, Richard Fulton, Suran Fernando, Antony Basten. Clinical Significance of Detectable Alphagal-Specific IgE in Individuals with Undetectable Mammalian Meat Specific IgE in Mammalian Meat Allergy Following Tick Bites. APCAACI, Taipei, Taiwan, November 2013.

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Website: www.allergy.org.au
Email: info@allergy.org.au
Postal address: PO Box 450 Balgowlah, NSW Australia 2093

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