



# Allergic Reactions due to Tick Bites

Clinical A/Professor Sheryl van Nunen

Senior Staff Specialist

Department of Clinical Immunology and Allergy

Royal North Shore Hospital

&

Sydney Medical School-Northern, University of Sydney

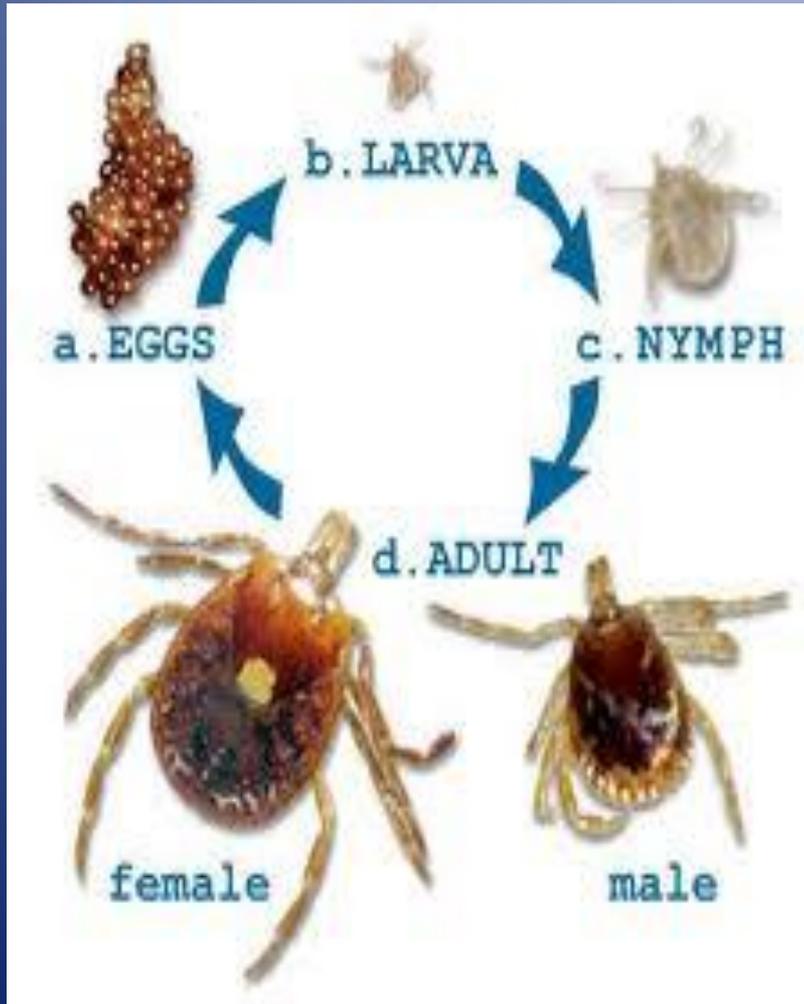


# Distribution of *Ixodes holocyclus*



- *Ixodes holocyclus* is found 20-30km inland from the coast along virtually the entire eastern seaboard of Australia. It can be found in pockets up to 100km inland, depending upon the surrounds.
- This tick is also found in the Australian Capital Territory and a similar tick is found around Launceston in Tasmania.
- There are several tick species, however, it appears likely that the *Ixodes holocyclus* is the tick causing most of the allergic problems in Man.
- It is also known as the “paralysis tick”.

# The Life Cycle of the Tick



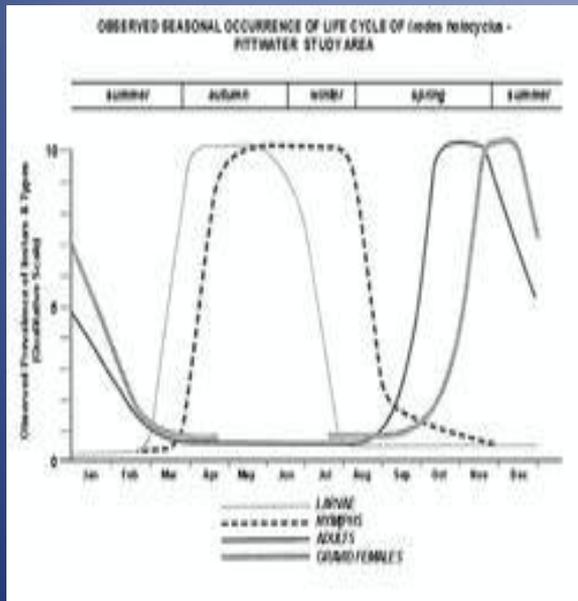
- Ticks are found most commonly in wet sclerophyll forests and temperate rainforests
- 2,500-3,000 eggs are deposited in moist leaf litter by the female before she dies
- Only a few of these eggs survive to adulthood
- 40-60 days after they've been laid the eggs hatch as six-legged larvae
- This larval tick must obtain a blood meal before it can moult to the next stage and to do so the larva "quests" i.e. It climbs to the top of the nearest vegetation and waves its forelegs to and fro slowly, thereby contacting a passing host-bandicoot, possum, kangaroo, koala
- The larva feeds on the host's blood for 4-6 days, then drops off the host and moults to the eight-legged nymph stage
- Nymphs seek a further blood meal for 4-8 days before moulting to the adult tick
- Adult female ticks feed for 10 days, drop off the host and then lay eggs over several weeks

# The Life Cycle of the Tick (2)

- The entire life cycle of the tick, comprising 4 stages & 3 hosts, takes around a year
- Each life stage can be present throughout the year
- Typically, larvae (“seed ticks”) from late February to April/May
- Nymphs (“grass ticks”) appear from March to September/October
- Adults from August to February, peaking around December
- In conditions favourable for ticks, a second peak can occur in May
- Adult ticks may be present even in mid-winter



# Ticks: Seasonal Factors



- Humid conditions are essential for survival of the adult tick (27° C/high humidity)
- Tick numbers are probably determined by rainfall in the previous year
- The weather along the Eastern seaboard is favourable for tick breeding
- Predators are limited- *Anystis* mites, insectivorous birds and wasps
- Adult ticks can re-attach to different dogs



# *Ticks and People*



- The natural host of the tick is the bandicoot
- Other native animals such as kangaroos, koalas and possums host ticks
- Individuals living in tick endemic areas report all creatures as having resident ticks: domestic animals and reptiles e.g. blue-tongued lizards
- People live in the areas where ticks are endemic
- Where people live in these areas surrounded by natural bushland , tick bites occur in humans



# *Allergic Conditions caused by Tick Bites*

The most common serious medical complaints caused by ticks are allergic reactions to their bites

- ❖ Large local allergic reactions
- ❖ Tick induced anaphylaxis
- ❖ Mammalian meat induced anaphylaxis associated with prior tick bites
- ❖ Anaphylaxis to both ticks and mammalian meat in individuals with the co-existing condition of mastocytosis



# *Large local allergic reactions to tick bites*

- ❑ “Large local reactions” are allergic reactions.
- ❑ Large local reactions are the least dangerous type of allergic reaction to ticks, however, they are physically limiting when present and very uncomfortable.
- ❑ These reactions commence within 4-12 hours and keep increasing in size for 24-72 hours .
- ❑ The allergen to which the body is reacting is most likely a protein molecule in the saliva of the tick.
- ❑ These reactions typically extend from the joint above the bite to the joint below the bite.
- ❑ Treatment consists of rest, elevation of the part above the heart (if possible), ice, regular antihistamines and often oral cortisone. Because these reactions are caused by a puncture wound and the tissues are grossly swollen, antibiotics are often given.
- ❑ Large local reactions usually take at least 10 days to resolve and typically have no after effects.
- ❑ Large local reactions occur with many different insects- bees, wasps, mosquitoes, midges.





# *Tick-induced Anaphylaxis:* *General information*

- Rarely, anaphylactic allergic reactions to tick bites have been fatal.
- Life-threatening allergic reactions to ticks are much more common than similarly severe reactions to bees or wasps.
- Life-threatening allergic reactions to ticks are much more common than shark attacks or being struck by lightning.
- The anaphylactic reaction itself is treated as for anaphylaxis from any other cause.
- Australian researchers have identified the allergens as proteins in the tick saliva.
- **Crucially, people who have an anaphylactic reaction to a tick bite react only when the tick is disturbed .**

# *Tick-induced Anaphylaxis: Symptoms*



Within seconds to a few minutes of removing a tick, the afflicted will typically note one or more of the following:

- generalised itch
- generalised feeling of warmth
- urticaria (welts) may appear
- breathing difficulty
- sensation of throat closure
- a feeling of “impending doom”
- dizziness and may
  
- collapse, due to a drop in the blood pressure and may
  
- be so severely affected as to lose consciousness

# *Tick-induced Anaphylaxis: First Aid*



- Lie the person down if possible and elevate the legs as this maximises the blood flow to the head and therefore the oxygen to the brain.
- Call 000 and explain that the reaction is life-threatening.
- If you are alone, open the front door and chock it and then lie down and put your feet up on a chair/settee, leaving a note beside you noting that you have been bitten by a tick, if time permits.
- If you have an adrenaline auto-injector (e.g. EpiPen<sup>®</sup>, Anapen<sup>®</sup>) in the home - use it while waiting if there is any closing over of the throat, breathing difficulty or impending loss of consciousness .



# Tick-induced Anaphylaxis: Treatment

- Oxygen and adrenaline are the mainstay.
- Oral corticosteroids and antihistamines are usually given for use at home over the ensuing 3 days.
- An authority prescription for an adrenalin auto-injector is given and/or instructions are given to see your family doctor as soon as possible for same.



# Prevention of further Tick Bite-induced Anaphylactic Reactions

- DO NOT SCRATCH ANYTHING YOU CAN'T SEE
- DO NOT DISTURB A TICK
- USE AN ETHER-CONTAINING AEROSOL (eg Aerostart<sup>®</sup>) TO KILL THE TICK INSTANTLY (THE ETHER FREEZE DRIES THE TICK)
- SCRAPE THE TICK OUT AFTERWARD OR WAIT FOR IT TO DROP OFF
- ***FIRST TIME: DO THIS ONLY UNDER MEDICAL SUPERVISION***



# *The Association between Tick Bites & Mammalian Meat Allergy*



- *The association between prior tick bites and mammalian meat allergy was first described in 2007 by*

van Nunen et al. The Association Between *Ixodes holocyclus* Tick Bite Reactions and Red Meat Allergy. Internal Medicine Journal 2007; 39 (Suppl5): A132.

- *The molecular basis has been determined by*

Commins et al. 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.

- *The allergen in the mammalian meat (beef, lamb, pork... meat from any animal apart from humans, great apes and Old World monkeys) is unique amongst allergens, as it is a carbohydrate allergen (all other known allergens are proteins).*



# *The Association between Tick Bites & Mammalian Meat Allergy: Typical Features*

- Mammalian meat allergy is exceedingly rare in adults in the absence of an association with prior tick bites.
- Tick bites precede any reactions to mammalian meats.
- Often, tick bites in the past often have given rise to small local reactions (or larger local reactions) usually to adult ticks, occasionally to smaller stages of ticks (nymphs, larvae).
- Mammalian meat allergy symptoms often do not commence until several months after the tick bites.
- The allergic reaction to the meat is typically delayed by several hours after the ingestion of the meat (usually 3-6 hours).
- Cross-reactivity occurs between mammalian meats e.g. venison.
- Amplifying factors for food allergy may modify the severity of the reactions.



# *The Association between Tick Bites & Mammalian Meat Allergy*



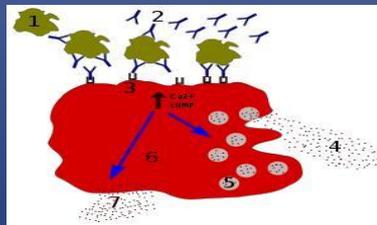
- Management of the meat allergy is limited to the avoidance of all mammalian meats and, in some instances, the avoidance of cows milk as well.
- Dietary review focussing upon iron intake, ensuring overall nutritional adequacy is advisable.
- Provision of an adrenaline auto-injector and training in its use.
- Prevention of future tick bites is considered prudent.



# *The rare problem of mammalian meat allergy after tick bites and co-existing mastocytosis*



- Mastocytosis is a very rare disease in which an increased number of mast cells (histamine releasing cells which result in the inflammation seen in allergic reactions) are made in the bone marrow.
- Allergens and other agents provoke mast cells to release histamine and a profound anaphylaxis results because the mast cells are increased in number.
- Around 3-4% of those with mammalian meat allergy after tick bites have co-existing mastocytosis.
- This condition must be checked for in any individual with a profound anaphylaxis, whatever the agent.
- Education regarding other potential triggers is essential for safety.



# *Prevention of Tick Bites*

- Avoid tick infested areas.
- Insect repellent (DEET e.g. RID, Aerogard Tropical, Bushmans).
- Re-apply the insect repellent each few hours.
- Wear light clothing (ticks may be more easily detected).
- Consider wearing permethrin treated outdoor clothing.
- Wear long-sleeved shirts and trousers/slacks and tuck legs into long socks.
- Remove all clothing after exposure and place in a hot dryer for 20minutes to kill any ticks.
- Search your body for ticks, particularly the head and behind the ears (they can take 2 hours to attach).



# *Tick Habitat Modification & Treatment*

- **Habitat Modification:**
  - ✓ remove low vegetation
  - ✓ clear brush
  - ✓ remove leaf litter
  - ✓ increase sunlight to the backyard
  - ✓ cut lawns
- **Habitat Treatment:**
  - ✓ “bandicoot boards”
  - ✓ insecticides



# *The Future?*

- Increased population at risk as population growth occurs along the Eastern seaboard of Australia.

+

- Increased numbers of ticks due potentially to the effects of global warming.

=

- Increased numbers of individuals with serious allergic conditions due to tick bites.

# *Acknowledgements*

Thank you to Kathy Kai, Community Environmental Officer and David Wilks, Biodiversity Officer, Ku-ring-gai Council, and David Le Breton, Lane Cove Council, for their invitations to speak , which were the stimuli to the preparation of this resource.

Stephen Doggett, Senior Hospital Scientist, Department of Medical Entomology, University of Sydney at Westmead for his generous advice and illustrations.

Wikimedia Common Source for some of the illustrations.

The staff in the ImmunoRheumatology Laboratory at Royal North Shore Hospital for their work in testing for the alphagal and mammalian meat RASTs.

**The staff at Mona Vale District Hospital, Manly Hospital, Hornsby Hospital, Royal North Shore Hospital, Sydney Adventist Hospital and Ryde Hospital Emergency Departments for their care and expertise in resuscitating so many of the sufferers of the severe allergic reactions to ticks and mammalian meat.**

[www.allergy.org.au](http://www.allergy.org.au)

[www.medent.usyd.edu.au](http://www.medent.usyd.edu.au)

[www.allergyfacts.org.au](http://www.allergyfacts.org.au)

## *Resources*



# New Developments



- TiARA (Tick-induced Allergies Research & Awareness)  
A research Fund of the Royal North Shore Hospital  
*Making life easier for those with tick-induced allergies  
and researching ways to prevent and cure tick-induced allergies*  
[www.rnsfundraising.com.au/store/donate/make-a-donation](http://www.rnsfundraising.com.au/store/donate/make-a-donation)  
and select TiARA Fund (Tick Allergies) from the dropdown menu