

Update on the Canine Ehrlichiosis epidemic in Northern Australia

with Professor Peter Irwin and Dr Bonny Cumming



GETTING 2 ZERO

Working together to save more lives

Overview

- **Peter's Presentation**

- What is Canine Ehrlichiosis?
- The disease and its clinical manifestations
- Diagnosis and treatment of ehrlichiosis
- The tick vector and how to prevent ehrlichiosis
- Specific considerations for G2Z

- **Bonny's Presentation**

- The Australian outbreak of ehrlichiosis and how it is unfolding
- Its impact on indigenous communities and its wider implications



What is Canine Ehrlichiosis?

- Disease of canids – domestic dogs, wild dogs, dingoes (?)
- Caused by a bacterium
- Obligate intracellular, Gram negative, rickettsial
 - *Ehrlichia canis*
- Transmitted by ticks
 - **The Brown Dog Tick** – which is present in Australia
- Once in the dog it infects monocytes and macrophages
 - **Causes systemic inflammation**
- Serious systemic illness = **Canine Monocytic Ehrlichiosis (CME)**



CME – A serious disease of dogs Worldwide

After Infection:

1. Acute phase

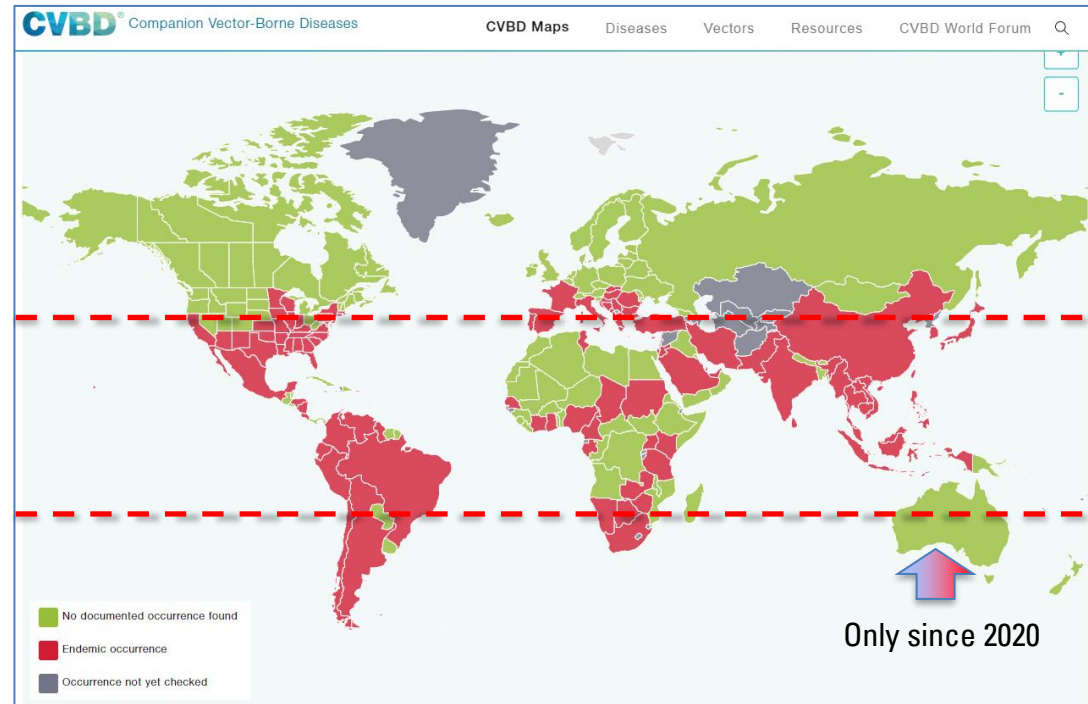
- Incubation 8-20 days
- Moderate to severe clinical signs

2. Sub-clinical phase

- Dormant/occult infection
- “Months to years”

3. Chronic (Bone Marrow Failure)

Distribution of Endemic CME is tropical/sub-tropical (CVBD)





Clinical Experience of CME in Australia

- Reports from northern Australia are of a **more severe disease** than is generally reported elsewhere in the world
 - High morbidity
 - High prevalence in Indigenous communities
 - High mortality (60-80% in some communities)
 - Bone marrow failure early
 - Prevalence of Subclinical phase is unknown

“The acute and chronic phases of infection often are not differentiated easily in naturally occurring cases” (Waddle & Littman, 1988 JAAHA 24: 615-620)



Why is CME so severe in northern Australia?

- The Outbreak of CME has several **unique epidemiological features**:
 1. A naïve canine population,
 2. A well established population of ticks in the top end, with...
 3. ... Ideal climatic conditions → **high tick densities (reduced ectoparasite control throughout much of northern Australia in Indigenous Communities)**, and
 4. Pre-existing coinfections and co-morbidities with other tropical diseases



Clinical Presentation of CME

- Lethargy (anorexia, malaise)
- Pyrexia
- Bleeding diatheses
 - Haemorrhages, epistaxis and pallor
- Eye disease (red eye, blue eye, blindness)
- Oedema – dependent swelling (brisket, scrotum)

- Other: Respiratory, Neurological, Emaciation, Death

- **Tick(s) – or history of recent tick(s)**
- **Living in or travel from top end of Australia**





Clinical Presentation of CME



Images: Gould et al. (2000) JSAP 41: 263; Leiva (2005) Vet Ophthalmol 8: 387; and Komnenou et al. (2007) Vet Ophthalmol 10: 137, J Beadle, S Phelan.





Clinical Pathology of CME

- **Major Clinical Pathological abnormalities**

- Anaemia and thrombocytopenia

- Regenerative or non-regenerative anaemia

- Leucocytosis or leucopenia

- Intracytoplasmic inclusions (monocytes) are rare and only occur in acute cases

- Pancytopenia

- Hyperglobulinaemia + hypoalbuminaemia

- Proteinuria

- CRP elevation





Diagnosis of CME – a Notifiable Disease

- Veterinarians obliged to notify State or Territory Authorities if a case suspected

1. Clinical Signs and Supportive History
2. Consistent Clinical Pathology



3. Specific Diagnostic tests (at State Labs)

- **PCR**
 - Positive **within 4-10 days PI**
 - Sensitivity decreases in subclinical and chronic phases
- **IFAT**
 - Seropositive **between 3-4 weeks PI**

Testing is FREE

but

There is a slow (2-5 days) turnaround time for results



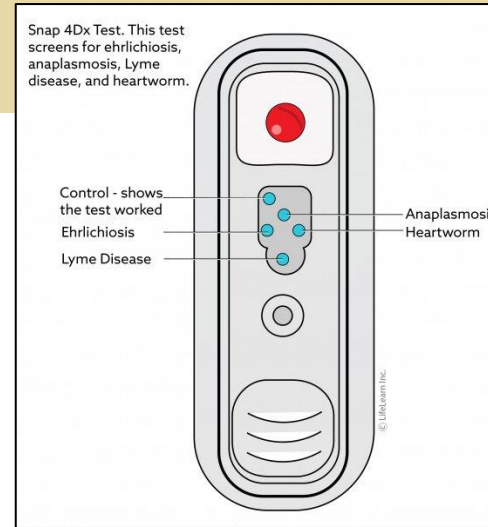
State and Territory Laboratories

Jurisdiction	Further information
Queensland	See Biosecurity Queensland website or call 13 25 23.
Western Australia	See WA Department of Primary Industries and Regional Development website or call (08) 9368 3929
South Australia	See SA Department of Primary Industries and Regions website
Northern Territory	See NT.gov and Berrimah Veterinary Laboratories on 8999 2249
Victoria	See Agriculture Victoria website or call 136 186
New South Wales	See NSW Department of Primary Industries website
ACT	Call the Biosecurity Veterinary Officer on 13 22 81
Tasmania	See Biosecurity Tasmania website or call 1300 368 550



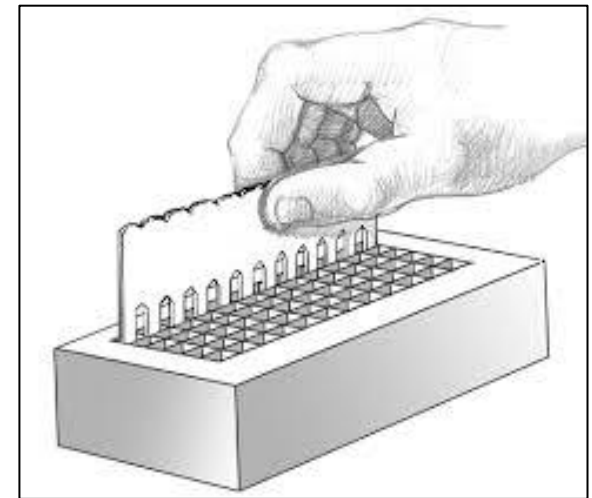
In-house tests for *E. canis* (overseas)

- Used extensively overseas to diagnose CME
- Immunochromatographic or ELISA in-clinic **serological** kits
- **Not readily available in Australia (yet)**
- **Discordance** (**false negatives**) has been noted between internationally-developed in-clinic kits and IFAT/PCR results
 - Reliability of these tests in Australia?
 - Need to develop tests locally with high Se/Sp



Iddex Snap 4Dx

Biogal ImmunoComb



Diagnostic Considerations

We need to increase our **clinical suspicion** and include CME as DDx

1. Risk of CME will be higher in the subtropics/tropics... .. But now always consider CME if you examine:
 - **Relocated or travelled** dogs
 - Dogs with **unknown or poor prior location/residence history**
2. Dogs that are unwell with **clinical signs** consistent with CME
 - Especially concurrent **pyrexia, malaise and bleeding diatheses**
 - Search for ticks



Management of CME

Two approaches to the management of CME

1. Treatment of infected dogs
2. Prevention of tick transmission and the control of ticks





Treatment of Infected dogs

Antibiotics

- Efficacy best in early infections (acute phase)
 - **Doxycycline is the drug of choice**
 - **10mg/kg per day for 28 days** (ACVIM Consensus Statement 2002)

Anti-inflammatory

- Ameliorates secondary injury and decreases morbidity
 - **Prednisolone** at anti-inflammatory dose for 5-7 days

Supportive Care

- As indicated (e.g. fluid therapy, blood transfusions, etc.)

Bone marrow disease

- Specific (and expensive) tailored therapy with a guarded prognosis



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The Vector: Brown dog tick (*Rhipicephalus sanguineus*)



Photo: Dr Anne Quain



The Vector: Brown dog tick (*Rhipicephalus linnaei*)



Succinctus

The “tropical lineage” of the brown dog tick *Rhipicephalus sanguineus* sensu lato identified as *Rhipicephalus linnaei* (Audouin, 1826)[☆]

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^b Australian National Insect Collection, CSIRO, GPO Box 1700, Canberra, Australian Capital Territory 2601, Australia

Photo: Dr Anne Quain



Distribution of the *Rhipicephalus linnaei* in Australia

From: Chalada et al. (2020)

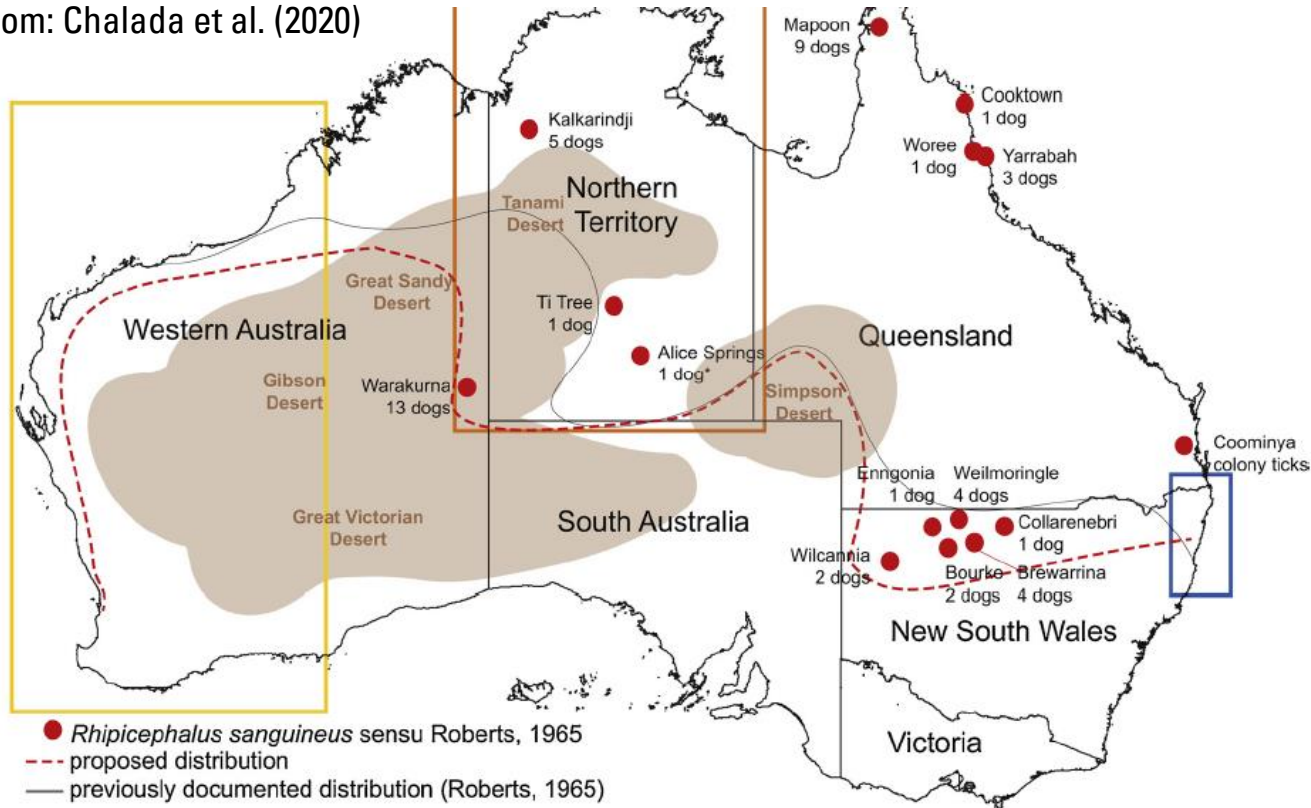


Photo: Dr A Quain



Rhipicephalus linnaei – implications for CME

- Three-host tick
 - Eggs → Larvae → Nymphs → Adults (male & female)
- Highly adapted to dogs (all canids)
- Endophilic – adapted to dwelling(s) – **not** a bush tick!
 - Houses, Kennels, Shelters
 - Seeks cracks and crevices for egg laying & moults
 - Ongoing presence of dogs maintains life cycle
- **Enzootic Range = Northern Australia**
 - **Extremely high tick numbers build up quickly**
 - **Very difficult to control**





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 - Ongoing presence of dogs maintains life cycle
- **Outside the Enzootic Range (Southern Australia)**
 - **Ticks will survive in some conditions (heated houses)**
 - **Small foci may become established**
 - **Won't survive in the bush or parks (too cold)**
 - **Needs infected dogs to maintain CME**





Ehrlichia canis pathogen transmission from the tick

- Thought to be one of the **most rapidly transmitted** tick-borne pathogens
- Evidence of transmission **within just 3 hours of tick attachment** (Fourie *et al.* 2013)
- Evidence of intrastadial transmission via grazing male brown dog ticks (Bremer *et al.* 2005)
- No evidence for transovarial transmission (female ticks will not transmit *E. canis* to eggs)

Veterinary Parasitology 197 (2013) 595–603

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

ELSEVIER

Transmission of *Ehrlichia canis* by *Rhipicephalus sanguineus* ticks feeding on dogs and on artificial membranes

Josephus J. Fourie^{a,*}, Dorothee Stanneck^b, Herman G. Luus^a, Frederic Beugnet^c, Michiel Wijnveld^d, Frans Jongejans^{d,c}

CrossMark



Transstadial and intrastadial experimental transmission of *Ehrlichia canis* by male *Rhipicephalus sanguineus*

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ABSTRACT

A South African strain of *Ehrlichia canis* was isolated and used to infect a laboratory-bred Beagle dog. *Rhipicephalus sanguineus* nymphs, which fed on this dog, moulted to adult ticks which carried infection rates of *E. canis* between 12% and 19% and were used in a series of *in vivo* and *in vitro* experiments.

Five groups of 6 dogs were challenged with the infected *R. sanguineus* ticks, which were removed 24 h, 12 h, 6 h or 3 h after the ticks had been released onto the dogs. The animals were monitored for fever and thrombocytopenia and were considered infected if they became serologically positive for *E. canis* antibodies as well as PCR positive for *E. canis* DNA. Seven dogs became infected with *E. canis* in the following groups: Group 1 (24 h tick challenge) 1 out of 6; Group 2 (12 h) 1 of 6; Group 3 (6 h) 2 of 6; Group 4 (6 h) 2 of 6 and **Group 5 (3 h) 1 out of 6**. Six of those 7 infected dogs developed fever and a significant thrombocytopenia. One dog did not show any symptoms, but seroconverted and was found PCR positive on several occasions. Five additional dogs were PCR positive on one test sample only but were not considered infected because they did not develop any specific *E. canis* antibodies.

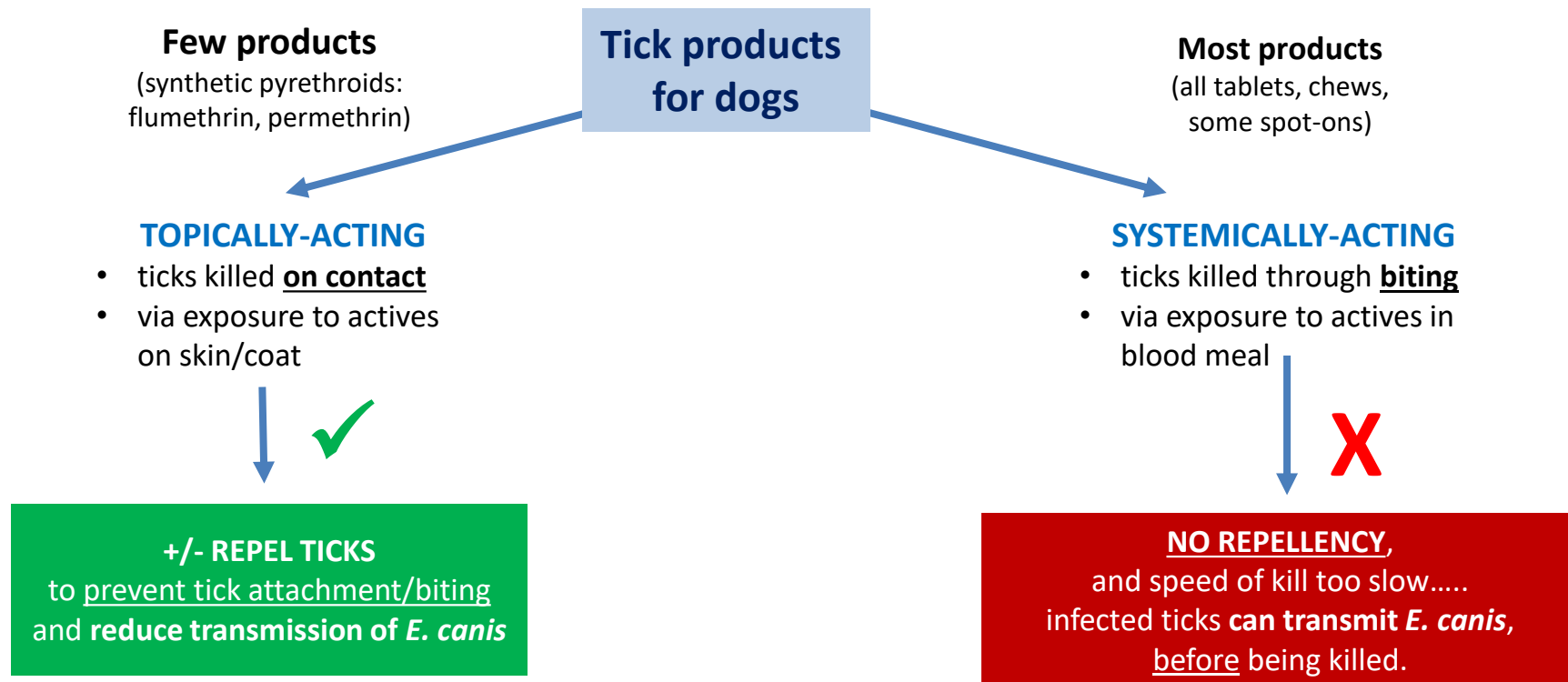
In vitro, *R. sanguineus* ticks attached and fed on bovine blood through silicone membranes with attachment rates up to 72.5% after 24 h increasing to 84.2% at 72 h. The ticks transmitted *E. canis* as soon as 8 h post application as demonstrated by *E. canis* DNA found in the nutritive blood medium.

In conclusion, transmission of *E. canis* by *R. sanguineus* ticks starts within a few hours after attachment, which is earlier than previously thought. These findings underpin the need for acaricides to provide either a repellent, an anti-attachment and/or a rapid killing effect against ticks in order to decrease the risk of transmission of *E. canis*.



The speed of transmission and prevention of *E. canis*

- The product must **KILL ticks or REPEL ticks to prevent biting < 3 HOURS**





The speed of transmission and prevention of *E. canis*

- The product must **KILL ticks or REPEL ticks to prevent biting < 3 HOURS**
- This is faster than the systemically-acting products (i.e. isoxazolines: Simparica, Nexgard, Bravecto, Credelio) can kill ticks - meaning that infected ticks **can transmit *E. canis* before they are killed.**
- Currently only two **topically-acting** products are available that prevent individual dogs from infection: **Seresto and Advantix**





Tick Control in **Infected dogs** & to **reduce spread of disease**

- If a dog is infected then 'any' tick control product is indicated:
 - Systemically acting (e.g. isoxazolines – the '-laners')
 - Topically acting (e.g. synthetic pyrethroids)



- If infection status is unknown then a topically-acting product is safest. **Assess risk.**



Some Specific Considerations for G2Z (for discussion)

- Consider potential for CME in any dogs with **unknown travel/location history**
 - Especially if **unwell** with consistent signs, but remember
 - Carrier state (subclinical phase)
- Retain **high clinical suspicion** for any dog with **northern Australia history**
- Test (if possible) or refrain from moving dogs from the top end to the south (in-house testing will help greatly with this)
- Assess risk! **Tick paralysis** (*I. holocyclus*) is much more likely a problem along eastern Australia and systemically-acting products are excellent for this!

Rhipicephalus sanguineus

Brown dog tick

Thank you – Any Questions?