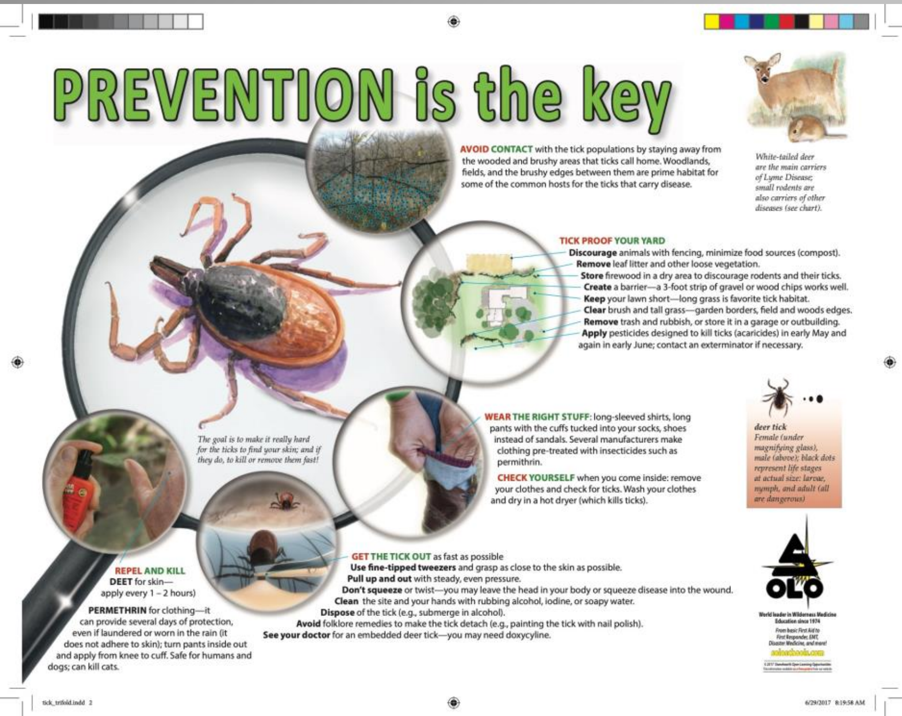
Tickborne Diseases – 2020



PREVENTION is the key

AVOID CONTACT with the tick populations by staying away from the wooded and brushy areas that ticks call home. Woodlands, fields, and the brushy edges between them are prime habitat for some of the common hosts for the ticks that carry disease.

White-tailed deer are the main carriers of Lyme Disease; small rodents are also carriers of other diseases (see chart).

TICK PROOF YOUR YARD

Discourage animals with fencing, minimize food sources (compost).
Remove leaf litter and other loose vegetation.
Store firewood in a dry area to discourage rodents and their ticks.
Create a barrier—a 3-foot strip of gravel or wood chips works well.
Keep your lawn short—long grass is favorite tick habitat.
Clear brush and tall grass—garden borders, field and woods edges.
Remove trash and rubbish, or store it in a garage or outbuilding.
Apply pesticides designed to kill ticks (acaricides) in early May and again in early June; contact an exterminator if necessary.

The goal is to make it really hard for the ticks to find your skin; and if they do, to kill or remove them fast!

WEAR THE RIGHT STUFF: long-sleeved shirts, long pants with the cuffs tucked into your socks, shoes instead of sandals. Several manufacturers make clothing pre-treated with insecticides such as permithrin.

CHECK YOURSELF when you come inside: remove your clothes and check for ticks. Wash your clothes and dry in a hot dryer (which kills ticks).

deer tick *Female (under magnifying glass), male (above); black dots represent life stages at actual size: larvae, nymph, and adult (all are dangerous)*

REPEL AND KILL
DEET for skin—apply every 1 – 2 hours)

PERMETHRIN for clothing—it can provide several days of protection, even if laundered or worn in the rain (it does not adhere to skin); turn pants inside out and apply from knee to cuff. Safe for humans and dogs; can kill cats.

GET THE TICK OUT as fast as possible
Use fine-tipped tweezers and grasp as close to the skin as possible.
Pull up and out with steady, even pressure.
Don't squeeze or twist—you may leave the head in your body or squeeze disease into the wound.
Clean the site and your hands with rubbing alcohol, iodine, or soapy water.
Dispose of the tick (e.g., submerge in alcohol).
Avoid folklore remedies to make the tick detach (e.g., painting the tick with nail polish).
See your doctor for an embedded deer tick—you may need doxycyline.

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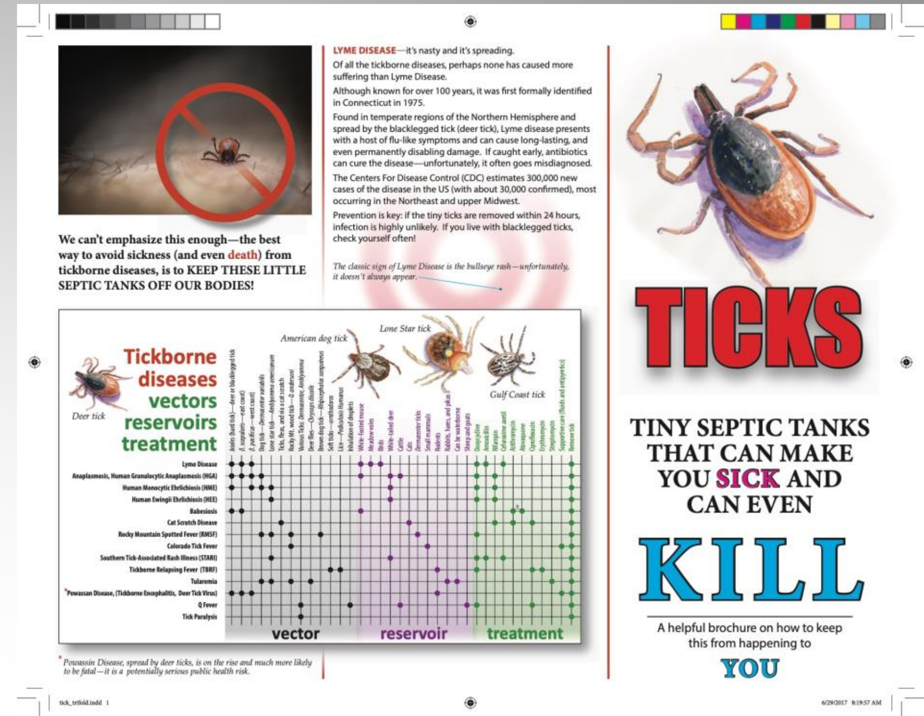

LYME DISEASE—it's nasty and it's spreading.

Of all the tickborne diseases, perhaps none has caused more suffering than Lyme Disease.

Although known for over 100 years, it was first formally identified in Connecticut in 1975.

Found in temperate regions of the Northern Hemisphere and spread by the blacklegged tick (deer tick), Lyme disease presents with a host of flu-like symptoms and can cause long-lasting, and even permanently disabling damage. If caught early, antibiotics can cure the disease—unfortunately, it often goes misdiagnosed.

The Centers For Disease Control (CDC) estimates 300,000 new cases of the disease in the US (with about 30,000 confirmed), most occurring in the Northeast and upper Midwest.

Prevention is key: if the tiny ticks are removed within 24 hours, infection is highly unlikely. If you live with blacklegged ticks, check yourself often!

The classic sign of Lyme Disease is the bullseye rash—unfortunately, it doesn't always appear.

We can't emphasize this enough—the best way to avoid sickness (and even death) from tickborne diseases, is to KEEP THESE LITTLE SEPTIC TANKS OFF OUR BODIES!

Tickborne diseases vectors reservoirs treatment

Deer tick
American dog tick
Lone Star tick
Gulf Coast tick

Lyme Disease
Anaplasmosis, Human Granulocytic Anaplasmosis (HGA)
Human Monocytic Ehrlichiosis (HME)
Human Ewingii Ehrlichiosis (HEE)
Babesiosis
Cat Scratch Disease
Rocky Mountain Spotted Fever (RMSF)
Colorado Tick Fever
Southern Tick-Associated Rash Illness (STARI)
Tickborne Relapsing Fever (TBRF)
Tularemia
*Powassan Disease, (Tickborne Encephalitis, Deer Tick Virus)
Q Fever
Tick Paralysis

vector reservoir treatment

Powassin Disease, spread by deer ticks, is on the rise and much more likely to be fatal—it is a potentially serious public health risk.

TICKS

TINY SEPTIC TANKS THAT CAN MAKE YOU SICK AND CAN EVEN

KILL

A helpful brochure on how to keep this from happening to

YOU

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Tickborne Diseases

- Leading insect vectorborne disease in USA.
  - 2004 – 2016, 642,000 mosquito, tick, and flea illnesses.
  - 491,000 were tickborne illnesses.
  - 2017, record number of cases reported to the CDC
    - 59,349 cases, up from 48,610 cases in 2016.
- 3 fold increase in insectborne illnesses in USA.
- Second only to mosquitoes Worldwide.
- Ticks are little cesspools.
- Lyme Disease is #1 tickborne illness.
- Anaplasmosis (HGA) is #2.
- Powassan Disease – virus – rare, but lethal
  - Same reservoir, vector, and host as Lyme Disease

Tick-borne diseases vectors reservoirs treatment

Deer tick

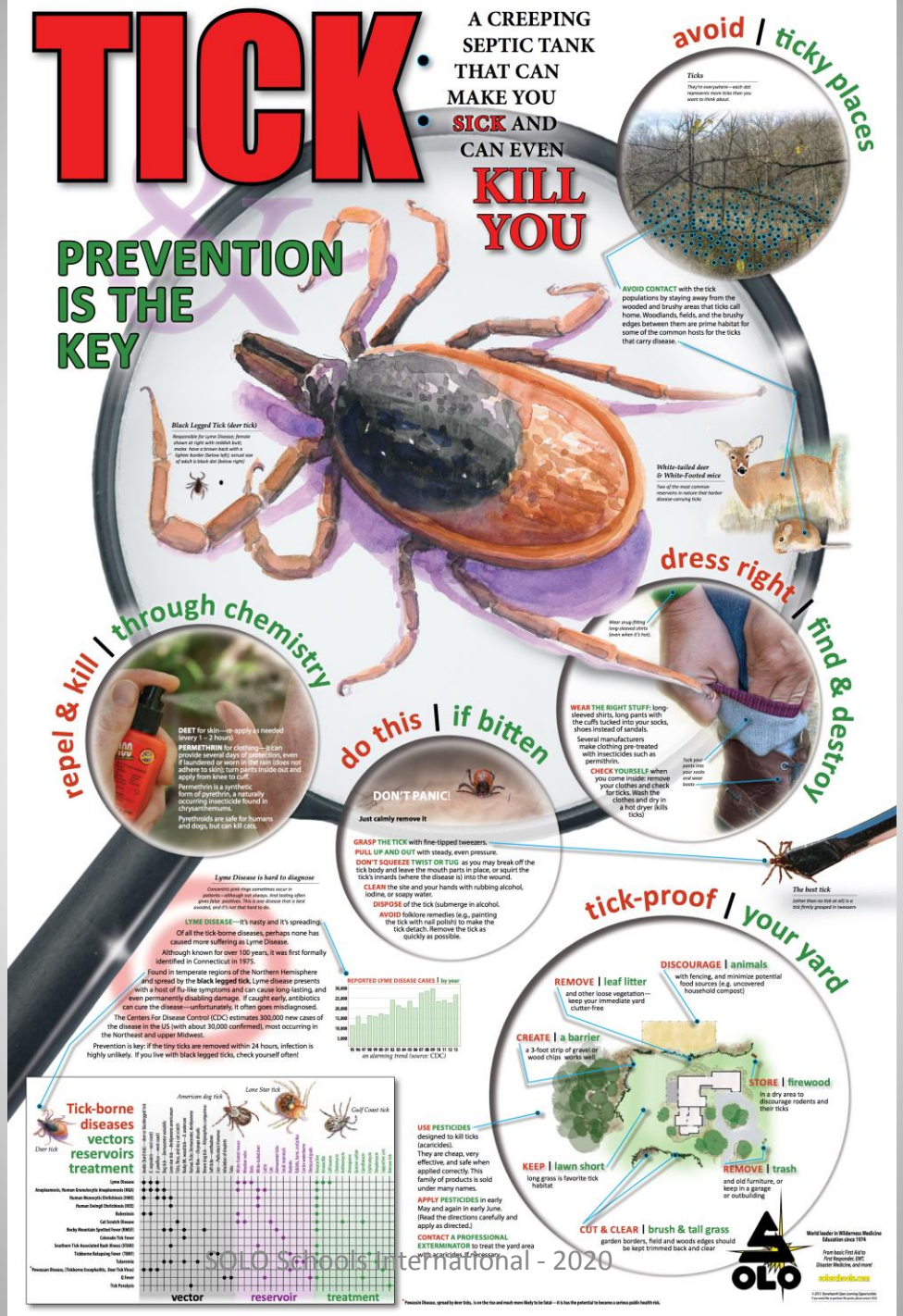
American dog tick

Lone Star tick

Gulf Coast tick

	Ixodes (hard tick)—deer or blacklegged tick	(*I. scapularis*—east coast)	(*I. pacificus*—west coast)	Dog tick—*Dermacentor variabilis*	Lone star tick—*Amblyomma americanum*	Ticks, fleas, and via a cat scratch	Rocky Mt. wood tick—*D. andersoni*	Various Ticks: *Dermacentor, Amblyomma*	Deer flies—*Chrysops discalis*	Brown dog tick—*Rhipicephalus sanguineus*	Soft ticks—*ornithodoros*	Lice—*Pediculosis Humanus*	Inhalation of droplets	White-footed mouse	Meadow voles	Birds	White-tailed deer	Cattle	Cats	*Dermacentor* ticks	Small mammals	Rodents	Rabbits, hares, and pikas	Can be waterborne	Sheep and goats	Doxycycline	Amoxicillin	Rifampin	Cefuroxime axetil	Azithromycin	Atovaquone	Ciprofloxacin	Erythromycin	Streptomycin	Supportive care (fluids and antipyretics)	Remove tick
Lyme Disease	●	●	●											●	●	●									●	●	●	●							●
Anaplasmosis, Human Granulocytic Anaplasmosis (HGA)	●	●	●	●										●			●	●							●	●	●								●
Human Monocytic Ehrlichiosis (HME)	●		●	●	●												●								●	●	●								●
Human Ewingii Ehrlichiosis (HEE)					●												●								●	●	●								●
Babesiosis	●	●												●																+	●				●
Cat Scratch Disease						●													●								●								●
Rocky Mountain Spotted Fever (RMSF)				●	●		●			●										●					●										●
Colorado Tick Fever							●														●														●
Southern Tick-Associated Rash Illness (STARI)					●												●								●	●									●
Tickborne Relapsing Fever (TBRF)											●	●										●									●	●			●
Tularemia				●	●		●		●														●	●								●		●
***Powassan Disease, (Tickborne Encephalitis, Deer Tick Virus)**	●	●	●																			●													●
Q Fever								●					●					●						●	●										●
Tick Paralysis								●																											●

vector **reservoir** **treatment**


TICK
A CREEPING SEPTIC TANK THAT CAN MAKE YOU SICK AND CAN EVEN KILL YOU
PREVENTION IS THE KEY
avoid | ticky places
Ticks
They're everywhere—each dot represents more ticks than you want to think about.
AVOID CONTACT with the tick populations by staying away from the wooded and brushy areas that ticks call home. Woodlands, fields, and the brushy edges between them are prime habitat for some of the common hosts for the ticks that carry disease.
Black Legged Tick (deer tick)
Responsible for Lyme Disease, female shown at right with reddish butt; male have a brown back with a lighter border (below left); actual size of adult is black dot (below right)
White-tailed deer & White-Footed mice
Two of the most common reservoirs in nature that harbor disease-carrying ticks
dress right | find & destroy
Wear snug-fitting long-sleeved shirts (even when it's hot).
WEAR THE RIGHT STUFF: long-sleeved shirts, long pants with the cuffs tucked into your socks, shoes instead of sandals.
Several manufacturers make clothing pre-treated with insecticides such as permithrin.
CHECK YOURSELF when you come inside: remove your clothes and check for ticks. Wash the clothes and dry in a hot dryer (kills ticks)
Tuck your pants into your socks and wear boots
repel & kill | through chemistry
DEET for skin—re-apply as needed (every 1 – 2 hours)
PERMETHRIN for clothing—it can provide several days of protection, even if laundered or worn in the rain (does not adhere to skin); turn pants inside out and apply from knee to cuff.
Permethrin is a synthetic form of pyrethrin, a naturally occurring insecticide found in chrysanthemums.
Pyrethroids are safe for humans and dogs, but can kill cats.
do this | if bitten
DON'T PANIC!
Just calmly remove it
GRASP THE TICK with fine-tipped tweezers.
PULL UP AND OUT with steady, even pressure.
DON'T SQUEEZE TWIST OR TUG as you may break off the tick body and leave the mouth parts in place, or squirt the tick's innards (where the disease is) into the wound.
CLEAN the site and your hands with rubbing alcohol, iodine, or soapy water.
DISPOSE of the tick (submerge in alcohol.
AVOID folklore remedies (e.g., painting the tick with nail polish) to make the tick detach. Remove the tick as quickly as possible.
The best tick
(other than no tick on us) is a tick firmly grasped in tweezers
Lyme Disease is hard to diagnose
Concentric pink rings sometimes occur in patients—although not always. And testing often gives false positives. This is one disease that is best avoided, and it's not that hard to do.
LYME DISEASE—it's nasty and it's spreading.
Of all the tick-borne diseases, perhaps none has caused more suffering as Lyme Disease.
Although known for over 100 years, it was first formally identified in Connecticut in 1975.
Found in temperate regions of the Northern Hemisphere and spread by the black legged tick, Lyme disease presents with a host of flu-like symptoms and can cause long-lasting, and even permanently disabling damage. If caught early, antibiotics can cure the disease—unfortunately, it often goes misdiagnosed.
The Centers For Disease Control (CDC) estimates 300,000 new cases of the disease in the US (with about 30,000 confirmed), most occurring in the Northeast and upper Midwest.
Prevention is key: if the tiny ticks are removed within 24 hours, infection is highly unlikely. If you live with black legged ticks, check yourself often!
REPORTED LYME DISEASE CASES | by year
an alarming trend (source: CDC)
tick-proof | your yard
REMOVE | leaf litter
and other loose vegetation—keep your immediate yard clutter-free
DISCOURAGE | animals
with fencing, and minimize potential food sources (e.g. uncovered household compost)
CREATE | a barrier
a 3-foot strip of gravel or wood chips works well
STORE | firewood
in a dry area to discourage rodents and their ticks
USE PESTICIDES designed to kill ticks (acaricides). They are cheap, very effective, and safe when applied correctly. This family of products is sold under many names.
APPLY PESTICIDES in early May and again in early June. (Read the directions carefully and apply as directed.)
CONTACT A PROFESSIONAL EXTERMINATOR to treat the yard area with acaricides. For persons
KEEP | lawn short
long grass is favorite tick habitat
REMOVE | trash
and old furniture, or keep in a garage or outbuilding
CUT & CLEAR | brush & tall grass
garden borders, field and woods edges should be kept trimmed back and clear
Tick-borne diseases
vectors
reservoirs
treatment
Deer tick
American dog tick
Lone Star tick
Gulf Coast tick
vector
reservoir
treatment
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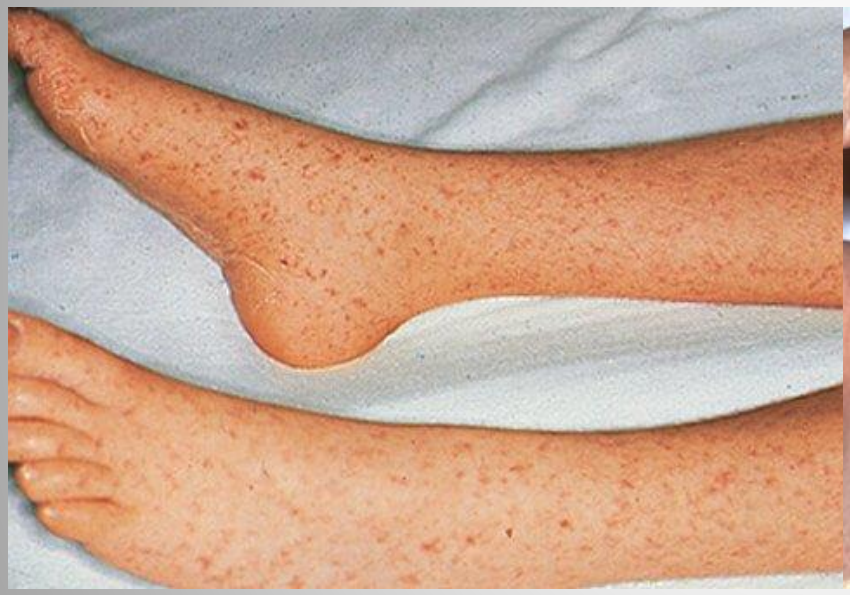
Tickborne Diseases in the USA:

- Lyme Disease (*Borrelia burgdorferi & Borrelia mayonii*)
- Lyme-like Disease (*Borrelia miyamotoi*)
- Tick-borne Relapsing Fever (various species of *Borrelia*)
- STARI – Southern Tick-Associated Rash Illness (*Borrelia lonestari*)
- Cat Scratch Fever (*Bartonella hensaelae*)
- Rocky Mt Spotted Fever (*Rickettsia rickettsii*)
- Spotted fever rickettsiosis (*Rickettsia parkeri*)
- 364D Rickettsiosis (*Rickettsia phillipi*) – California only
- Human Monocytic Ehrlichiosis (*Ehrilchia chaffeensis*)
- Human Ewingii Ehrlichiosis (*Ehrlichia ewingii*)
- Anaplasmosis (*Anaplasma phagocytophalia*) – (was HGE)
- Babesiosis (*Babesia microti*)
- Tularemia (*Francisella tularensis*)
- Q Fever (*Coxiella burnetii*)
- Colorado Tick Fever (RNA *coltivirus*)
- Powassan encephalitis (*Flavivirus*)
- Bourbon Virus (*Thogotovirus*)
- Heartland Virus Disease (*Phlebovirus*)
- -- not infectious disease related --
- Tick Paralysis (neurotoxin)
- Alpha Gal mammalian meat allergy (galactose-alpha-1,3-galactose)

Lyme Disease

Cat Scratch Fever

Rocky Moutain Spotted Fever



Tularemia Ulceration

Colorado Tick Fever

+ Tick bites can induce an allergy to red meat!

Alpha Gal Meat Allergy

Galactose – alpha – 1,3 – galactose (“alpha gal”).
Produced in the gut of the tick, injected into victim.
Antibodies made against alpha gal.
Alpha gal also found in red meats, mammalian and poultry.
Allergy can range from hives to anaphylaxis.

It is very plain and simple:

No one can afford to get chewed on by ticks any more!

No one should risk a tick bite ever again.

It is all about prevention, prevention, prevention.

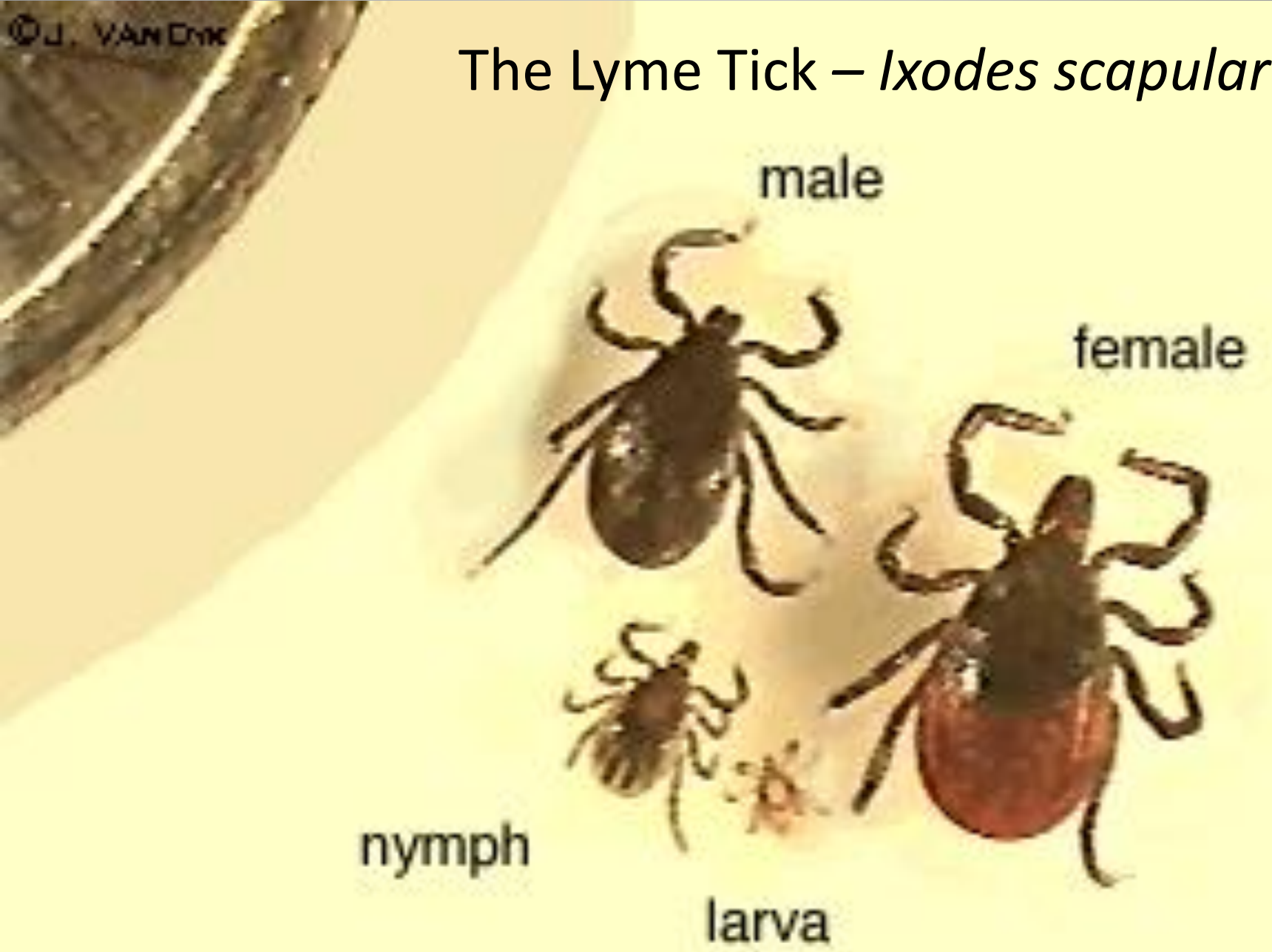
c/c: Tick Bite

- 24yo male, presents to your office c/o a rash on the back of his right shoulder over the past 4 days that is increasing in size daily. Admits to mild itchiness.
- He denies any fever, chills, sore throat, cough, bruising, or arthralgias.
- He states that he has 2 dogs and for the past several weeks he has removed a lot of ticks from his dogs and himself.
- One of his neighbor's dogs has recently been diagnosed and treated for Lyme Disease.

Black Legged Tick - The Lyme Tick

Ixodes scapularis

The Lyme Tick – *Ixodes scapularis*



The Lyme Rash – Eythema Migrans

Patient with rash

- 48yo male, has just returned for the coast of Georgia and Alabama and he is c/o a rash on his lower abdomen that has been increasing in size for the past 3 days.
- He admits to low grade fever, general malaise, mild headache.

The Rash

Lone Star Tick

Lyme Disease by the number

- Epidemiolgy: cases reported to the CDC:
- 1999 - 15,127 - most from the Northeast and Mid-Atlantic states
- 2000 - 12,874
- 2001 – 17,029 – reported in 43 states and DC.
- 2002 – 23,763 – reported in all states except Hawaii, Montana, Oklahoma
- 2007 – 27,000
- Since 2008, averaging 30,000 cases per year
- National average is 9.1/100,000
- Still most common in the Northeast and Mid-Atlantic states – NH is #1, Carroll County is #1 in NH
- CDC states that we are only treating 1 out of 10 cases

Mosquitoborne viruses - 2014

• West Nile Virus	1,301
• St Louis Encephalitis	3
• Eastern Equine Encephalitis	5
• Western Equine Encephalitis	0
• La Crosse Encephalitis	34
• Dengue – local	422
• Dengue – imported	250
	2015

Lyme Disease

- Distribution:
  - children ages 5-14
  - adults ages 50-59
- Seasonal:
  - May (7%)
  - June (28%)
  - July (31%)
  - August (12%)
- Symptoms:
  - EM (68% of cases)
  - arthritis (33%)
  - Bell's Palsy (8%) (Bell's Palsy a second time is Lyme)
  - radiculopathy (3%)

Lyme - Etiology

- Spirochete - *Borrelia burgdorferi* & *mayonii*

  (*B. garinii* & *B. Afzeli* in Europe)
- 1970's - investigation of a cluster of JRA in Old Lyme, CT.
- Isolated in 1981.
- Like syphilis, Lyme Disease is a great imitator.
- Very significant infectious disease that can cause life-long morbidity.

Lyme - Vector

- Deer tick *Ixodes scapularis* (east) & *I. pacificus* (west):
- The life cycle of a tick; egg, larva, nymph, or adult.
  - The nymph and adult stages can spread Lyme Disease.
- It is said that, a tick has to be attached for at least 24 hours to transmit Lyme Disease. Maybe!
- Yet, only 1 hour to transmit Powassan Disease.
- Typically spread by nymph because they are so hard to see.
- Most common reservoir are white-footed mice and chipmunks, not white-tail deer.
- White-tail deer geographically distribute Lyme Disease.

Lyme - Pathophysiology

- Lyme spirochete is rapidly distributed to all parts of the body, including CNS.

- All forms of the disease are disseminated disease.

Yes, we do have Lyme Disease in Africa

Lyme – Diagnosis
Rash – Erythema Migrans

- Rash:

  Erythema Migrans (EM) is diagnostic, if > 5cm.

  - occurs in 3 - 30 days.

  - does not have to appear at the bite site.

  - may appear in multiple sites at once.
- Is the only absolute indicator of Lyme, may only be seen in 50 - 80% of cases.
- May take 1 month to develop serologic antibody titers.

EM, flulike symptoms, and exposure do not require laboratory confirmation before treatment.

Diagnostic Recommendations

- ELISA, IgM & IgG titers will be negative in early LD.
- IgG more likely to be positive with disseminated or late-stage disease.
- False negative serologies approach 30%.
- False positives are about 10%.
- Western Blot has been replaced with a Tick Panel.
- If Western blot negative, but still suspicious, repeat in 4 - 6 weeks.

? To treat and repeat?

Diagnostic Recommendations

- LP when neurologic findings are present
  - CSF + if:
  - Lymphocytic pleocytosis, mildly elevated protein.
  - Absence of oligoclonal bands or myelin basic protein (MS).
  - Can have oligoclonal bands specific to *Borrelia*.
  - (+) culture for *B. burgdorferi*.
  - (+) serology for Lyme antibody.
  - (+) polymerase chain reaction (PCR).
- MRI scan for areas of inflammation.
  - Can be very similar to MS.

Stages of Lyme Disease

- Stage 1: Early localized disease:
  - Incubation is 1 - 30 days.
  - Erythema migrans (50 - 80%), 7 – 14 days after the tick is removed.
  - Flu-like sxs within days: Fever, headache, myalgias, arthralgias, and neck stiffness.
  - May be asymptomatic.
  - Lymphadenopathy, regional more often than generalized.

Stage 2 – disseminated

- Stage 2: Early disseminated disease:
  - Weeks to months.
  - Multiple erythema migrans - secondary annular lesions.
  - Cranial neuropathies - 15% (may appear like a Bell's palsy).
    - CN 6, 7, 8
  - Lymphocytic or aseptic meningitis.
  - Cardiac manifestations - 8%: conduction defects, pericarditis, cardiomyopathy.
  - Orchitis, hepatitis, iritis, conjunctivitis, hepatosplenomegaly.
  - Migratory arthralgias.
  - Erythematous throat.

Stage 3 – late or chronic disseminated

- Stage 3: Late or chronic disseminated:
  - Months to years.
  - Arthritis - 50%, synovitis, tendinitis, bursitis
  - Neuropsychiatric behaviors: psychosis, dementia, memory loss, depression.
  - Encephalopathic symptoms: headache, confusion, fatigue, memory loss.
  - May mimic other CNS diseases: MS, Parkinsonian, stroke-like, neuronitis.

I HATE TICKS

Neuroborreliosis

- Suggested criteria for diagnosis of neuroborreliosis:
- No past history of neuroborreliosis
- CSF anti-*B burgdorferi* antibodies
- Positive anti-*B burgdorferi* antibody index (European)
- Favorable clinical outcome after proper antibiotic therapy
- Absence of alternative diagnosis

- *Neuroborreliosis spans all stages – it can begin as early as 3 weeks after infection.*

Cranial Neuritis

- Cranial neuritis: 50-60%
- CN 7, Bell's Palsy is the most common.
- But, can be bilateral, 35%, and can affect other cranial nerves.
- Radiculoneuritis: 45%
- CNS involvement 15-20%

Aseptic Meningitis

- Aseptic Meningitis in 15-30% of untreated patients:
- Headache – 50%
- Fatigue – 40%
- Fever or myalgia – 30%
- Neck stiffness – 20%
- Photophobia – 20%

Encephalopathy

- *Borrelia* encephalopathy:
- Mild confusional state
- Disturbances in memory, concentration, sleep, mood, personality, and language.
- Depression

Encephalomyelitis

- *Borrelia* encephalomyelitis:
- Rare, occurs in late disseminated disease.
- Hemiparesis, ataxia, seizures, cognitive impairment, bladder dysfunction, and hearing loss

Radiculoneuritis

- Acute radiculoneuritis:
- 50 – 85% of cases.
- Can occur in 2 – 4 weeks after infection
- Acute onset of motor deficits, severe radicular pain, and sensory loss
- Inflammatory radiculoneuropathy is indistinguishable from spinal-root compression

Peripheral Neuropathy

- Peripheral neuropathy:
- Decreased vibratory sensation in the lower extremities
- Stocking glove distribution

Neuropsychiatric

- Neuropsychiatric findings:
  - Depression
  - Anxiety
  - Schizophrenia-like psychosis
  - Bipolar disorder
  - Dementia

Cardiac & Ophthalmic

- Acute-onset atrioventricular conduction abnormalities & blocks -8%
- Ophthalmic findings – 5%
- Iritis
- Keratitis
- Retinal vasculitis
- Optic neuritis


Maasi Mara Kenya

Treatments

- Tick bite, Lyme Disease, prophylaxis:
  - One dose of doxycycline 200mg po
  - What about children < 8yo?
    - CDC is now recommending using doxycycline in all ages for treating anaplasmosis.
    - Concern about staining the adult teeth in children.
    - Does not occur with doxycycline.
    - No evidence with up to 5 treatments before 8yo.

Doxycycline

Treatment : Early-Stage Disease

- Erythema migrans and other symptoms of early dissemination:
  - **Doxycycline 100mg po bid x 3 weeks.**
    - **Peds: <45kg – 2.2mg/kg bid**
  - Amoxicillin 500mg po tid x 28 days.
    - peds: 50mg/kg.day div tid
  - Cefuroxine 500mg po bid x 28 days.
    - peds: 250mg po bid

Lyme: Neurologic Disease

- Cranial nerve palsy:
  - doxycycline or amoxicillin
- Aseptic meningitis or radiculopathy:
  - Parenteral ceftriaxone 2gms/day IV
    - (peds: 100mg/kg/day IV)
  - Penicillin G, 20 – 24 million units/day IV
    - (peds: 300,000units/kg/day IV)

Lyme: Cardiac Disease

- 1st or 2nd degree heart block:
  - doxycycline or amoxicillin.
- 3rd degree heart block:
  - ceftriaxone or PCN G IV

Lyme: Arthritis

- First episode of arthritis:
  - doxycycline or amoxicillin.
- Recurrent arthritis after oral regime???
  - doxycycline, amoxicillin, or ceftriaxone, PCN G.
- Persistent arthritis after parenteral therapy???
  - Treat the symptoms.
- Chronic Lyme Disease, post Lyme syndrome???
  - Treat the symptoms.

Not controversial

- Tick bite, Lyme prevention is doxycycline 200mg po once.
- Doxycycline 100mg po bid for a minimum of 21 days or
- Amoxicillin 500mg po tid for a minimum of 28 days.
- If younger than 8 years old, use amoxicillin 50mg/kg/d into 3 doses.
- Alternative: cefuroxime (Ceftin) 500mg po bid x 6 weeks.
- Parenteral: ceftriaxone (Rocephin) 2g IV once daily for 2 - 6 weeks.

Controversial

- Chronic Lyme Disease and long-term use of antibiotics.
- No evidence to suggest that long-term antibiotics improve the outcome.
- It is an autoimmune disorder not infectious.

Lyme: Prevention

- Insecticide Permethrin, apply to clothing, long-acting.
- Insect repellent DEET, can apply to skin, have to reapply frequently.
- Protective clothing.
- Tick checks several times a day.
- LYMErix vaccine is no longer available, stopped in February 2002.

Summary of Tickborne Diseases In the North America:

DISEASE	ORGANISM	TREATMENT
Lyme Disease	- *Borrelia burgdorferi*	**(doxycycline)**
Lyme-like Disease	- *Borrelia miyamotoi*	**(doxycycline)**
Cat Scratch Fever	- *Bartonella hensaelae*	(azithromax)
Rocky Mountain Spotted Fever	- *Rickettsia rickettsii*	**(doxycycline)**
Human Monocytic Ehrlichiosis	- *Ehrlichia chaffeensis*	**(doxycycline)**
Human Ewingii Ehrlichiosis	-*Ehrlichia ewingii*	**(doxycycline)**
Anaplasmosis (HGA)	- *A. phagocytophalia*	**(doxycycline)**
Colorado Tick Fever	- RNA *coltivirus*	(not needed)
Babesiosis	- *Babesia microti*	(atovaquone)
	• Atovaquone + azithromax, or clindamycin + quinine	
Tularemia	- *Francisella tularensis*	(doxycycline)
Tick Relapsing fever	- various species of *Borrelia*	**(doxycycline)**
STARI	- *Borrelia lonestari*	**(doxycycline)**
Tick paralysis	- neurotoxin	(remove tick)
Q fever	- *Coxiella burnetii*	**(doxycycline)**
Powassan encephalitis	- *Flavivirus*	(no treatment)
364D Rickettsiosis	- *Rickettsia phillipi*	**(doxycycline)**

Comorbid Factors

- Other tickborne diseases commonly found with Lyme Disease:
- Anaplasmosis
- Babesiosis micortis - Babesoisis
- Baronella henselae – Cat Scratch Fever


Mwisho na asante sana

Cat Scratch Fever
Bartonella hensaelae

Vector is thought to be ***Bartonella hensaelae.***

- First diagnosed in 1931.
- Incidence is 22,000/yr or 6.6/100,000 in the USA.
- Usually a pediatric infection.
- Transmission:
  - is by a flea bite, tick bite,
  - or cat licking an open wound, dog bite,
  - crab claws, cactus spines.

Symptoms of CSD

- Incubation is 3 – 30 days.
- Primary lesion: a single brownish papule or pustule,
  2 – 5mm.
- Can last 1 – 4 weeks.
  Regional lymphadenopathy, can last 4 – 6 weeks.
- Other sxs: low grade fever, nausea/vomiting, malaise, anorexia, weight loss, sore throat, headache, splenomegaly.
- Can involve CNS, liver, spleen, and lungs.
  - Significant abscesses.

Diagnosis of CSD

History cat-related injury,
flea or tick bites.
+ skin test no longer considered accurate.
+ blood test - IFA (90% specific, 50% sensitive)
or biopsy of the affected nodes.
Negative PPD.
Characteristic lymph node lesions.

Primary lesions - CSD

Treatment of CSD

CSD antibiotic efficacy not proven,
most recover on their own over 2 – 5 months.
can cause very significant abscess disease..

Zithromax (azithromycin), “Z pack”
has been shown to shorten recovery.

Rocky Mt Spotted Fever

RMSF – *Richettsia richettsii*

- First recognized in 1896.
- Most prevalent in south-central and coastal southern states.
- Transmitted by wood and dog tick species.
- Most common in the southeastern US.
- About 1000 cases reported per year, mostly in children.
- Without prompt and appropriate treatment can be fatal.

Symptoms of RMSF

- Incubation is 2 –14 days after tick bite.
- Initial onset includes fever, chills, severe headache, muscle pain, mental confusion, followed by the rash.

Rash, starts on wrist and ankles then moves centrally up the extremities, typically spares the face.

Diagnosis of RMSF

- The rash, bx of the rash may show
  R. rickettsii.
- Blood and protein in the urine.
- Antibody titer by complement fixation or immunofluorescence.
- Low platelets, low RBC.
- Elevated creatinine, possible clotting disorder with elevated PT & PTT.

Treatment - RMSF

- Treatment:

  doxycyline 100mg po

  bid x 7 days.
- Vaccine: no vaccine available.

Ehrlichiosis

- Acute infection without chronic long-term consequences.
- Ehrlichia bacteria belong to the family Rickettsiae.

Human Monocytic Ehrlichiosis: *Ehrlichia chaffeensis*

- First described in 1987.
- Transmitted by the lonestar tick, *Amblyomma americanum* and the american dog tick, *Dermacentor variabilis*.

Anaplasmosis

- Anaplasmosis (HGA): *Anaplasma phagocytophalia*
- First described in 1994.
- Transmitted by the *Ixodes* species.
- (*Ehrlichia ewingii* is the most recently recognized human pathogen.)

Distribution – HME & HGA

- Distribution:
  - found mainly in Southeast and south central states
  - has been reported in upper Midwest and Northeast.

Symptoms – HME & Anaplasmosis

Onset is 7 - 10 days after the tick bite.

- Fever, chills, severe headache, malaise, muscle pains, they can also have nausea, vomiting, confusion, and joint pain.
- Rash may occur in HME but not HGE, it is similar to RMSF.
- Most people do not seek medical attention, but it can be fatal.

Diagnosis & Treatment

- Diagnosis:

  CBC: lower WBC count, low platelet count,

  LFT: elevated ALT, AST, LDH

  DX by PCR in first 10 days,

  then IFA after 21 days.

  Treatment: doxycycline 100mg po

  bid x 14 days.

Colorado Tick Fever: *RNA virus*

- Acute viral infection.
- Self-limiting, not dangerous. Dengue-like.
- Transmitted by a dog tick, *Dermacentor andersoni*.
- Distribution: western US,
- Seasonal: March to September.

Symptoms of CTF

Onset is 3 – 6 days after tick bite,

Fever continues for about 3 days,

then stops, then recurs in 1 – 3 days,

then again several days later for several days.

Fever, sweating, severe muscle aches,

joint stiffness, photophobia, nausea,

vomiting, generalized weakness,

occasional faint rash.

Diagnosis & Treatment of CTF

- Diagnosis:

  Can confirm infection several weeks later by complement fixation for Colorado Tick Fever or by immunofluorescence.

  CBC – low WBC
- Treatment:

  Remove the tick fully.

  Pain reliever may be necessary.

Babesiosis: *Babesia microti*

- Malaria-like illness that invades erythrocytes.
- Transmitted by *Ixodes* deer ticks.
- Rare – 200 cases reported since 1968.
- Used to be rare, not any more!
- Distribution is along the immediate coast and the off-shore islands of the Northeast.

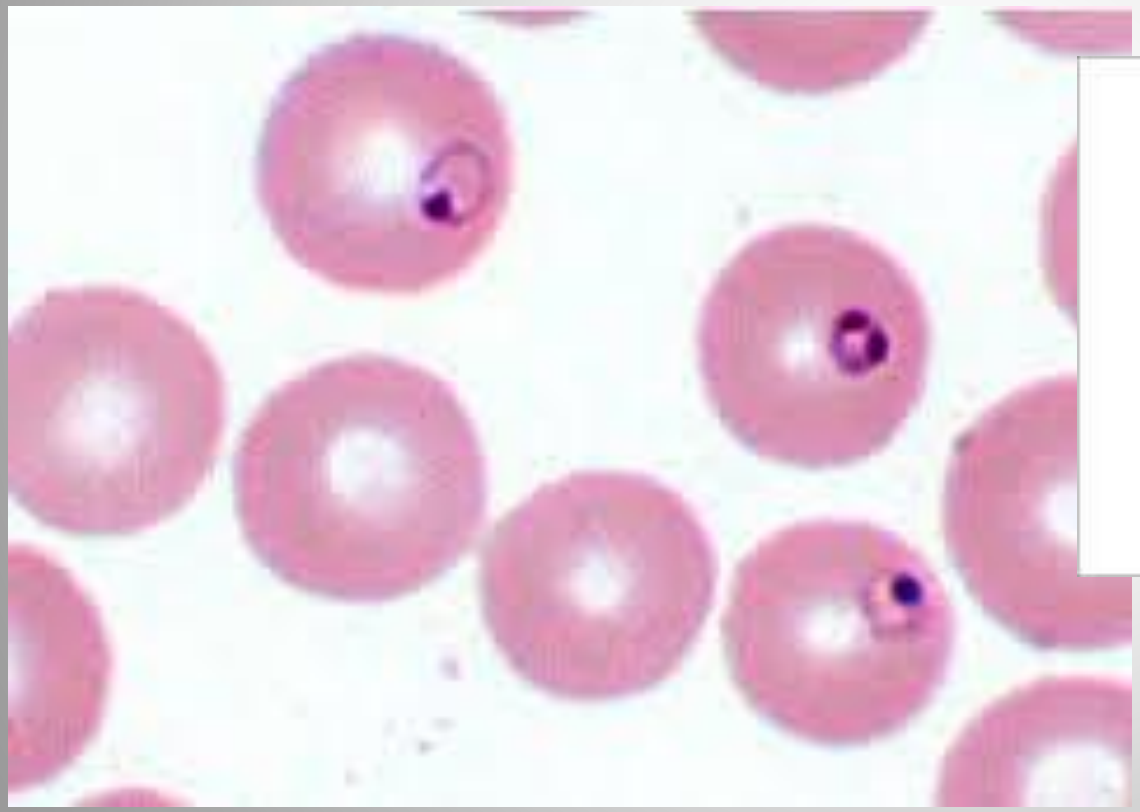
Symptoms - Babesiosis

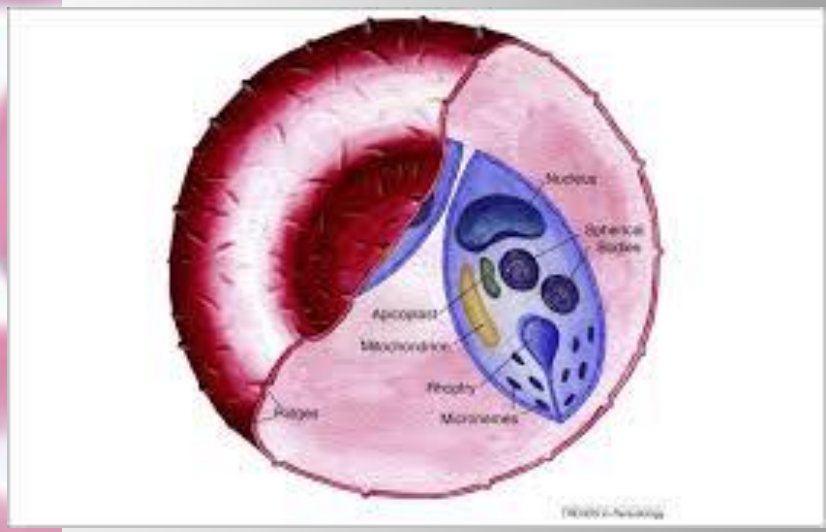
- Symptoms: onset about 7 days post tick bite.
- Malaise, anorexia, fatigue that progresses to high fever, drenching sweats, muscle and joint pain, headache, nausea, vomiting, cough, dark urine.

Diagnosis & Treatment of Babesiosis

- **Diagnosis** is made by blood smear, finding the characteristic “ring” in the RBCs.
- **Treatment:**
  - atovaquone (Mepron) 750mg po bid x 7 – 10 days
  - (repeat dose based on LFTs and CBC) +
  - azithromycin (Zithromax) 500mg PO day one then 250mg PO x 6 days
- Or:
  - quinine sulfate 650mg PO tid x 7 days +
  - clindamycin 300-600mg PO tid 7 days

Peripheral Smear






OVERLAND
MISSIONS

Tularemia: *Francisella tularensis*

- Stockpiled as a biological weapon in the 1960's.
- Can survive for weeks at low temperatures in water, moist soil, hay, or carcasses.
- Worldwide 500,000 cases per year.
- USA 150 – 300 cases per year.
- Transmission: handling infected tissues or pelts of cottontail rabbits, from bites from ticks or deer flies, or from eating infected meats.
- Can pass through unbroken skin.

Symptoms - Tularemia

- Incubation is 1 – 21 days.
- Erythematous skin papule forms at the entry site that progresses to a skin ulceration with fever and lymphadenopathy, axilla and inguinal.
- Entrapment in reticuloendothelial organs induces abscesses.

Tularemia skin ulceration

Symptoms of Tularemia cont':

- Headache, muscle ache, conjunctivitis, fever, chills, sweating, dyspnea,

  weight loss, and joint stiffness.
- If inhaled, multiply causing necrotizing granulomata in the alveoli (weapon).
- Bacilli survive inside monocytes.

Diagnosis of Tularemia

Skin ulcers with regional lymphadenopathy and fever = tularemia.

- Smears of aspirates from nodes will contain organisms.
- Forshay's test = skin test antigen.
- Serology for tularemia.
- Blood cultures for tularemia.
- Chest Xray

Treatment of Tularemia

- Gentamycin or Tobramycin
- Tetracycline
- Chloramphenicol also effective, but relapses occur.

Tickborne Relapsing Fever: Various species of *Borrelia*

- Transmitted by soft ticks: *Ornithoduros sp*
  From rodent reservoir.
- Inoculation occurs in minutes.
- Massive spirochetemia - *Borrelia*

Symptoms of Tickborne Relapsing Fever

Onset in 3 – 18 days,

- Abrupt onset of:

  high fever, shaking rigors, headache, muscle pains, weakness, anorexia, cough, nausea, vomiting, abdominal pain.
- Relapses 3 – 10 times, each time the symptoms are less severe.

Diagnosis & Treatment of Tickborne Relapsing Fever

- **Diagnosis: blood smear**
  70% will show spirochetes.
- **Mortality rate is 1% with treatment, 30 – 70% without.**
- **Treatment:**
  tetracycline
  doxycycline
  erythromycin
  chloramphenicol

STARI – *Borrelia lonestari*

- **Southern Tick-Associated Rash Illness:**
- Rash similar to Lyme Disease.
- Distributed in the southeastern and south-central states.
- Transmitted by the lone star tick, *Amblyomma americanum*.
- Symptoms:

  similar to Lyme's including EM.

Lone Star Tick

Lone star tick & Dog tick

Distribution of STARI

Q fever: *Coxiella burnetii*

- Can cause pneumonia, hepatitis, and endocarditis.
- Transmitted by inhaling contaminated droplets from infected animals or by ticks.
- Incubation is about 20 days.

Symptoms of Q fever:

- Acute:
  - Flu-like illness, that can last up to 3 weeks, with high fevers, headache, and muscle pain.
  - Can develop pneumonia (1/3 of cases), & hepatitis.
- Can develop into chronic Q fever if untreated over 6 months.
  - Endocarditis, aneurysm, cirrhosis, lung scarring.

Diagnosis & Treatment of Q Fever

- Diagnosis:

  Antibody titer.

- Treatment:

  Acute: doxycycline.

  Chronic: doxycycline + hydroxychloroquine


USAID

Tick Paralysis:

- Neurotoxin in the saliva
- Human cases are rare and usually occur in children under 10.
- Engorged gravid female produces a neurotoxin in its salivary glands.
- Once the tick is removed the symptoms diminish rapidly.
- Can occur anywhere there are ticks.
- Onset is usually after the tick has been attached for about 5 – 7 days, usually on the scalp.

Symptoms & Treatment of Tick Paralysis

Symptoms:

- Fatigue, numbness of the legs, muscle pains.
- Paralysis develops from the lower extremities to the upper extremities and, if the tick is not removed, tongue and facial paralysis will occur.
- Can progress to convulsions and respiratory failure.

Treatment:

- Remove the tick and the mouth parts.

CDC – August 2015
Symptoms of Powassan Virus (POW)

- Many people who become infected with Powassan (POW) virus do not develop any symptoms.
- The incubation period (time from tick bite to onset of illness) ranges from about 1 week to 1 month.
- POW virus can infect the central nervous system and cause encephalitis and meningitis.
- Symptoms include fever, headache, vomiting, weakness, confusion, loss of coordination, speech difficulties, and seizures.
- Approximately half of survivors have permanent neurological symptoms, such as recurrent headaches, muscle-wasting and memory problems.
- Approximately 10% - 50% of POW virus encephalitis cases are fatal.

Diagnosis of POW

- CDC testing for blood samples or CSF for antibodies directed against POW

- Treatment: Supportive care!
- Same for:
- Powassan Disease (POW)
- Heartland Virus (HRTV)
- Bourbon Virus
- Colorado Tick Fever

Tickborne Illness - Travelers

- Lyme Disease in Europe & Asia. (*Borrelia afelzi)*
  RX = **doxycycline**
- Crimean-Congo Hemorrhagic Fever
  in Africa and the Middle East.
  Rx = **doxycycline**
- Kyasanur Forest Disease in India.
  Rx = **doxycycline**
- Tickborne encephalitis in Europe.
  Rx = **doxycycline**
- African Tick Fever in Africa.
  Rx = **doxycycline**

Prevention of Insectborne Disease

- Prevention of zoonoses and arborviruses is prevention of insect bites.
- Insect repellents, DEET, permethrin, NEEM.
- Permethrin – does not stick to skin.
- Clothing – including tick-proof gaiters.
- Sleeping under mosquito netting.
- Tick checks.


twalomba


Asante sana