**Rickettsia, Ehrlichia, and Borrelia**

Risk Factors for infection: exposure to vector (tick/louse/mite)

**Rickettsia**
fastidious, gram negative bacteria, which are obligate intracellular pathogens

Pathogenesis:
- vector bites and feeds
- regurgitates bacteria into skin bite site
- Bacteria carried via lymphatics to small blood vessels to general circulation where they invade endothelial cells (primary target)
- spreads to contiguous endothelial cells, smooth muscle cells, and phagocytes
- eventually spread via the microcirculation and invade all organs systems

**ENDEMIC DISEASES**
Rocky mountain spotted fever (R. rickettsii) vector=tick
Murine typhus (R typhi) vector=flea

**EPIDEMIC DISEASES**
Rickettsialpox (R. akari) vector=mite
Epidemic typhus (R. prowazekii) vector=louse

**Rashes**
Rickettsial species cause a petechial rash in early disease that starts on trunk and spreads outward (centrifugal).
Two notable exceptions:
- *R. akari* has a characteristic papulo-vesicular rash (looks like chicken pox).
- *R. rickettsii* starts on the wrists, ankles, soles, and palms and then spreads proximally (centripetal)

**Rocky Mountain Spotted Fever**
Causative agent: *Rickettsia rickettsii*
Vector: tick
- May-Sept (peak months when people are outside with potential tick exposure)
- Endemic regions are South Atlantic and South Pacific states
- After 7-14 d asymptomatic incubation period, sudden onset of fever, headache, malaise, myalgia.
- GI disturbances, hepatomegaly and jaundice can occur in the later stages
- rash with three stages:
  1. erythematous macule - blanches on pressure
  2. macular papular - a result of fluid leakage from infected blood vessels
  3. hemorrhage - into center with frank petechiae
Endothelial invasion leads to angiitis with local thrombus formation and subsequent end organ damage

Diagnosis
*R. richettsii*:
- fastidious organism (hard to culture and stain)
- skin biopsy
- PCR
- Serologies

Treatment
doxycycline

**Rickettsialpox**
Causative agent: *Rickettsia akari*
Vector: mite
An eschar forms right at the bite site
A papular-vesicular rash with fever, headache, lymphadenopathy, chills, myalgia

Diagnosis

Treatment
Self-limited
Doxycycline or tetracycline

**Epidemic Typhus**
Causative agent: *R. prowazekii*
Vector: louse
Crowding and poor sanitation
Incubation approximately one week with the abrupt onset intense headache, chills, fever, and myalgia.
No eschar
Rash starts fifth day of illness in the axillary folds and upper trunk, spread centrifugally, spares face, palms, and soles.

Diagnosis

Treatment
Doxycycline
**Ehrlichia**
Small, obligate intracellular gram negative bacteria that cause a flu-like illness (fever, HA, chills, myalgia, malaise)
Symptoms of ehrlichiosis are the same as those of rickettsial diseases
Lab results: thrombocytopenia, leukopenia, elevated LFT
Pathogenesis: enters via tick bite and spreads via lymphatics to the blood.
“Spotless” Fever (but 20-30% with HME can have rash)
Clustered inclusion-like appearance in the host cell vacuoles: morula (Latin for “mulberry”).
transmitted by ticks
Multiple species that infect either granulocytes or monocytes

**Human Granulocytic Ehrlichiosis (HGE)**
Causative agent: Anaplasma phagocytophilum
Vectors: Ixodes ticks
Reservoirs: white-footed mouse, chipmunks, and voles.
Year round disease with one peak incidence in July and then another in November
Northeast distribution
Can be severe: ARDS, septic shock like picture, rhabdomyolysis, neurologic sequelae including demyelination polyneuropathy or a brachial plexopathy.

**Human Monocytic Ehrlichiosis (HME)**
Vector: Lone star tick (*Amblyomma americanum*)
Reservoir: dog
Seasonal: May-July
Southeastern and Southern central U.S.

Diagnosis:

Treatment
Doxycycline or tetracycline.

**Borrelia**
Lyme Disease
-Causative agent *B. burgdorferi* a treponeme
-Vector: Ixodes ticks (nymphs)
reservoirs: the white-footed mouse, white tailed deer, cattle, horses, dogs
Clinical stages of infection:
1) local: erythema migrans
2) early disseminated -
  • Cardiac - heart block, myocarditis, myopericarditis
  • Musculoskeletal - generalized joint pain, joint effusion - the knee is the most common.
  • Neurological - meningitis, Bell’s palsy, peripheral neuropathy, encephalitis (extremely rare)
  • erythema migrans may persist
3) chronic disseminated (months to years after bite)
• chronic destructive arthritis of the large joints,
• end stage cardiomyopathy
• stroke, meningoencephalitis, dementia, peripheral neuropathy which is irreversible
• acrodermatitits chronica atrophicans

Diagnosis: Use of antibodies

Treatment: oral versus IV

Other Borrelia:
*Borrelia hermsii
*Borrelia recurrentis*"

**Prevention of vector borne diseases**