**Rocky Mountain Spotted Fever (RMSF)**

**ORGANISM:** Rickettsia rickettsii is a genus of intracellular bacteria that causes the infections RMSF and associated Rickettsial Spotted Fevers. R. rickettsii is the species responsible for RMSF.

**VECTOR & DISTRIBUTION:**
Primary vectors include the Rocky Mountain Wood Tick, the American Dog Tick and the Brown Dog Tick. Therefore, the area at risk includes the entire continental United States and Mexico.

**SYMPTOMS:**
Early symptoms of RMSF include:
- Fever
- Headache
- Nausea/Vomiting
- Anorexia
- Myalgia
- Abdominal pain
- Rash

**DIAGNOSIS:**
POWV frequently progresses to encephalitis and/or meningitis, which typically leads to chronic neurological deficit or death.

**TREATMENT:**
Currently, there is no treatment protocol for POWV and therapy is primarily supportive.

**Tularemia**

**ORGANISM:** This rare and infectious disease is caused by Francisella tularensis.

**VECTOR & DISTRIBUTION:**
Tularemia has become evident worldwide, mainly in rural areas. It is spread by insect bites, dear flies, dog ticks, wood ticks, lone star ticks, and exposure to sick or dead animals. Occasionally, it can be spread by airborne bacteria found in soil, contaminated food or water, or by eating or handling undercooked meat of an infected animal.

**SYMPTOMS:**
- Skin
- Eyes
- Lymph nodes
- Fever/Chills
- Headache
- Exhuastion

**LAB TESTING:**
Laboratory findings can include thrombocytopenia, hyponatremia and elevated hepatic transaminases, but these are frequently not apparent early in the course.

**TREATMENT:**
Antibiotics targeting bacterial rRNA in ribosomal complexes are used, including macrolides, tetracyclines, ketolides, and fluoroquinolones which are bactericidal rather than bacteriostatic.

**Mycoplasmas**

**ORGANISM:** Mycoplasmas are small, self-replicating organisms found as both commensal and pathogenic bacteria in humans.

**VECTOR & DISTRIBUTION:**
Mycoplasma species are distributed throughout the United States. Direct exposure is the most accepted method of transmission. Certain Mycoplasma species, particularly M. fermentans, have been identified in blood-sucking arthropods, including lice, ticks. Reactivation is possible when the immune system is under attack, such as with Borelia infection.

**SYMPTOMS:**
Early systemic symptoms include fatigue and myalgias. In addition to atypical pneumonia, M. pneumoniae can also induce autoimmune hemolytic anemia. Late complications may involve the neurologic, cardiovascular, hematologic, gastrointestinal and integumentary systems and include:
- Pericarditis/Mycarditis
- Nephritis
- Encephalitis
- Meningitis

**TREATMENT:**
Once suspected, diagnosis can be confirmed by antibody testing or PCR. This is complicated by the fact that there are many species of Mycoplasma that can cause disease in humans and most testing is species-specific.

**Tularemia**

**DIAGNOSIS:**
A presumptive diagnosis of tularemia may be made through testing of specimens using direct fluorescent antibody, immunohistochemical staining, or PCR. Confirmation may be made by culture or acute and convalescent serology.

**NOTE:** These can persist even after treatment with antibiotics.

**Tularemia**

**POWV**

**DIAGNOSIS:**
POWV diagnosis requires a detailed history of possible exposure, signs and symptoms — and a high clinical suspicion. As the virus is contained in the tick’s saliva, transmission can occur within minutes of a bite. Confirmation by laboratory testing may include both blood and spinal fluid.

**POWV**

**TREATMENT:**
This infectious disease can be treated effectively with antibiotics, including doxycycline or IV gentamicin, if diagnosed early.
**Bartonella**

**ORGANISM:** Bartonella is a genus of small gram-negative intracellular organisms. Three species are responsible for the majority of human Bartonella infection.

**VECTOR & DISTRIBUTION:** The distribution of Bartonella species is worldwide; anywhere fleas, lice and ticks are found. Primary tick vector is the black-legged tick, the primary vector of Lyme disease.

**SYMPTOMS:** Symptoms are frequently neurological/psychological. They may involve a combination of body systems and include:
- Headaches, frequently frontal
- Chest pain/Palpitations
- Air hunger
- Dizziness
- Fever/Chills/Sweats/Body aches
- Jaundice
- Hepatosplenomegaly lasting about three days
- Very high temperatures, delirium and tachycardia are followed by drenching sweats
- Malfunction of vital organs
- Renal failure
- Hepatic failure
- Coagulopathies
- Toxins or septic shock-like syndromes
- “Babesia-like” symptoms such as:
  - Fever/Chills/Sweats/Body aches
  - Headache, frequently at vertex
  - Dizziness
  - Loss of appetite/Nausea
  - Chest pain/Palpitations
  - Arterial hypertension
- If left untreated, patients can develop complications, such as:
  - Low blood pressure
  - Hemolysis – Thrombocytopenia
  - Disseminated intravascular coagulation (DIC)
  - Malfunction of vital organs
  - Death

**DIAGNOSIS:**

- Patient history of suspected tick bite/episodes/travel history with developing symptoms
- General lab findings of anemia, thrombocytopenia, and elevated liver transaminases, elevated C reactive protein and hyponatremia. Confirmation may rely on a single elevated Ig G immunofluorescent antibody (IFA) titer or paired acute and convalescent IFA titers.

**TREATMENT:** To prevent progression to severe, life-threatening disease, start treatment if pathogen is suspected.
- Doxycycline is drug of choice for treatment in all ages.
- Short courses have not been shown to be harmful in children.

**Anaplasma Phagocytophilum**

**ORGANISM:** Anaplasma phagocytophilum is an obligate intracellular gram-negative bacteria of the order Rickettsiales.

**VECTOR & DISTRIBUTION:** Black-legged ticks, bodie scapularis and bole pacificus. Distribution includes most of the U.S. rust of the Rookies, the Pacific coast and temperate eastern Canada.

**SYMPTOMS:**

- In the early stages, within 1-2 weeks after the tick bite, mild to moderate symptoms include:
  - Headaches
  - Fever
  - Myalgias
  - Arthralgias

- In the later stages, within 5-14 days after the bite, if known, early symptoms of all species include:
  - Severe headaches
  - Fever
  - Malaise
  - GI symptoms include nausea, vomiting and anemia
  - Rash appear in less than 30% of adults, and 60% of children

**DIAGNOSIS:** A rash is rarely reported with this infection (<10% of cases). Therefore, presence of a rash may indicate a co-infection with other tick-borne pathogens.

**TREATMENT:** Treatment should begin early, based on clinical suspicion – delay can lead to increased morbidity and mortality.
- Doxycycline is the treatment of choice for Erlichia, as it is for most Rickettsial infections.

**Ehrlichia**

**ORGANISM:** Ehrlichia chaffeensis is an obligate intracellular, gram-negative species of Rickettsiales bacteria which is responsible for Human Monocytic Ehrlichiosis.

**VECTOR & DISTRIBUTION:** The primary vector, the Lone Star Tick, can be found across the southeastern and Atlantic coastal U.S. and stretching as far north as Maine and Minnesota. Ehrlichia muni-like agent (EM) is a species recently found in patients in Wisconsin and Minnesota and the vector is the Black-legged tick, Ixodes scapularis.

**SYMPTOMS:** Within 5-14 days after the tick bite, if known, early symptoms of all species include:
- Fever
- Headache
- Myalgias
- GI symptoms include nausea, vomiting and anemia
- Rash appear in less than 30% of adults, and 60% of children

**DIAGNOSIS:** Laboratory studies may reveal relative lymphopenia, thrombocytopenia, elevated serum transaminases, elevated C reactive protein and hypogammaglobulinemia. Confirmation may rely on a single elevated Ig M or Ig G immunofluorescent antibody (IFA) titer or paired acute and convalescent IFA titers.

**TREATMENT:** Treatment should begin early, based on clinical suspicion – delay can lead to increased morbidity and mortality.
- Doxycycline is the treatment of choice for Babesia, as it is for most Rickettsial infections.