Tickborne Disease Educational Handout

Tick Prevention Techniques

How to Repel Ticks on Skin and Clothing:

- Use a repellent that contains at least 20 percent DEET, picaridin, or IR3535 on exposed skin in order to have several hours of protection.
- Wear clothing that contains permethrin. You can treat your clothing and gear, such as boots, pants, socks and tents with products that contain 0.5% permethrin.

Finding and Removing Ticks from Your Body:

- Bathe or shower as soon as possible after coming indoors (preferably within 2 hours) in order to wash off and more easily find ticks that may be on you.
- Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body when you return from tick-infested areas. Parents should assist their children in checking for ticks under the arms, in and around the ears, inside the belly button, behind the knees, between the legs, around the waist, and especially in their hair.
- Ticks can ride into the home on clothing, gear, and pets, then attach to a person later, so carefully examine pets, coats, and day packs.
- You can tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks on dry clothing.

What ticks look like

- Relative sizes of blacklegged ticks at different life stages
- As a general rule, adult ticks are approximately the size of a sesame seed and nymphaal ticks are approximately the size of a poppy seed.

In VT 99.5% of all tickborne diseases are spread via the blacklegged tick. The diseases it can spread are Lyme disease, anaplasmosis, babesiosis, Powassan virus disease, and Borrelia miyamotoi disease.
Safely Removing a Tick

1. Use fine-tipped tweezers to grasp the tick as close to the surface of the skin as possible.

2. Pull straight upwards with steady, even pressure. Don’t twist or jerk the tick as this can cause the mouth-parts to break off and remain in the skin. If this happens, remove the mouth-parts using the tweezers. If you are unable to remove the mouth easily with the tweezers, leave it alone and let the skin heal.

3. After removing the tick, thoroughly clean the bite area and your hands with either rubbing alcohol, an iodine scrub, or soap and water.

4. Dispose of a live tick by either submerging it in alcohol, placing it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet. Do not crush a tick with your fingers.

Major Signs and Symptoms for Tickborne Diseases Carried by the Blacklegged Tick:

Lyme disease:

*Early Signs and Symptoms (3 to 30 days after tick bite):*

- Fever, chills, headache, fatigue, muscle and joint aches, and swollen lymph nodes are common
- Erythema migrans rash (sometimes clears as it enlarges, resulting in a target or “bull’s-eye” appearance): Occurs in approximately 70 to 80 percent of infected persons
- May feel warm to the touch but rarely will be itchy or painful

*Later Signs and Symptoms (days to months after tick bite):*

- Severe headaches and neck stiffness
- Severe joint pain and swelling, particularly the knees and other large joints.
- Loss of muscle tone or droop on one or both sides of the face
- Heart palpitations or experiencing an irregular heart beat
- Episodes of dizziness or shortness of breath
- Shooting pains, numbness, or tingling in the hands or feet
- Problems with short-term memory

Anaplasmosis:

- Most commonly reported symptoms are fever, malaise, muscle aches, headache, nausea, vomiting, fatigue, chills, and joint pain.
• Symptoms may not appear until 7-14 days after a tick bite due to its incubation period.
• Rash is rarely reported in patients with this disease and the presence of a rash may signify the possibility of coinfection with another organism.
• Severe clinical presentations may include difficulty breathing, hemorrhage, renal failure or neurological issues.

**Babesiosis: Babesia microti**

• Many people who are infected with Babesia microti feel fine and do not experience any symptoms.
• The most commonly reported symptoms when present include fever, headache, chills, sweats, body aches, nausea, appetite loss, fatigue, dark urine.
• Symptoms may not appear until 7-14 days after a tick bite due to its incubation period.
• In rarer cases, infection can lead to hemolytic anemia resulting in yellowing of the skin (jaundice) and dark urine.
• Can cause a severe infection in individuals who do not have a spleen, have a weak immune system or have serious health conditions such as liver or kidney disease.

**Powassan virus disease:**

• The most common symptoms are fever, headache, vomiting, and generalized weakness.
• Initial symptoms may not be present for 1-4 weeks due to its incubation period.
• Infection will usually progress to meningoencephalitis. This may present with meningeal signs, altered mental status, seizures, aphasia, paresis, movement disorders, or cranial nerve palsies.

**Borrelia miyamotoi disease:**

• The most common symptoms are fever (may be relapsing), muscle aches, fatigue, joint aches, chills, headaches.
• Initial symptoms may not be present for 12-16 days after tick bite.
• Rash is an uncommon finding.

**Laboratory and Diagnostic Testing:**

**Lyme:**

*Lab Tests:*

• Erythrocyte sedimentation rate: often elevated
• Liver function tests: mildly elevated hepatic transaminases
• Urinalysis: microscopic hematuria or proteinuria may be seen.
• In Lyme meningitis lumbar puncture should be performed: CSF typically shows lymphocytic pleocytosis, slightly elevated protein, and normal glucose.

**Diagnostic Testing:**

• A two-step process is used when testing blood for evidence of antibodies against the Lyme disease bacteria. Both steps can be completed using the same blood sample.
• The first step of the process uses a testing procedure called enzyme immunoassay (EIA) or rarely, an indirect immunofluorescence assay (IFA). If the first step is negative, no further testing of the specimen is recommended. However, if the first step is positive or indeterminate the second step should be performed. The second step uses a test called an immunoblot test, which is commonly a Western blot test. A positive result is considered only if the EIA/IFA and the immunoblot are both positive.

**Anaplasmosis:**

**Lab Tests:**

• Should order a complete blood cell count and a chemistry panel. Thrombocytopenia, leukopenia, or elevated liver enzyme levels are helpful predictors of anaplasmosis, but may not be present in all patients.

**Diagnostic Testing:**

• The gold standard serologic test for diagnosis of anaplasmosis is the indirect immunofluorescence assay (IFA) using A. phagocytophilum antigen, performed on paired serum samples to establish a significant (four-fold) rise in antibody titers. The first sample should be collected as early in the disease as possible, preferably in the first week of symptoms, and the second sample should be taken 2 to 4 weeks later. In most cases of anaplasmosis infection, the first IgG IFA titer is typically low, or “negative,” and the second titer will typically show a significant (four-fold) increase in IgG antibody levels. IgM antibodies usually rise at the same time as IgG near the end of the first week of illness and may remain elevated for months or longer. Additionally, IgM antibodies are less specific than IgG antibodies and more likely to result in a false positive so IgG titers should be ordered.
• During the acute phase of illness, a sample of whole blood can be tested via polymerase chain reaction assay to determine if a patient has anaplasmosis. This method is most sensitive in the first week of illness, and the sensitivity rapidly decreases following the administration of the appropriate antibiotics. A negative result does not completely rule out the diagnosis of anaplasmosis and thus treatment should not be withheld strictly due to a negative result.
• During the first week of illness a peripheral blood smear may be performed to reveal morulae (microcolonies of anaplasma) in the cytoplasm of white blood cells in up to 20% of patients. However, the observance of morulae in a particular cell type cannot conclusively identify the infecting species and culture isolation of A. phagocytophilum is only available at specialized laboratories.

**Babesiosis**
Lab Tests:

- A complete blood cell count and chemistry panel should be ordered as hemolytic anemia and thrombocytopenia are frequently seen. Other findings may include proteinuria, hemoglobinuria, and elevated levels of liver enzymes, blood urea nitrogen, and creatinine.

Diagnostic Testing:

- If the diagnosis of babesiosis is suspected, manual review of blood smears should be requested explicitly. In symptomatic patients with an acute infection, Babesia parasites usually can be detected by light-microscopic examination of blood smears, although multiple smears may need to be examined. Due to the difficulty of being able to distinguish between Babesia and Plasmodium parasites or artifacts it is reasonable to consider having a reference laboratory confirm the diagnosis via blood-smear examination or other molecular/serologic methods.

Powassan virus disease:

Lab Tests:

- Lumbar puncture: CSF findings include lymphocytic pleocytosis (neutrophils can predominate early), normal or mildly elevated protein, and normal glucose.

Diagnostic Testing:

- No commercially-available tests; testing available at CDC and selected state health departments.
- Measurement of virus-specific IgM antibodies in serum or CSF, but cross-reaction with other flaviviruses (e.g., West Nile, dengue, or St. Louis viruses) can occur. Therefore, plaque reduction neutralization tests should be performed to confirm the diagnosis.
- RT-PCR may detect viral RNA in acute CSF specimens or tissues but the sensitivity is not currently known and thus this method should not be used to rule out the diagnosis.

Borrelia miyamotoi disease:

Lab Tests:

- CBC and metabolic studies: patients commonly have laboratory studies that reveal leukopenia, thrombocytopenia, and/or mildly elevated transaminase levels.
- In patients with meningoencephalitis a lumbar puncture should be performed: the cerebrospinal fluid can reveal an elevated white blood cell count (with a lymphocyte predominance) and an elevated protein concentration.

Diagnostic Testing:

- Blood tests used for Lyme disease are not helpful in the diagnosis of B. miyamotoi infections.
- Confirmation of a diagnosis relies on the use of either PCR tests that detect DNA from the organism or antibody-based tests. Both types of tests are currently under development and not widely commercially available but can be ordered from a limited number of laboratories.
Treatment:

Lyme Disease:

- Antibiotics routinely used for oral treatment include doxycycline (100mg BID orally), amoxicillin (500mg TID orally), or cefuroxime axetil (500mg BID orally) for 14-21 days.
- Patients with certain neurological or cardiac forms of illness may require intravenous treatment using drugs such as ceftriaxone or penicillin.
- Regardless of the cause of post treatment lyme disease syndrome (PTLDS), studies have not shown that patients who received prolonged courses of antibiotics are any better in the long run than patients treated with placebo. Furthermore, long-term antibiotic treatment for Lyme disease has actually been associated with serious complications. Patients with PTLDS almost always get better over time without additional treatment.

Anaplasmosis:

- Doxycycline is the first line treatment for adults and children of all ages and should be initiated immediately if anaplasmosis is suspected. Standard duration of treatment is from 7 to 14 days of 100mg orally twice a day. Some patients may continue to experience symptoms including headache, weakness and malaise for weeks after adequate treatment.
- Rifampin has been used successfully in several pregnant women with anaplasmosis, and studies suggest that this drug appears to be effective against Anaplasma species.

Babesiosis:

- Atovaquone (750mg BID orally) is given along with Azithromycin (first day 500-1000mg orally, subsequent days 250-1000mg orally) for 7-10 days or
- Clindamycin (600mg TID orally) is given along with Quinine (650mg TID orally) for 7-10 days

Powassan virus disease:

- There is no specific antiviral treatment for Powassan disease that is currently available. Patients with suspected Powassan disease should receive supportive care as deemed appropriate.

Borrelia miyamotoi disease:

- Physicians have successfully treated patients using a 14 day course of doxycycline (100mg BID orally).
- Physicians have also used Amoxicillin and ceftriaxone.
# Quick Reference Guide:

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<th>Disease</th>
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<th>Signs and symptoms</th>
<th>Lab Results</th>
<th>Diagnostic testing</th>
<th>Treatment</th>
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<tr>
<td>Lyme Disease (Borreliaburgdorferi)</td>
<td>3-30 days</td>
<td>-Fever, chills, headache, fatigue, muscle and joint aches, and swollen lymph nodes, erythema migrans rash</td>
<td>-Elevated erythrocyte sedimentation rate, mildly elevated hepatic transaminases, microscopic hematuria or proteinuria.</td>
<td>-The first step is an EIA or rarely, IFA. If the first step is negative, no further testing of the specimen is recommended.</td>
<td>-Either doxycycline (100mg BID orally), amoxicillin (500mg TID orally), or cefuroxime axetil (500mg BID orally) for 14-21 days.</td>
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<td>Powassan virus disease (Powassan virus)</td>
<td>1-4 weeks</td>
<td>-The most common symptoms are fever, headache, vomiting, and generalized weakness. -Infection will usually progress to meningoencephalitis, which may present with meningeval signs, altered mental status, seizures, aphasia, paresis, movement disorders, or cranial nerve palsies.</td>
<td>CSF findings include lymphocytic pleocytosis (neutrophils can predominate early), normal or mildly elevated protein, and normal glucose.</td>
<td>-Measurement of virus-specific IgM antibodies in serum or CSF, but cross-reaction with other flaviviruses can occur. Therefore, plaque reduction neutralization tests should be performed to confirm the diagnosis. -RT-PCR may detect viral RNA in acute CSF specimens or tissues but the sensitivity is not currently known and thus this method should not be used to rule out the diagnosis.</td>
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| **7-14 days** | -Many people do not experience any symptoms.  
- The most commonly reported symptoms when present include fever, headache, chills, sweats, body aches, nausea, appetite loss, fatigue.  
- In rarer cases, infection can lead to hemolytic anemia resulting in jaundice and dark urine.  
- Can cause a severe infection in individuals who do not have a spleen, have a weak immune system or have serious health conditions such as liver or kidney disease.  
- Decreased hematocrit due to hemolytic anemia, thrombocytopenia, elevated serum creatinine and BUN, mildly elevated hepatic transaminase values.  
- If the diagnosis is suspected, manual review of blood smears should be performed.  
- Babesia parasites usually can be detected by light-microscopic examination of blood smears, although multiple smears may need to be examined.  
- Due to the difficulty of being able to distinguish between Babesia and Plasmodium parasites or artifacts it is reasonable to consider having a reference laboratory confirm the diagnosis.  
- Atovaquone (750mg BID orally) is given along with Azithromycin (first day 500-1000mg orally, subsequent days 250-1000mg orally) for 7-10 days or  
- Clindamycin (600mg TID orally) is given along with Quinine (650mg TID orally) for 7-10 days. |
| **12-16 days** | - The most common symptoms are fever (may be relapsing), muscle aches, fatigue, joint aches, chills, headaches.  
- Rash is an uncommon finding.  
- Patients commonly have leukopenia, thrombocytopenia, and/or mildly elevated transaminase levels.  
- In patients with meningoencephalitis the CSF can reveal an elevated WBC count (with a lymphocyte predominance) and an elevated protein concentration.  
- Confirmation of a diagnosis relies on the use of either PCR tests that detect DNA from the organism or antibody-based tests.  
- Patients have successfully been treated using a 14 day course of doxycycline (100mg BID orally).  
- Amoxicillin and ceftriaxone can also be used. |
<table>
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<td>7-14 days</td>
<td>-Most commonly reported symptoms are fever, malaise, muscle aches, headache, nausea, vomiting, fatigue, chills, and joint pain. -Rash is rarely reported in patients with this disease and the presence of a rash may signify the possibility of coinfection with another organism. -Severe clinical presentations may include difficulty breathing, hemorrhage, renal failure or neurological issues. -Mild anemia, thrombocytopenia, leukopenia (characterized by relative and absolute lymphopenia and a left shift), mild to moderate elevations in hepatic transaminases. -Visualization of morulae in the cytoplasm of granulocytes during examination of blood smears is highly suggestive of a diagnosis. -The gold standard serologic test is the indirect IFA using <em>A. phagocytophilum</em> antigen, performed on paired serum samples to establish a significant (four-fold) rise in antibody titers. The first sample should be collected as early in the disease as possible, preferably in the first week of symptoms, and the second sample should be taken 2 to 4 weeks later. In most cases of anaplasmosis infection, the first IgG IFA titer is typically low and the second titer will typically show a significant (four-fold) increase in IgG antibody levels.</td>
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Standard duration of treatment is from 7 to 14 days of 100mg BID orally or IV.