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Overview of Tick-Borne Diseases

0.25 HOUR CE

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Lyme disease is a topic that significantly captures the attention of our patients. To enhance awareness, our pharmacy provides informative flyers, and the one focused on Lyme disease is particularly popular among our clientele. A personal commitment of mine involves inquiring about the diagnosis whenever I come across a doxycycline prescription. If the patient mentions terms like “tick” or “Lyme”, I promptly hand them one of our brochures and guide them to our selection of permethrin spray.

Surprisingly, many people are unfamiliar with this preventive product. While hunters, fishermen, and hikers are usually acquainted with permethrin spray, my concern lies with casual outdoors enthusiasts, picnickers, or gardeners who may not be aware of its benefits. I've observed that, after being educated, most patients who have had a tick encounter opt to purchase permethrin spray, which is conveniently displayed on our pharmacy counter.

Living in an area where we encounter deer daily, my wife strategically placed “tick tubes” around our property. These tubes, which are simple to make, offer excellent protection against deer ticks and contribute to our ongoing efforts to safeguard our community from Lyme disease.

Overview of Tick-Borne Diseases

Lyme Disease

Lyme disease, caused by the spirochetal bacterium *Borrelia burgdorferi*, is the most prevalent vector-borne disease in the United States. The origins of Lyme disease trace back to 1977 when it was initially described as “Lyme arthritis” during studies of a cluster in Connecticut. Children initially believed to have juvenile rheumatoid arthritis exhibited various symptoms, including swollen knees, paralysis, skin rashes, headaches, and severe chronic fatigue.

The connection between Lyme disease and the deer tick was established in 1981 by Dr. Willy Burgdorfer, who was originally studying Rocky Mountain Spotted Fever, which is also caused by a tick bite. Dr. Burgdorfer identified a spirochete bacterium carried by ticks as the culprit behind Lyme disease, and, in 1982, the medical community honored his discovery by naming the spirochete *Borrelia burgdorferi*.

Interestingly, more than 130 years ago, in 1883, German physician named Alfred Buchwald first described the chronic skin rash, or erythema migrans, now recognized as a symptom of Lyme disease. However, it took until the 1960s and 1970s for Lyme disease to be officially recognized in the United States.

The challenge with Lyme disease lies not so much in the ticks we remove, but in those that go unnoticed, introducing the *Borrelia burgdorferi* spirochete to our patients. Surprisingly, only around 25% of individuals with erythema migrans recall the tick bite responsible for transmitting Lyme disease. The characteristic “bullseye” rash, erythema migrans, manifests in 70-80% of cases, leaving 20-30% of patients without this visual indicator. When Lyme disease goes undiagnosed and progresses, the consequences become more apparent. National surveillance for Lyme disease was initiated in the United States in 1991, employing a case definition based on clinical and laboratory findings. This approach is consistent with the surveillance of other notable diseases such as measles, meningitis, syphilis, and rabies.

Early Disseminated Lyme Disease

Lyme disease can progress with the appearance of additional erythema migrans lesions in various body areas days to weeks after a tick bite, if left untreated. The infection may lead to neurological consequences, including facial or Bell’s palsy (loss of muscle tone on one or both sides of the face) and severe headaches with neck stiffness due to meningitis (occurring in 15% of patients). Muscular and joint pain and swelling, particularly in large joints like knees (present in 60% of patients), may occur. Shooting pains that interfere with sleep and heart palpitations accompanied by dizziness due to changes in heartbeat (present in 1% of patients) are also potential manifestations of the disease. Early detection and intervention are crucial to preventing the progression of Lyme disease and mitigating these severe consequences.

Late Disseminated Lyme Disease

Several months to years after a tick bite, patients with untreated Lyme disease may experience a delayed onset of symptoms. Around 60% of untreated individuals may develop intermittent arthritis characterized by severe joint pain and swelling, particularly affecting large joints such as the knees. This manifestation underscores the importance of timely diagnosis and treatment to prevent the progression of the disease and alleviate the associated joint-related complications.

Treatment of Lyme Disease

Early Lyme disease is typically addressed with a 10- to 14-day antibiotic course, and the specific duration is determined by the selected drug. The antibiotic choice is tailored to the disease stage and symptoms, with common options encompassing doxycycline, amoxicillin, cefuroxime, and azithromycin.

Newer treatments for Lyme disease involve the use of loratadine and its metabolite, desloratadine. Desloratadine acts by inhibiting BmtA (Borrelia metal transporter A). Desloratadine, marketed under the brand name Clarinex, functions by blocking transition metal entry into the bacterial cell. Transition metals, which are crucial for bacterial metabolism and virulence, include iron (Fe), manganese (Mn), and zinc (Zn). When these metals are obstructed, Borrelia burgdorferi is starved, leading to its demise in laboratory settings. It's essential to note that this research is in the early phases and recommending it to patients would require further evaluation and validation.

Powassan (Deer Tick Virus)

The black-legged deer tick, *Ixodes scapularis*, also can carry another disease called Powassan virus. Powassan virus disease, a deer tick virus disease, is transmitted by *Ixodes scapularis*, with larvae typically avoiding human bites and preferring smaller hosts like rodents and birds. Unlike their adult counterparts, larvae lack the ability to transmit Lyme disease bacteria during their blood meal. Adult deer ticks, carrying various human pathogens such as Lyme disease, anaplasmosis, babesiosis, *Borrelia miyamotoi* disease, Powassan virus

disease, and ehrlichiosis linked to *Ehrlichia muris eauclairensis*, act as vectors. The Powassan virus is becoming more prevalent, with 90% of ticks in Pennsylvania State Park carrying it, and most cases in the United States occurring in the northeast and Great Lakes regions during the ticks' active season from late spring to mid-fall. Notably, the virus can be transmitted within 15 minutes of a tick bite, contrasting with other tick-borne diseases like Lyme disease, where the tick needs over 24 hours of attachment to transmit the infection.

Initial Symptoms

May include fever, headache, vomiting, and weakness. Some infected individuals may remain asymptomatic, and the infection can go unnoticed. However, 91% of patients treated for Deer Tick Virus (DTV) infections develop severe neuroinvasive diseases such as meningitis or encephalitis.

CDC Treatment Recommendation

No vaccines or medications are currently available for the prevention or treatment of Powassan virus infection. Medical professionals typically focus on treating symptoms to alleviate patient discomfort. Severe cases may require hospitalization, with individuals needing respiratory support and medications to reduce brain swelling.

Prevention

Preventive measures align with those for Lyme disease: use permethrin spray on clothes worn in tick-endemic areas. Permethrin spray remains effective for 42 days, even after multiple launderings.

Tick Prevention on a Larger Scale

One entomologist tip is to use tick tubes. First, soak cotton balls in permethrin, then stuff them into paper towel rolls and place them outside your home. Position the tubes in areas where rodents are likely to access them, such as under logs, leaf litter, or rocks. This keeps them drier, extending the tube's lifespan. If no activity is observed in a tube after a few weeks, relocate it to another spot.

Mice will carry the treated cotton back to their nests, effectively killing black-legged ticks without causing harm to the mice.

Have a great day on the bench!!

References

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Test Questions Pharmacist, Pharmacy Technician

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1. **In early disseminated lyme disease what symptom occurs in various body areas days to weeks after a tick bite if left untreated?**
    a. Shooting pains
    b. Heart palpitations
    c. Erythema migrans lesions
    d. Dizziness

2. **In late disseminated Lyme Disease patients may experience what delayed symptom?**
    a. Intermittent arthritis
    b. Loss of consciousness
    c. Irritable bowel syndrome
    d. Migraines

PHARMACIST LEARNING OBJECTIVES

1. Differentiate between early and late disseminated Lyme disease

PHARMACY TECHNICIAN LEARNING OBJECTIVES

1. Differentiate between early and late disseminated Lyme disease

OVERVIEW

Micro-learning opportunities were created in response to evidence that learning is maximized when delivered in short and focused 'bursts.' In this session, tick-borne diseases are broadly discussed with an emphasis on treatment and prevention.

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Pharmacist, Pharmacy Technician

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