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CD Summary

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LOVE AT FIRST BITE: VECTOR-BORNE DISEASE IN OREGON

As Gregor Samsa awoke one morning from uneasy dreams, he found himself transformed in his bed into a gigantic insect.

\- Franz Kafka, *The Metamorphosis*

Samsa's experience would put a crimp in just about anyone's day, but there are other interactions with arthropods that can be just as unpleasant. In any case, the winter is past, the rain is over and gone; the flowers appear on the earth, the time of the singing of birds is come, the voice of the turtle is heard in our land… and before too long, there will be so many mosquitoes, ticks, and other disease vectors out there it will make you long for winter again. Moreover, the geographic ranges of these arthropods are changing with the climate, bringing some diseases to parts of Oregon that haven't seen them before. In this *CD Summary*, we'll talk about where vectors are, what diseases they carry, and how to assess and protect your patients.

While we generally worry about only three species of ticks in Oregon, many species of mosquitoes from three genera thrive here. Several *Culex* species are found in eastern Oregon, and they regularly test positive for West Nile virus. Happily, none of the three *Aedes* species mosquitoes known to transmit dengue virus (*A. albopictus*, *A. aegypti, A. japonicus*) is native to Oregon, but they have been reported in neighboring California. *Anopheles* mosquitoes that could transmit malaria are found in Oregon, but imported cases are sufficiently uncommon and parasitemia is short-lived (thanks to treatment) that we don't fret too much about the possibility of autochthonous transmission.

Table. Diagnostic techniques for vector-borne disease

		Diagnosis by		
Disease	**Vector**	**Clinical and exposure**	**Pathogen detection***	**Antibody detection**
Dengue	Mosquito		✓	
Malaria	Mosquito	✓		
West Nile	Mosquito			✓
Zika	Mosquito		✓	✓
Anaplasmosis or Ehrlichiosis	Tick	✓		
Babesiosis	Tick	✓		
Colorado tick fever	Tick	✓		
Lyme	Tick			✓
Plague	Flea	✓		
RMSF	Tick			✓
Tick-borne relapsing fever	Tick		✓	✓
Tularemia	Tick	✓		

*culture or detection of pathogen-specific antigen or nucleic acid

WHERE ARE THE ARTHROPOD VECTORS?

Vector control folks from around the state tell us that ticks and mosquitoes were out earlier in the spring of 2018 than in years past. There are three main tick species in Oregon (see maps in references). Each has different ranges. The brown dog tick (*Rhipicephalus sanguineus*) is present throughout Oregon and can carry *Rickettsia rickettsii*, the pathogen that causes Rocky Mountain spotted fever (RMSF). The Rocky Mountain wood tick (*Dermacentor andersoni)* is found east of the Cascades, usually above 4,000 feet, though there are recent reports of exposures below that elevation. Its bite can result in RMSF, Colorado tick fever, and tularemia. West of the Cascades, you'll find the Western blacklegged tick (*Ixodes pacificus*), which carries the agents of Lyme disease, anaplasmosis, and relapsing fever.

WHERE ARE THE DISEASES?

From 2014–2018, 1,348 cases of vector-borne disease were reported to the Oregon Health Authority: 255 confirmed, 355 presumptive, 738 suspect. Lyme disease accounted for more than half of these reports with 44 confirmed cases, 258 presumptive cases, and 530 suspect cases. Among confirmed cases of vector-borne disease were also 87 cases of malaria, 53 cases of Zika, 14 cases of tularemia, and 11 West Nile disease cases.

Following their vectors, three diseases have strong regional concentration in Oregon. Of the 288 confirmed and presumptive Lyme disease cases with location information,

248 resided west of the Cascades. All seven cases of Colorado tick fever — all of which were confirmed — lived in central Oregon. Corresponding with mosquito testing, eight of the 11 confirmed and nine of the 10 presumptive cases of West Nile virus disease resided east of the Cascades.

Tularemia cases were split, with seven cases on each side of the Cascades. Remember that tick bites aren't the only way to get tularemia; 10 of 14 reported cases denied having seen a tick prior to their illness.

You might be surprised to see any cases of malaria and Zika in Oregon. Neither disease is endemic to Oregon, or the United States. Remember that we report not what was contracted here, but what was diagnosed among Oregon residents; all Oregonians with confirmed malaria, chikungunya, and dengue fever who could be interviewed had traveled to a country where the diseases are endemic. The same is true for all cases of Zika, except for one confirmed case that was transmitted by sexual contact and three presumptive cases of vertical transmission.

EMERGING TICK-BORNE DISEASES

Rickettsia sp. 364D causes Pacific Coast tick fever, which often presents with an eschar, fever, and headache; rash is relatively uncommon. The vector (Pacific Coast tick, *Dermacentor occidentalis*) is present in California and may have pushed into southwestern Oregon. Efforts to look for this potential emerging pathogen in Oregon are underway. Since it's relatively new, diagnostic capabilities for *R*. 364D infection are still expanding.

Borrelia miyamotoi is a species of spiral-shaped bacteria that also causes tick-borne relapsing fever (TBRF). As you can guess from the name, it is related to *B. burgdorferi*, which causes Lyme disease. First identified in 1995 in ticks from Japan, *B. miyamotoi* has since been detected in one species of tick found in Oregon — viz., the western black-legged tick (*Ixodes pacificus*). *B. miyamotoi* infection presents with nonspecific symptoms, including fever, headache, chills, myalgia, and arthralgia. Laboratory confirmation of *B. miyamotoi* is possible by PCR on blood from acutely symptomatic patients; they may be seronegative at presentation.

Oregon Health Authority and Jackson County Vector Control officials collected 2,166 ticks in 459 vials between November 2017 and May 2018 at different locations county-wide. *B. burgdorferi* was identified in 12/459 (2.6%, similar to that found in a study in 2000), and *B. miyamotoi* was identified in 37/459 vials (8.1%, no previous studies done in Oregon). We continue to collect *Ixodes pacificus* ticks, which live west of the Cascades, to learn more about the distribution of these pathogens.

HOW SHOULD I ASSESS MY PATIENT?

People do not always feel ticks and insect bites. For example, 22 of the 31 people with confirmed Lyme disease who were interviewed denied having seen a tick prior to their illness. Many early symptoms of vector-borne diseases are non-specific, including fatigue, chills, fever, and headaches. It is therefore important to ask all patients with such symptoms about travel history, time spent outdoors, and exposures to animals, including pets.

Some diseases can be identified by typical signs, such as erythema migrans ("bulls-eye" rash) with Lyme disease, and painful lymphadenitis with the bubonic form of plague. Many vector-borne diseases will cause typical hematologic changes; consult your favorite resource for details. The Centers for Disease Control and Prevention (CDC) has provider-specific pages for many diseases, and Heymann's Control of Communicable Diseases Manual is a handy resource.

As with all diseases, clinical presentation will guide you toward a diagnosis. Methods for definitively identifying one of these diseases fall into one of three categories: clinical presentation and exposure history, detecting the agent, or detecting the immune response. Consult the Table (*verso*) for details. Your clinical laboratory and the Oregon State Public Health Laboratory are excellent resources for determining which samples to collect.

PREVENTING VECTOR-BORNE DISEASE

The best way to prevent arthropod-borne disease is to prevent being bitten. Insect repellent is very helpful against both mosquitoes and ticks. Check the link below for the Environmental Protection Agency's (EPA's) insect repellent chooser to find those that will meet your patients' needs. Wearing long sleeves and pants can help prevent bites. It's also important to research areas before travel; check sites like CDC's Travelers' Health to see which diseases are present and which prevention methods are recommended at your destination. We also ask that you counsel patients who develop illnesses like dengue, Zika etc., to avoid mosquito bites for two weeks after symptom onset. (There is no evidence that mosquitoes native to Oregon can transmit dengue or Zika, but we don't want to find out the hard way.)

While mosquitoes generally stay outside, fleas are not above taking a free ride in with pets, and ticks may still be attached to patients and pets when they return indoors. Patients should check their body, clothing, gear, and pets for ticks. Potential problem hiding areas include the hair, ears, armpits, belly button and backs of the knees.

The proper way to remove a tick is to grasp the tick with forceps as close to your skin as possible and pull straight out (Figure). Do not twist. Repeat as necessary. Remedies from old wives' tales, such as burning a tick out or "painting" it with acetone are likely to increase the risk of disease transmission.

Your patients can help prevent disease in their pets and themselves by keeping their pets up to date on flea and tick repellent. Patients should work with their veterinarian to choose the appropriate product.

Figure. The proper way to remove a tick.

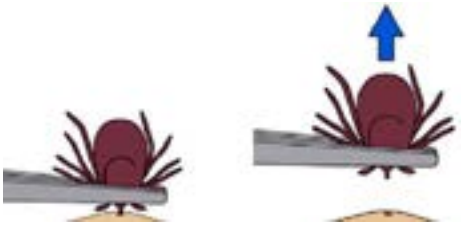

Image source: (accessed 3/17/2019) www.cdc.gov/lyme/removal/index.html

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MORE INFORMATION

- CDC's Division of Vector-Borne Diseases: www.cdc.gov/ncezid/dvbd/index.html
- ArboNET Disease Maps: https://wwwn.cdc.gov/arbonet/maps/ADB_Diseases_Map/index.html
- CDC maps: Geographic distribution of ticks that bite humans: www.cdc.gov/ticks/geographic_distribution.html
- EPA insect repellent search tool: www.epa.gov/insect-repellents/find-repellent-right-you
- CDC Travelers' Health: https://wwwnc.cdc.gov/travel
- 2004 *CD Summary* on tick-borne disease: www.oregon.gov/OHA/PH/DISEASESCONDITIONS/COMMUNICABLEDISEASE/CDSUMMARYNEWSLETTER/Documents/2004/ohd5309.pdf

REFERENCES

1. Control of Communicable Diseases Manual 20th edition. Heymann, D, ed. APHA Press, Washington, D.C.