Fatal *Streptococcus equi* subsp. *zooepidemicus* Infection Associated with Equine Exposure — King County, Washington, 2016

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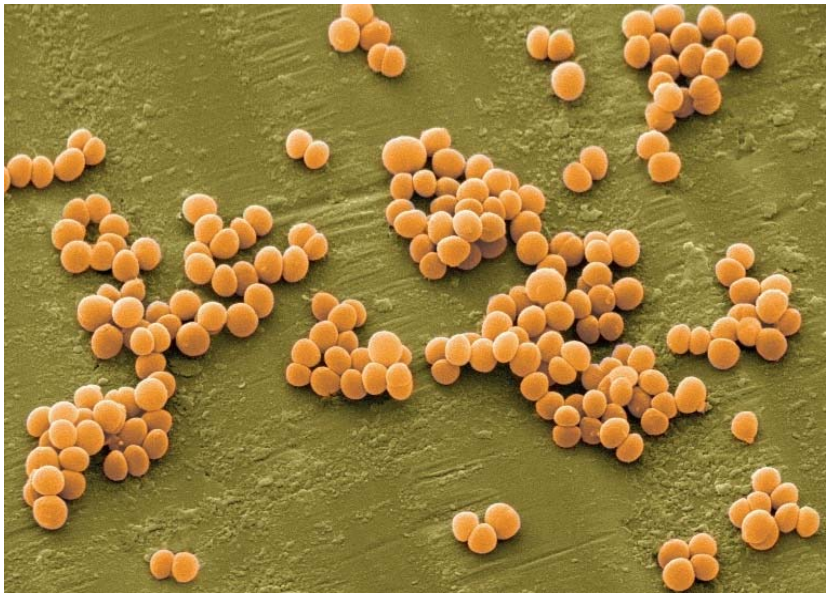
Washington State Department of Health

Zoonotic & Vector-borne Disease Workshop

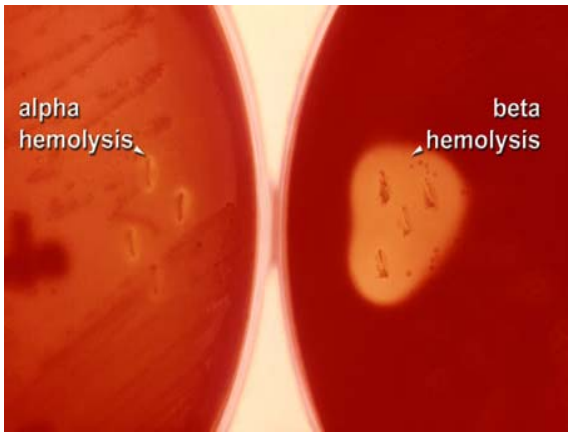
September 22, 2016

Streptococcus

- Gram positive cocci
- Categorized by degree of hemolysis on blood agar
  - Alpha, beta, or gamma
- Medically important Streptococci
  - Alpha and beta hemolytic species



Beta-hemolytic Streptococci



- Serological grouping of species by cell wall antigen composition
  - Lancefield grouping
    - Twenty groups (A through H, K through V)
- Multiple human and animal pathogenic species
  - Group A Streptococci (*S. pyogenes*)
    - Humans: sore throat, skin infections
- Some species are normal flora in humans and animals
- Several zoonotic species

Streptococcus equi subspecies *zooepidemicus*

- Beta-hemolytic Group C Streptococci
- Opportunistic pathogen that causes a variety of infections in many species
  - Dogs, horses, swine, and guinea pigs
  - Horses: respiratory, wound and uterine infections
- Normal bacteria flora in horses
- Rare zoonotic organism
  - Unpasteurized dairy products or direct horse contact

Outbreak Detection: March 17, 2016

- Public Health–Seattle & King County (PHSKC) notified of two persons who received a diagnosis of *Streptococcus equi* subspecies *zooepidemicus* infections

- Patient A: healthy 37 y/o female
  - Operated horse boarding and riding facility in King County, WA
  - Fed, groomed, exercised the facility's six horses daily
- Patient B: previously healthy 71 y/o female
  - Mother of Patient A
  - Non-WA State resident visiting Patient A

Timeline of Outbreak: February–March 2016

- Week of February 21
  - Patient A: mild pharyngitis and cough
  - Patient B: symptoms consistent with an upper respiratory infection
  - Horse T: mucopurulent ocular and nasal discharge
- February 25
  - Patient B had close contact (i.e., riding, petting and walking) with Horse T
- February 29
  - Patient B had close contact with Horse T
  - Horse T started treatment with sulfa-based antibiotics

Timeline of Outbreak: February–March 2016

- March 2
  - Patient B developed vomiting and diarrhea
- March 3
  - Patient B found unconscious and transported to a hospital and died that day
- March 6
  - Blood culture from Patient B grew *S. zooepidemicus*

Timeline of Outbreak: February–March 2016

- March 10
  - Patient A went to healthcare provider for throat swab and culture
  - Nasal swabs collected on all 6 horses at Facility A
- March 14
  - Patient A throat culture grew *S. zooepidemicus*
  - 3 of 6 horses nasal cultures grew *S. zooepidemicus*

Objectives

- Determine the magnitude of the outbreak
- Identify risk factors
- Provide recommendations for prevention

Horse Boarding and Riding Facility (Facility A)

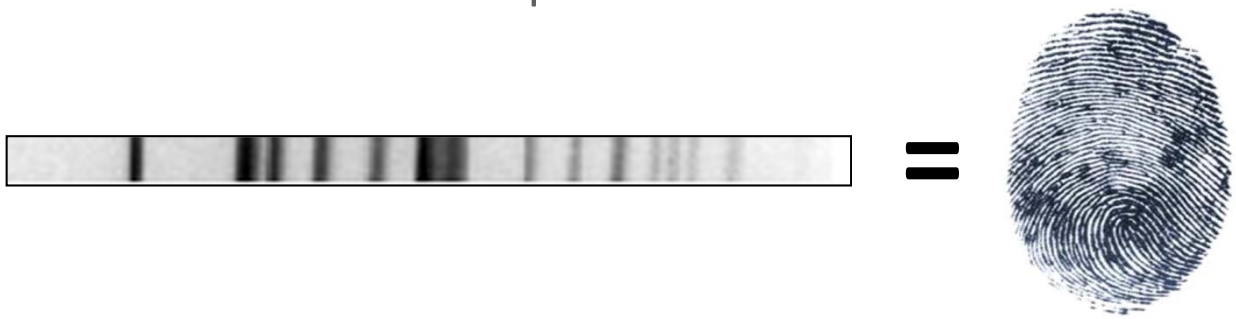
- March 21, 2016 : PHSKC site visit
  - Facility A's veterinarian collected nasal swabs from all 6 horses
  - All 6 horses kept in pens that allow face to face contact
  - No easily accessible handwashing facilities where horses were kept
  - Owner identified 31 horse riders who used facility
    - February–March 2016

Risk Assessment of Facility Users

- March 23, 2016: PHSKC notified all horse riders of investigation and *S. zooepidemicus* information
- March 26, 2016: Free confidential testing for horse riders at Facility A
  - Throat swabs (n =15)
  - 1 page questionnaire administered to better characterize horse exposure
    - Date(s) of horse exposure
    - Type(s) of exposures

Pulsed-Field Gel Electrophoresis (PFGE)

- Molecular subtyping of *S. zooepidemicus* bacteria
  - PFGE pattern: Molecular (DNA) fingerprint of each isolate
  - High agreement with epidemiological relatedness
  - Completed at Washington State Public Health Laboratories
    - Human and Equine isolates



Human and Equine Testing Results

Source	Collection Date	Sample type	Culture result(s)	PFGE pattern(s)
Patient B	March 3	Blood	*S. zooepidemicus*	A
Patient A	March 10	Throat swab	*S. zooepidemicus*	A
Horses at Facility A (n=6)	March 10	Nasal swab	*S. zooepidemicus (n=3/6), 50%*	A (n=2) B (n=1)
Horses at Facility A (n=6)	March 21	Nasal swab	*S. zooepidemicus (n=3/6, 50%)*	A (n=1) B (n=2)
Facility A Horse Riders (n=15/31)	March 26	Nasal swab	*S. zooepidemicus* (n=3/15, 20%)	A

Human and Equine Testing Results

Source	Collection Date	Sample type	Culture result(s)	PFGE pattern(s)
Patient B	**March 3**	**Blood**	***S. zooepidemicus***	**A**
Patient A	March 10	Throat swab	*S. zooepidemicus*	A
Horses at Facility A (n=6)	March 10	Nasal swab	*S. zooepidemicus (n=3/6), 50%*	A (n=2) B (n=1)
Horses at Facility A (n=6)	March 21	Nasal swab	*S. zooepidemicus (n=3/6, 50%)*	A (n=1) B (n=2)
Facility A Horse Riders (n=15/31)	March 26	Nasal swab	*S. zooepidemicus* (n=3/15, 20%)	A

Human and Equine Testing Results

Source	Collection Date	Sample type	Culture result(s)	PFGE pattern(s)
Patient B	March 3	Blood	*S. zooepidemicus*	A
Patient A	**March 10**	**Throat swab**	***S. zooepidemicus***	**A**
Horses at Facility A (n=6)	March 10	Nasal swab	*S. zooepidemicus (n=3/6), 50%*	A (n=2) B (n=1)
Horses at Facility A (n=6)	March 21	Nasal swab	*S. zooepidemicus (n=3/6, 50%)*	A (n=1) B (n=2)
Facility A Horse Riders (n=15/31)	March 26	Nasal swab	*S. zooepidemicus* (n=3/15, 20%)	A

Human and Equine Testing Results

Source	Collection Date	Sample type	Culture result(s)	PFGE pattern(s)
Patient B	March 3	Blood	*S. zooepidemicus*	A
Patient A	March 10	Throat swab	*S. zooepidemicus*	A
Horses at Facility A (n=6)	**March 10**	**Nasal swab**	***S. zooepidemicus (n=3/6), 50%***	**A (n=2) B (n=1)**
Horses at Facility A (n=6)	**March 21**	**Nasal swab**	***S. zooepidemicus (n=3/6, 50%)***	**A (n=1) B (n=2)**
Facility A Horse Riders (n=15/31)	**March 26**	**Nasal swab**	***S. zooepidemicus*** **(n=3/15, 20%)**	**A**

Equine Testing Results by Collection Date

Source Horse	Culture Results March 10	Culture Results March 21	PFGE pattern Mar 10/Mar 21
T	*S. zooepidemicus*	*S. zooepidemicus*	A/A
S	*S. zooepidemicus*	No growth	A/-
W	No growth	*S. zooepidemicus*	-/B
M	*S. zooepidemicus*	*S. zooepidemicus*	B/B
MM	No growth	No growth	-/-
P	No growth	No growth	-/-

Equine Testing Results by Collection Date

Source Horse	Culture Results March 10	Culture Results March 21	PFGE pattern Mar 10/Mar21
T	*S. zooepidemicus*	*S. zooepidemicus*	A/A
S	*S. zooepidemicus*	No growth	A/-
W	No growth	*S. zooepidemicus*	-/B
M	*S. zooepidemicus*	*S. zooepidemicus*	B/B
MM	No growth	No growth	-/-
P	No growth	No growth	-/-

Animal Testing Results by Collection Date

Source Horse	Culture Results March 10	Culture Results March 21	PFGE pattern Mar 10/Mar 21
T	***S. zooepidemicus***	***S. zooepidemicus***	**A/A**
S	***S. zooepidemicus***	**No growth**	**A/-**
W	No growth	*S. zooepidemicus*	-/B
M	*S. zooepidemicus*	*S. zooepidemicus*	B/B
MM	No growth	No growth	-/-
P	No growth	No growth	-/-

Human and Animal Testing Results

Source	Collection Date	Sample type	Culture result(s)	PFGE pattern(s)
Patient B	March 3	Blood	*S. zooepidemicus*	A
Patient A	March 10	Throat swab	*S. zooepidemicus*	A
Horses at Facility A (n=6)	March 10	Nasal swab	*S. zooepidemicus (n=3/6), 50%*	A (n=2) B (n=1)
Horses at Facility A (n=6)	March 21	Nasal swab	*S. zooepidemicus (n=3/6, 50%)*	A (n=1) B (n=2)
Facility A Horse Riders (n=15/31, 48%)	**March 26**	**Nasal swab**	***S. zooepidemicus* (n=3/15, 20%)**	**A (n=3)**

Facility A Horse Riders with Positive *S. zooepidemicus* Culture Characteristics (n=3)

Median Age in years (range)	12 (9 to 14)
Female (%)	67%
Clinically Ill (%)	0%

- Close exposure to a particular horse were not significantly associated with a positive *S. zooepidemicus* culture

Investigation Summary

- Rare zoonotic pathogen in humans
- Older persons might have increased risk for a fatal outcome with *S. zooepidemicus* infections
  - 32 reported cases: median age = 61 years (range <1 to 83 years) with 7 deaths (case-fatality rate = 22%)
- Presumed URI in Patient B may have increased risk of invasive *S. zooepidemicus* infection
- Upper respiratory symptoms in Horse T may have increased spread of *S. zooepidemicus*

Limitations

- Route and timing of transmission to humans and horses can not be determined
  - Ubiquitous organism in facility A
  - Most colonized humans and horses not ill
  - Patient A sought throat culture due to mother's death

Public Health Recommendations

- Practice good hand hygiene
  - Contact with horses and other animals, areas where animals are housed
- Avoid close contact with sick horses
  - Signs of respiratory infection
- Further investigation of *S. zooepidemicus* zoonotic transmission risk factors and spectrum of human illness is recommended

Acknowledgements

Public Health — Seattle & King County

Krista Rietberg
Beth Lipton
Elysia Gonzales
Shelly McKiernan
Erin Kovalenko
Meagan Kay
Jeff Duchin

CDC

Miwako Kobayashi
Chris Van Beneden
Bernard Beall

State Health Departments

MT CA

Washington State Public Health Laboratories

Kaye Eckmann
Maryann Watkins

Washington State Department of Health

Hanna Oltean
Ron Worhle
Scott Lindquist

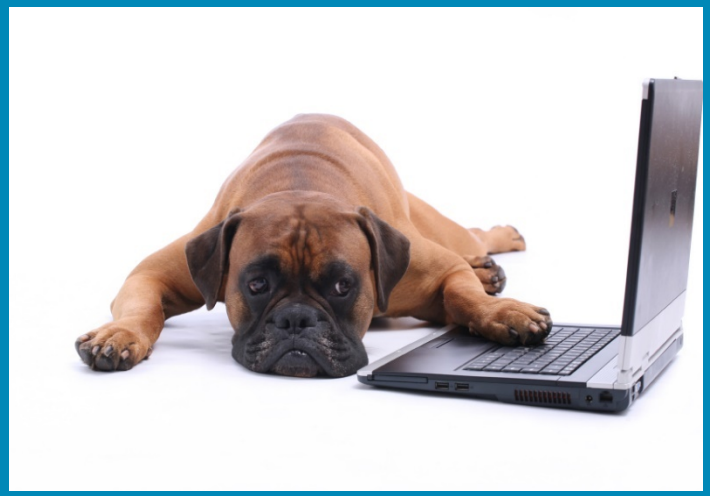
Washington Department of Agriculture

Washington Animal Disease Diagnostic Lab

Northwest Equine Veterinary Associates

Chantal Rothschild

MORE ZOONOTIC INFORMATION



Onchocerca lupi Canine Infection — King County, WA, February, 2016

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Public Health–Seattle & King County

Washington State Department of Health

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September 22, 2016

Onchocerca lupi (*O. lupi*)

- Emerging zoonotic parasite that infects dogs, cats, and humans
  - Suspected vector: Blackfly (genus *Simulium*)
  - Blackfly required to transmit infective stage microfilariae from infected animal to another animal or human
- Typical clinical presentation involves ocular nodules
  - Eyelids, conjunctiva, and sclera
- Canine infections appear common
- Feline infections appear rare
- 1st human case reported in Turkey (2010)
  - 13 cases identified worldwide

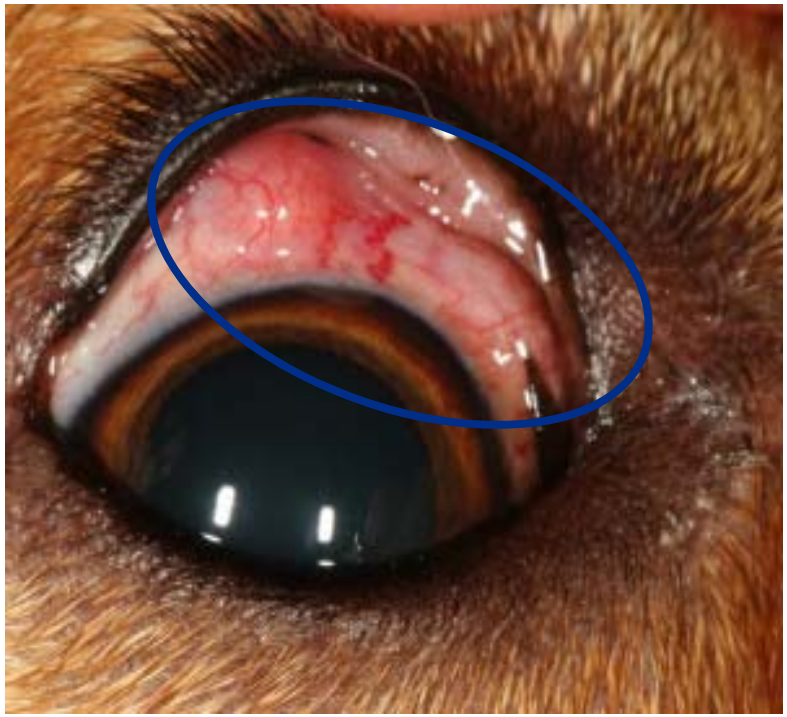
O. lupi in the United States

- Epidemiology of canine *O. lupi* infections is not completely known
  - Causative agent of onchocerciasis in canines (2013)
  - Appears endemic in the canine population
    - Southwestern region
- 6 human cases described (2013–2015)
  - 5/6 (83%) occurred in children (range 22 months to 50 years)
  - 5/6 (83%) resided in the Southwestern region
  - Invasive disease manifestation
    - 1/6 (17%) eye involvement
    - 3/6 (50%) spinal nodules

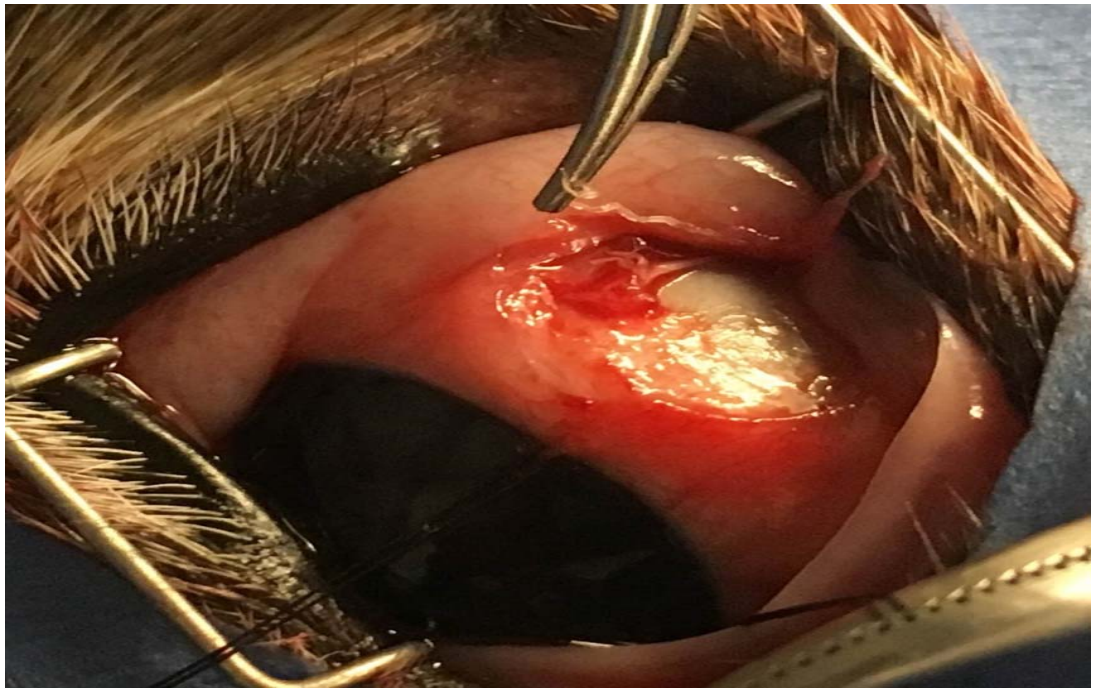
Case Notification: February, 2016

- Washington State Department of Health (WADOH) Public Health Veterinarian notified Public Health–Seattle & King County (PHSKC)
  - 1 confirmed canine infection of *Onchocerca lupi* (*O. lupi*)
  - Adult canine presented to a King County Veterinary Ophthalmologist with a sclera granuloma
    - Surgical removal of nematodes from scleral nodule identified as *O. lupi*
  - Imported from Southwestern United States approximately a year prior
  - No previously documented cases in WA state

Case Notification

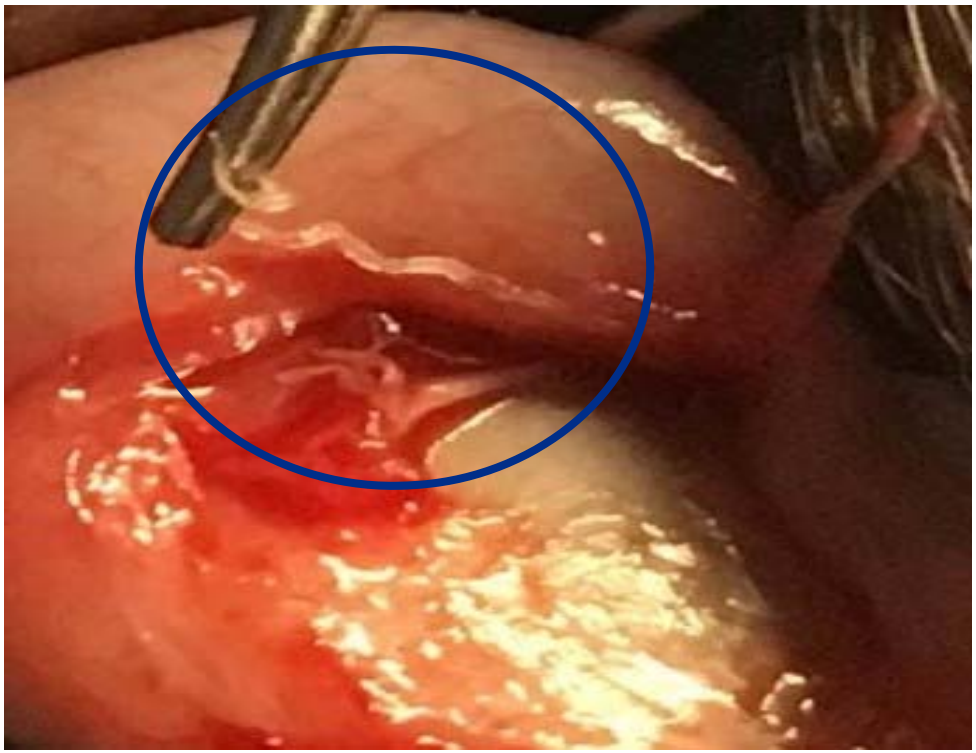


O. lupi Nematodes in Sclera Granuloma (Canine)



2016 by Dr. AJ Marlar (image adapted with permission)

O. lupi Nematodes in Sclera Granuloma (Canine)



2016 by Dr. AJ Marlar (image adapted with permission)

Objectives

- Confirm source of infection
  - imported vs. locally acquired

- Provide guidance on zoonotic potential

Investigation Outcome

- Blackflies (genus *Simulium)* is present in Washington State
  - Geographic distribution unknown
- No human cases in household noted
  - Very low risk of human infection
- Washington State Veterinary Medical Association Notification
  - March/April 2016 WA Veterinarian article
  - No other canine/feline cases identified in Washington State
- Canine patient has recovered

Conclusion

- 1st documented case of canine *O. lupi* infection in Washington State
  - Travel history to *O. lupi* endemic area
- Black flies (genus *Simulium*) are present in Washington State
- Domestic canines and felines as a potential reservoir for human infection is unknown
- Veterinarians should consider *O. lupi* infection as a differential for pets that present with ocular nodules, especially with travel history to the southwestern United States
- Contact WADOH Public Health Veterinarian with laboratory confirmed canine or feline cases for further investigation

Acknowledgements

Public Health — Seattle & King County

Beth Lipton

Meagan Kay

Washington State Department of Health

Ron Worhle

Elizabeth Dykstra

CDC

Paul T. Cantey

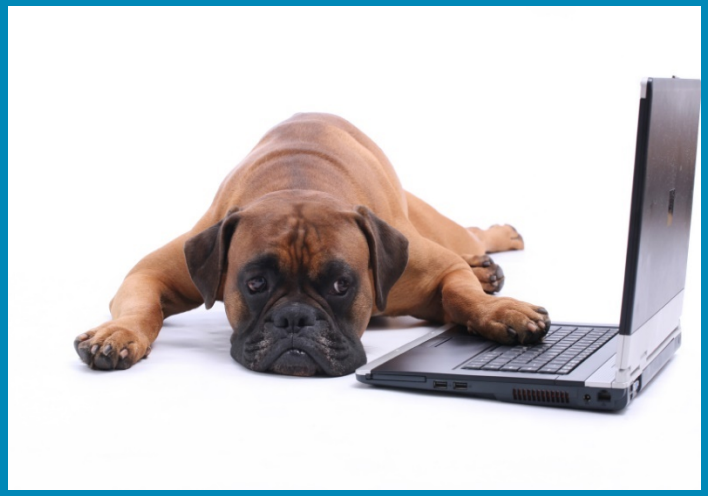
Northwest Animal Eye Specialist

AJ Marlar

Washington State Veterinary Medical Association

Candace Joy

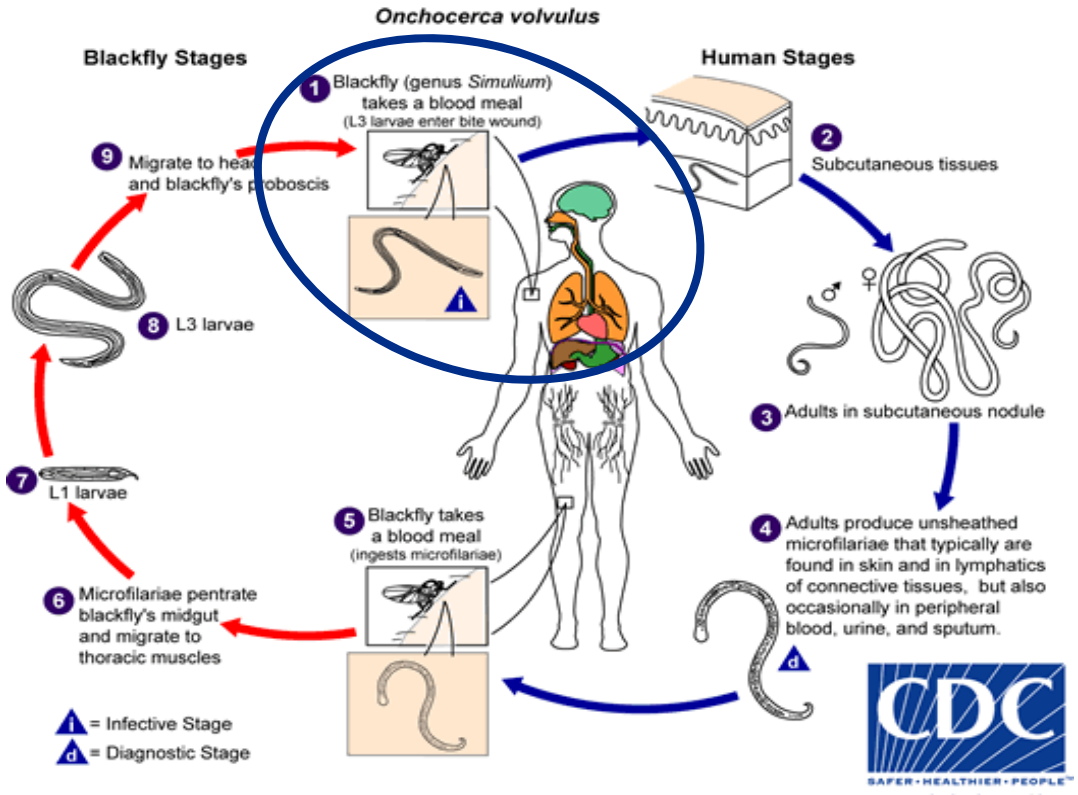
Thank You! Any Questions?



END OF PRESENTATION

EXTRA SLIDES TO FOLLOW

O. volvulus life cycle



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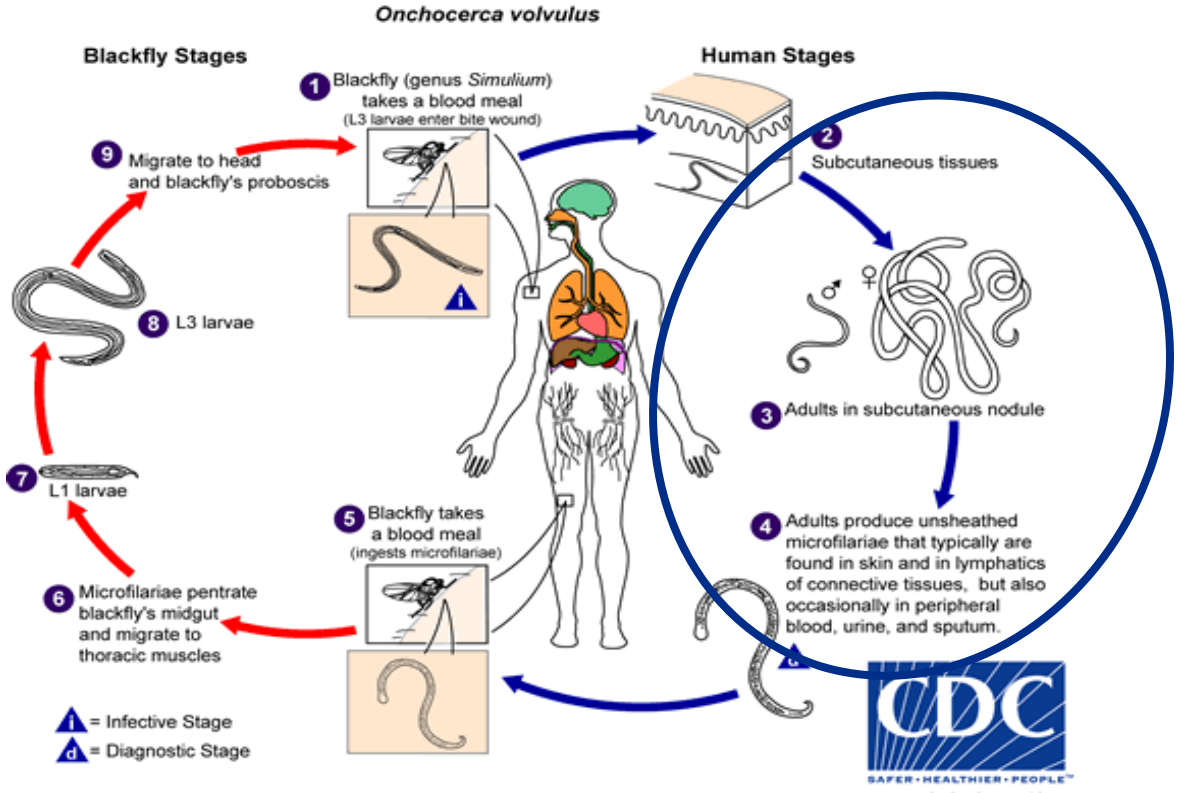

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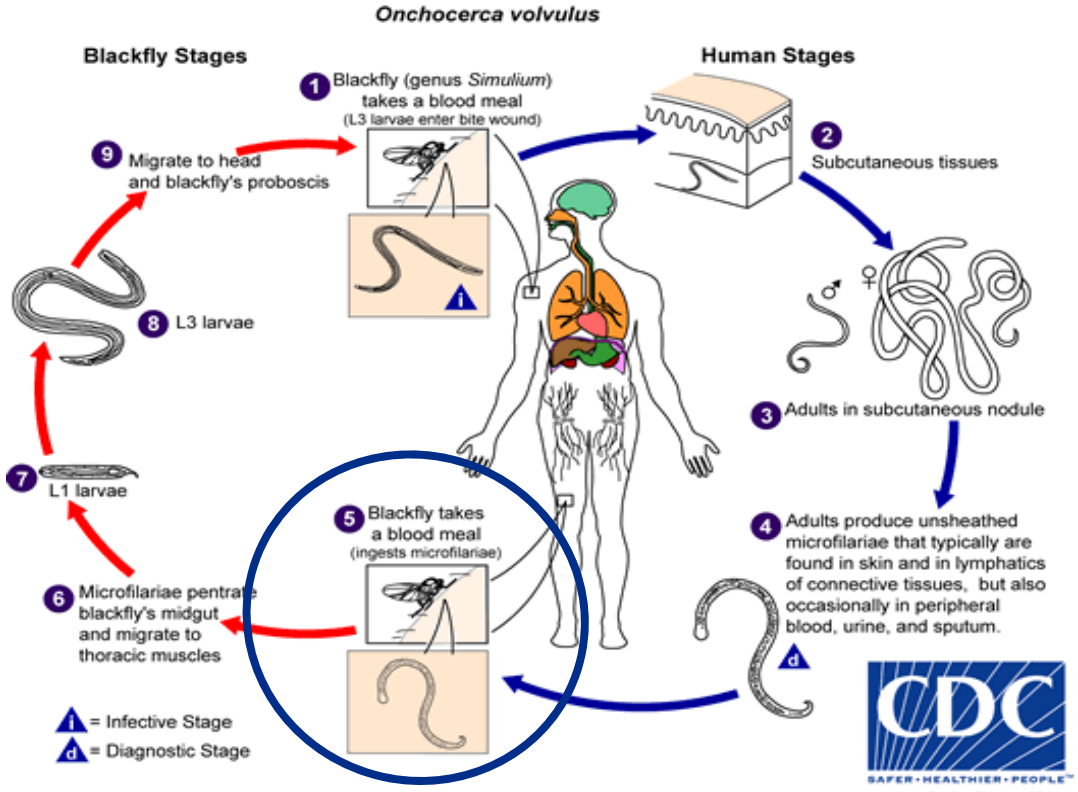

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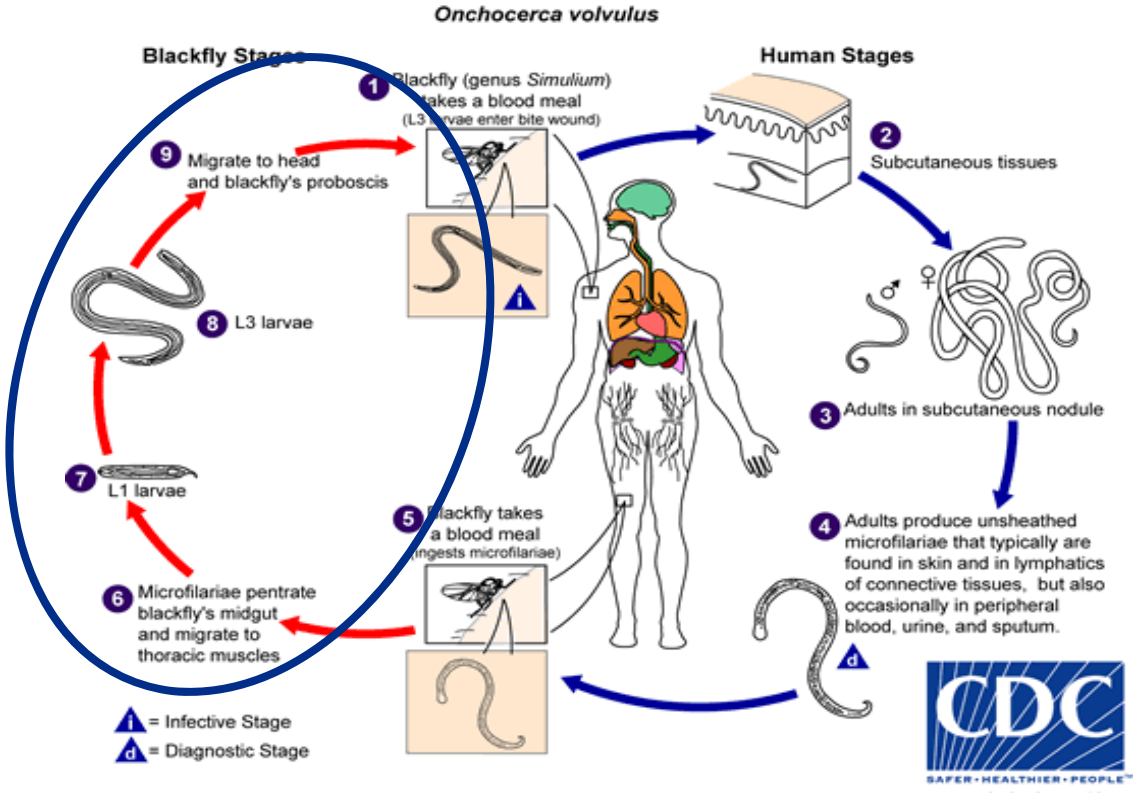

The Emergence of Zoonotic *Onchocerca lupi* Infection in the United States – A Case-Series

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This case-series describes the 6 human infections with *Onchocerca lupi*, a parasite known to infect cats and dogs, that have been identified in the United States since 2013. Unlike cases reported outside the country, the American patients have not had subconjunctival nodules but have manifested more invasive disease (eg, spinal, orbital, and subdermal nodules). Diagnosis remains challenging in the absence of a serologic test. Treatment should be guided by what is done for *Onchocerca volvulus* as there are no data for *O. lupi*. Available evidence suggests that there may be transmission in southwestern United States, but the risk of transmission to humans is not known. Research is needed to better define the burden of disease in the United States and develop appropriately-targeted prevention strategies.

Keywords. *Onchocerca lupi*; emerging infectious diseases; zoonotic infection.

Since the recognition of *Onchocerca lupi* as a common canine infection in parts of Europe and the United States [1–8], there has been growing interest in the parasite and its geographical distribution, range of natural definitive hosts, arthropod vectors, and pathology. Although the parasite's life cycle is not fully unbeen identified elsewhere [14, 15], and 5 additional cases have been identified in the United States.

Onchocerca lupi was first identified in a Caucasian wolf (cited in [16]) but since that time has been reported primarily in domestic dogs and cats in the United States [1, 9, 17, 18] and

Cantey T., et. al. CID (2015)

Next Up!

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