Swine Brucellosis in Florida

Danielle Stanek, DVM
Medical Epidemiologist
Zoonotic and Vectorborne Disease Program
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Division of Disease Control and Health Protection
Brucella Species Capable of Causing Human Illness

- *Brucella melitensis* (goats/sheep)
- *Brucella abortus* (cattle, bison, elk, caribou, moose)
- *Brucella suis* (swine)
- *Brucella canis* (dogs)
- *Brucella ceti* and *Brucella pinnipedialis* (marine mammals)

Photo credit David Pearce, FDOH in Escambia County
Brucellosis Reporting in Florida

- *Brucella abortus*, *B. melitensis* and *B. suis* infections in animals reportable to Florida Department of Agriculture and Consumer Services (FDACS)

- Human illnesses caused by any species of *Brucella* reportable to Florida Department of Health (FDOH)
Human Brucellosis Case Definition

• An illness characterized by acute or insidious onset of fever and one or more of the following: night sweats, arthralgia, headache, fatigue, anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly).

Confirmed
• Culture and identification of *Brucella* spp. from clinical specimens
OR
• Evidence of a fourfold or greater rise in *Brucella* antibody titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart

Probable
• *Brucella* total antibody titer of greater than or equal to 160 by standard tube agglutination test (SAT) or *Brucella* microagglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms
OR
• Detection of *Brucella* DNA in a clinical specimen by PCR assay
**Brucella suis** in Florida

- Second highest feral swine population in the U.S.
- 1963-1975: 61 human brucellosis cases reported in Florida
  - 39% swine related
  - 13% pig hunters
Florida Brucellosis Cases: 2009-2013

- Brucella suis Cases
- All Brucellosis Cases
Proportion of Brucella Positive Feral Swine, 1997-2009

Seroprevalence in Feral Swine

- 0%
- 1-10%
- 11-25%
- >25%
- Not tested

Labels on tested counties indicate number of human cases reported during the time period.

Testing was opportunistic and does not reflect the true prevalence of Brucella countywide.

USDA-APHIS data
Transmission

- 10-100 organisms infectious dose
- Direct contact of infectious blood, uncooked meat or organs of infected animals with breaks in skin or mucous membranes
- Ingestion of unpasteurized milk or inadequately cooked meat
- Inhalation or mucosal exposure to aerosolized bacteria
- Live vaccines for animals Strain 19, Rev-1, RB51
- Rare person-to-person (sexual, breast feeding, in utero, organ transplant, transfusion)
Brucella suis in Swine

- Continuous bacteremia 5 weeks
- Intermittent bacteremia up to 34 weeks
- Meat from positive swine PCR positive

Photo credit Cindy Seegers, FDOH in Lake County
Farming Pigs in Florida

Photo credit: Mark Krause USDA-APHIS, VS
Feral Swine and Cattle

- 10-15 sporadic *B. suis* infections in FL cattle annually, most often in dairy animals
- Can localize in udder
- Bulk milk testing positive; additional testing often culture positive milk
- Raw milk transmission risk to humans

Photo credit C. Dix Harrell, USDA-APHIS, VS
Hunter *Brucella* Exposure

- Cuts while dressing a hog out
- Open wound exposure to hog blood or raw meat or organs
- Splash or spray to eye or mucous membrane with hog body fluid
- Eating uncooked or undercooked meat or organs from a hog

Courtesy of CDC and USDA-APHIS
*Brucella suis* Hunting Exposure

Photo credits Barry Inman, FDOH in Brevard County
Human *Brucella suis* Cases, 2009-2013

Number of Cases

\[(n = 38*)\]

- **0**
- **1**
- **2**
- **3**
- **4**

*8 cases serologic testing only*
Brucella suis 2009-2013

- 89% (34) male
- 92% white; 87% non-Hispanic
- 1-69 years; median age 37
- 1 household cluster involving a 7 year old girl who assisted her father with dressing out a hog
- 3 cases with a likely false culture result of Ochrobactrum

N = 38: 30 culture confirmed; 8 MAT positive for smooth Brucella
Risk Factors

• 89% hunting &/or handling raw hog meat
• 89% of hunters did not regularly use gloves
• 13% ate hog meat; 8% undercooked
• 11% reported cuts while hunting
• 8% reported eating unpasteurized milk products
• 5% occupational risk (1 veterinarian, 1 dairy worker)
Brucellosis Clinical Signs

- Incubation from 5 days to 5 months
- May cause intermittent symptoms
- Insidious presentation often unrecognized
- Chronic localized infection in joints, bones and organs including heart
Common Symptoms of Brucellosis: 2009-2013

N=38 probable and confirmed cases
Brucella suis: Clinical Presentations

- 3-5% FL cases in past 5 years with serious cardiovascular complications (vs. 17% previous 5 years)
- 1 fatal case 46 years of age
- 16% joint and bone infections
- 1 kidney removal
- Time to diagnosis
  - 6 week median
  - Range 1-135 weeks

Chris Paddock CDC
**Brucella suis cases**

- 4 culture positive persons denied direct feral swine contact
- Person with vague history of feral swine around home
- Homeless person with poor recall
- Former spouse of a pig hunter
- Child 22 months of age
Brucella Testing

• Culture gold standard
• Polymerase chain reaction (PCR)
• Serology: microagglutination test (MAT)
• Serology: enzyme-linked immunosorbent assay (ELISA)
Brucellosis Treatment

- Ioannina recommendations
- Antibiotics for at least 6 weeks
- No monotherapy (two or more antibiotics needed)
- Treatment failure and relapses reported to be 4.6-24% for oral treatment; 5-8% for oral-parenteral treatment
- 22% treatment failure and relapses for *Brucella suis* (FDOH data 1999-2008)
Lab Exposures: When the Unexpected Happens
Brucella and Laboratory Exposures

- Brucellosis: one of the 10 most frequently reported laboratory-acquired infections (LAI) in the U.S. (Traxler, 2010)
- 2009: 41% of 120 reported U.S. brucellosis cases resulted in laboratory exposures.
- 2009-2013 Florida Brucella lab exposures ranged from 16-115 annually

Data courtesy of J.R. Saah, NC Division of Public Health and R. Traxler, CDC
**FL-NC *Brucella* Exposure**

Index Case FL

Lab A FL
5 high-risk exposures
6 low-risk exposures

Lab B NC
5 high-risk exposures
1 low-risk exposure

LAI Case NC

Lab C NC
11 high-risk exposures
24 weeks after Lab A exposures

- 2 week delay in initiation of PEP
- Onset week 8 after PEP initiation

J.R. Saah NC Division of Public Health, et al. 2010
Lab Exposure Causes

- *Brucella* uncommon
- Failure in communication
- Clinician or lab staff does not realize aerosol potential
- Sniffing cultures
- Testing failures/anomalies
  - Automated biochemical machine misidentification *Ochrobactrum*
  - Gram stain variable or positive (*Micrococcus*)
  - Catalase failure
Brucella Surgical Exposures

- Aerosol generating procedures: drilling, saws, high pressure irrigation
- Airborne precautions
- Theoretical risk; no cases linked to date
- Human and animal necropsies or autopsies

From: http://hq.afnews.af.mil
Post-Exposure Management

- Submit isolate for confirmation to state lab
- Serologic follow-up, 6 month fever watch, antibiotic prophylaxis
Brucellosis and Pets
Brucellosis in a Child

- A 22 month old child with a 10 day duration of joint pain followed by fever.
- Culture positive for *B. suis*.
- 3 pigs, 5-6 dogs (2 bull dogs, 2 curs, 1 or 2 labs), possibly 3 cows, chickens.
- Parents report hunting feral hogs regularly but deny eating feral or owned hogs.
- Child reportedly only had contact with the dogs.
- Bull dog had pups 6-9 months prior but all pups died within 24 hours.
- 3 of 5 dogs and 1 of 3 pigs serologically positive for smooth *Brucella*.
Canine *Brucella suis* Case

- 7+ year old male neutered cattle dog
- Bone plate on leg 7 years ago
- Fight with unknown animal in woods 2 years ago
- Recent lameness in the leg with the plate: suspect loose plate
- Surgery to repair plate increased suspicion of an infectious process
- Culture positive *B. suis* resulted in exposure assessment of lab and surgical staff
## Brucella suis in Dogs

<table>
<thead>
<tr>
<th>Year</th>
<th>Breed</th>
<th>Spayed/Neutered</th>
<th>Testing</th>
<th>Exposure</th>
<th>Illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>cattle dog</td>
<td>M(N)</td>
<td>culture</td>
<td>farm</td>
<td>bone plate infection</td>
</tr>
<tr>
<td>2013</td>
<td>1 black lab</td>
<td>F(S) lab</td>
<td>serology</td>
<td>farm</td>
<td>newborn pups died</td>
</tr>
<tr>
<td></td>
<td>2 bull dogs</td>
<td>M(I) &amp; F(I) bull dogs</td>
<td></td>
<td>hunting</td>
<td>unilateral orchitis</td>
</tr>
<tr>
<td>2013</td>
<td>bull dog</td>
<td>M(I)</td>
<td>culture</td>
<td>farm</td>
<td>unilateral orchitis</td>
</tr>
<tr>
<td>2012</td>
<td>mixed breed</td>
<td>F(S)</td>
<td>culture</td>
<td>farm</td>
<td>disco-spondylitis</td>
</tr>
<tr>
<td>2012</td>
<td>3 hunting dogs</td>
<td>M(I), 2 unknown</td>
<td>serology</td>
<td>hunting</td>
<td>unilateral orchitis</td>
</tr>
</tbody>
</table>

M=male; N= neutered; F= female; S=spayed; I=intact
Canine *Brucella suis* Cases, 2012-2014

Number of Cases
(n = 9*)
- 0
- 1
- 3

*6 cases serologic testing only*
Canine *Brucella suis* Risk

- Undetermined risk to people
- No studies demonstrating curative treatment protocol for infected dogs
- Need data-based recommendations for dog owners whose pets hunt or live on farms
Prevention and Control

- CDC-USDA brucellosis prevention hunter flyer distributed by FDACS to feral swine transport permit holders and by USDA WS to their contacts
- Newsletter and other outreach to commercial labs from FDOH Public Health Laboratories to increase awareness on how to prevent exposures
- USDA-APHIS, WS conducts opportunistic testing of feral swine and shares findings with partners to help direct outreach
- Shared response with FDACS and FDOH for human cases involving domestic animals or if possibility of importation of non-endemic Brucella
- Outreach to human health care providers from FDOH related to brucellosis in people; veterinary and pet owner guidance forthcoming
- Additional surgery exposure guidance from CDC
One Health-One Medicine!

- Brucellosis in wildlife can impact hunters, human and veterinary health care providers, laboratory staff, pets, families and domestic livestock health.

- Shared surveillance and outreach are important tools to help reduce risk for people and animals.
Resources

- FL DOH Brucellosis: http://www.floridahealth.gov/diseases-and-conditions/brucellosis/index.html
- CDC Brucellosis: http://www.cdc.gov/brucellosis/
- CDC Biosafety Resources: http://www.cdc.gov/biosafety/publications/index.htm
- Photo credit for first slide: Dr. C. Dix Harrell, USDA-APHIS, Veterinary Services
Contact Information

- Dr. Danielle Stanek
danielle.stanek@flhealth.gov
850-245-4117

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