Zoonotic Causes of Disease in Goats and Risks to You

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• Zoonoses are diseases that can be transmitted from animals to people
  – Rabies and influenza are commonly known zoonotic diseases
  – Q fever, Sore mouth, Toxoplasmosis, Salmonella, Campylobacter, Chlamydophila, are less common goat infections which also cause human illness

• Be informed
• Protect your health and that of your family and friends!

**Common Zoonotic Diseases of Goats**

• Skin
  – **Orf**
  – **Ring Worm**

• Abortion causing
  – **Q fever**
  – **Toxoplasmosis**
  – Campylobacter
  – Salmonella
  – Chlamydophila

• Raw Milk
  – Listeria
  – Campylobacter
  – E coli
  – Salmonella

• **Kid scours**
  – E coli
  – Cryptosporidium
  – Salmonella
  – Giardia

• **Other**
  – Caseous Lymphadenitis
  – Rabies

**Producer exposures to zoonoses**

• Handling goats with skin lesions without gloves
• Wearing barn clothes in the house
• Drinking unpasteurized milk
• Kidding environment – especially during an abortion storm when handling aborted material
• Handling contaminated hay, feed, manure

**Orf or Sore Mouth**

• **The Barnyard Perspective**
• Also known as: Contagious eczema, sore mouth, scabby mouth, contagious pustular dermatitis
• Worldwide distribution
• Common skin disease in US sheep and goats
- 40% sheep operations*
- 15% goat operations*

• Incubation period: 2-3 days

• Transmission:
  - Direct or indirect
    - Live virus found in dried scabs years after shed (12 years**)
    - Animal handling equipment

• Extremely infectious
  - Up to 90% of flock become ill
  - Mild loss of condition
  - Sores on lips and mouth
  - Lambs and kids greater risk for more serious lesions

• Orf Clinical Signs
  - Papules, pustules, scabby lesions found commonly on lips and skin of face

• Human perspective
  - Often initially misdiagnosed as cutaneous anthrax
  - Risks for infection
    - Vaccination (live vaccine)
    - Contact with infected sheep or goats

• Lesions may be painful
• Persons with compromised immune systems may develop serious infection

• Prevention and Control
  - Keep closed herd
  - Do not purchase from known infected herd
  - Quarantine newly purchased animals
    - Some animals may be silent shedders (no clinical signs)
  - Do not allow contact with other goats at shows

• If herd is infected
  - Vaccinate 2 months prior to kidding to reduce chance of outbreak during nursing
  - Vaccinate to limit duration of outbreak if herd newly infected
  - Vaccinate at least six weeks prior to shows to reduce chance of outbreak during show

• Prevention and Control
  - Vaccine may transmit infection to humans
    - Wear gloves when handling vaccine
    - Wear gloves when handling newly vaccinated animals
  - Scabs may be infectious
    - Wear gloves when handling animals with scabby mouths, udders

Goat Herd Abortions
• Abortion rates in an unaffected herd typically < 2%
• Abortion storm
  - 15 to 70% pregnancies affected
  - Often clustered in time

• Endemic infection
  - 5 to 7%
  - Mistaken as “normal”

Q Fever: An Agricultural Perspective

Animal reservoirs
• Primary reservoirs - Cattle, sheep, goats
  - Reduced fertility
  - Sporadic, late-term abortions

Other reservoirs -
• Argasid and Ixodes ticks transmit during feeding, survives in feces up to 6 years
• Cats, rats, rabbits, mice, filth flies, deer, other wild animals
  - Iowa State U evaluating white tail deer role in bringing into operations
• Forms hardy spore-like form
  – Survives heat, cold, dessication
  – Wool, clay, sand

Ruminant shedding
• Milk, fecal, placental fluids, fetal tissues, vaginal mucus, urine
• Ruminant species variation
  – Cattle shed more in milk and for longer periods\(^1\)\(^,\)\(^2\)
    • Vaginal mucus shedding limited in time
  – Sheep/Goats shed periparturiently (wks - months post partuition)\(^3\)
    • Caprine
      – Milk main route
      – Vaginal mucus and feces less common
    • Ovine
      – Feces, milk, and vaginal mucus shedding
      – Most shed by all routes simultaneously

• Studies
  • Goats with reproductive failure…abortion’s
    • 1\(^{\text{st}}\) year – 30% abortions, 25% shedding (PCR)
    • 2\(^{\text{nd}}\) year – 9% abortions, 94% shedding (PCR)
  • Goat herd abortion episode
    • 11-17% of goats aborted
    • Seronegative on ELISA, tissues positive on PCR

• Little current information on Q fever incidence or geographic distribution in the US

• Message
  • Can have animals with clinical abortions but seronegative
  • Can have animals with no clinical signs that are shedding
  • Animals don’t have to be seropositive to shed organism

Transmission
• Oral ingestion – unclear risk\(^1\)
  – Seroconversion in humans after exposure
  – Pathogenesis unknown
• Tick – not major route of transmission between animals
• Animal to animal transmission common especially around time of abortion
  – Shedding in environment via urine, feces, placental fluid
  – Organism shed in absence of clinical signs
  – Rat reservoirs implicated in Netherlands\(^2\)
• Persistent environmental contamination
• Aerosolization – common cause of human infection
  – Current data out of Netherlands confirms
    • 59% of human cases occurred in individuals that live within 5 km (3 miles) of infected farms while only 12% of population
    • RR of infection is ~ 31 x’s more likely to be infected if live within 2km of infected farm than if lived >5km away
    • Arable land, lack of vegetation and low soil moisture

• Testing Procedures
• Serological testing
  • National Veterinary Services Laboratory
  • 3,000 – 4,000 serological samples / year
  • 2010 – 3076 submissions, 85 positive (2.8%)
  • Complement fixation USDA licensed / official
    • ELISA testing – exports
    • Test comparison: CF and ELISA results
      • 88% agreement between CF and ELISA
    • IFA testing – phase I / phase 2 antibodies
Testing Nationally
- Many veterinary diagnostic labs test for C. burnetii
  - Serologic tests
    - Some sent to NVSL for confirmation
  - PCR testing sometimes sent to CDC
- Washington State
  - Raw milk farms required to test for Coxiella
- Reportable to state animal health agency in 44 states

Prevalence U.S. Cattle
- 2003 CDC study demonstrated 22/24 (92%) seropositive bulk tanks (IFA) from vet school dairy cattle herds
- 2001-2003 study in mostly Northeast dairy herds demonstrated 94% of dairy cattle bulk tanks positive by PCR (3 yr period)
  - Mostly NY but 18 other states represented
- 2007 NAHMS study in 17 states – PCR of raw bulk tank milk samples
  - % operation positive increased as herd size increased
    - 69.8% small operations (<100 head) positive
    - 98.8% large operations (500+ head) positive
    - Overall 76.9% herds positive

Current studies
- NAHMS 2011 study included Coxiella serology and soil samples collected from farms
  - 22 states, 13,249 sheep, 563 operations
    - ELISA at NVSL
    - IFA at Iowa State University
      - positives, equivocals, subset negatives
    - Soil PCR at Iowa State University
      - Dirt samples in or around sheep pens
- NOAA – seal/sea lions
- USGS – sea otters
- Washington State University – prevalence in WA goat herds

Prevalence U.S. Sheep and Goats
- Sheep and goat rates in US are unknown at present
  - Newfoundland study – 60% seroprevalence goats
  - Goats – small population studies highest seroprevalence of ruminant reservoirs
    - Preliminary data from Iowa State diagnostic lab suggests herd level shedding may be high ~45%
    - Dr Paula Menzies data collected from both bulk tank and abortion samples submitted to lab ~45%
- Netherlands outbreak in 2007- 2009
  - Began with abortions on goat farms 2005 – 2007
    - 15 dairy goat farms, 1 dairy sheep farm
    - In 2007, there were 168 human cases
    - In 2008, there were 1,000 human cases
    - In 2009, there were 2,357 human cases
  - What happened?
    - Increase in goat populations (10 fold increase from 1998 to 2008), naive human population, good conditions for aerosol spread, other?

Human Perspective
- Organism is highly infective
- 1 organism can infect a human when inhaled
- Major human outbreaks often associated with
  - Parturient small ruminants
  - Dusty and windy conditions
  - Close proximity (<2 miles) to farms with aborting does
- Incubation period: usually 2-3 weeks
• Asymptomatic (~50% of infected persons)
• Acute illness
  • Fever, chills, severe sweats, cough, malaise, headache, chest pain, weight loss
  • Pneumonia or hepatitis
• Chronic disease (rare; 1-5% of all infections)
  • Primarily endocarditis
  • Chronic hepatitis, recurrent miscarriages, bone or liver infections
  • Risk factors: pregnancy, pre-existing heart valve defect, immunosuppression
  • Chronic fatigue syndrome
• Considered to be an occupational risk
  • Slaughterhouse workers
  • Biomedical research
  • Veterinarians
  • Producers.....
• Overall seroprevalence 3.1%
  • Higher in older age groups
  • Higher in Mexican-Americans (7.4%)
• Outbreak of Q Fever, 2011
  • Traced goats from Farm A to 20 additional farms
    • Included WA, MT, and OR
    • 17 of 21 total farms participated in investigation
  • Detected C. burnetii in herds at 16 of 17 farms
  • Identified 20 human infections (11 WA; 9 MT)
    • 15 (75%) were symptomatic
    • 4 hospitalized; no deaths
  • Genetic analysis identified same strain (type 8) in 3 specimens
    • Index goat placenta, MT goat, WA environmental swab
  • Risk factor analysis in progress

Control of Coxiella - goats
• Non-specific
  • Education
  • Reduce Contamination of the Environment
    • Isolation of affected animals and their progeny
    • Reduce manure spread on farms
    • Prompt removal of placentas/aborted fetus'
• Specific
  • Antibiotics
    • Limit abortions but do not suppress transmission
  • Vaccination – not available in the US
    • Reduces abortions and transmission if given to non-pregnant animals

Prevention of Q Fever - humans
• Protective clothing, masks, gloves
• Reduce potential to bring into the home by changing barn clothing and boots before entering home
• Use disinfectant hand wash

Toxoplasmosis
• Naïve cats become infected by eating infected rodents, birds, aborted material
• Cats pass oocysts for ~ 5 to 14 days.
• Sporulated oocysts infective for up to 18 mo.
  • Contaminate feed & pasture with feces
• Naïve does mount an immune response
  • If pregnant will infect placenta & fetuses
  • Mummies / abortions / stillbirths /weak & small kids
  • Lesions on placentas
Toxoplasmosis in Humans
• Prevalence – 22.5% of US population 12 years and older
• Transmission
  – Foodborne
    • Eating undercooked meat (mostly lamb, pork, venison)
    • Not washing hands well after working with uncooked meat
  – Zoonotic transmission
    • Cats play important role – contaminate soil, water, barn environment, goat feed
      – Shed millions of oocysts for up to three weeks after infected
    • Humans become infected when in contact with feces
      – Cleaning litter boxes
      – Working with contaminated hay, goat feed
      – Working with soil, eating vegetables contaminated with soil
  – Congenital toxoplasmosis (to fetus) from new infection while pregnant
  – Organ donation or blood transfusion – Rare

Human Illness from Toxoplasmosis
• Fetal infection
  – Signs:
    • Premature birth or underweight fetus
    • Damage to brain and eyes
    • Milder damage not apparent until older
• Post-Natal Infection
  – Usually mild illness with fever and swollen glands
• Infection is life-long
• If impaired immune system
  – Encephalitis
  – Retinal damage
  – Altered mental state

Control of Toxoplasmosis
• Cats – Spay them
  – Operations on which cats had litters were highest risk for toxoplasmosis*
• Rodent control
  – Infected mice will pass to offspring
• Feed protection from feces
  – Grain in containers
  – Don’t feed top bales to pregnant ewes
  – Purchased feed may contaminated

General Precautions
• Handling of aborted tissues and females
  – Wear mask & gloves
• Protection when assisting births especially:
  – Pregnant women
  – Very young and very old
  – Immuno-compromised
• Wear dedicated protective clothing
  – Includes hat, coat, boots
  – Change clothing before entering home
• Wash hands and arms with disinfectant after goat work
• Safer to drink pasteurized milk
• Practice Good Biosecurity - always