Veterinary Public Health Activities in Nebraska

Annette K. Bredthauer, DVM
Public Health Veterinarian

Position established December 2003

Responsibilities

- Rabies Control Coordinator
- Bio-terrorism, Agro-terrorism prevention
- Zoonotic disease surveillance
Public Health Veterinarian Responsibilities

- Responsible Antibiotic usage
- Liaison with Vets, government, universities and industry
- Medical Entomology
- West Nile Virus Surveillance
Zoonotic Disease

- Rabies
- Tularemia
- Q Fever
- Hantavirus
- Avian Influenza
- SARS
- Monkeypox

- Brucellosis
- Food-borne illness (animal origin)
- Parasites
  - Scabies
  - Headlice
- WNV
Zoonotic Diseases

- Psittacosis
- Salmonella
  - Food-borne infection - meat
  - Hamsters - Pet Shops
- LCM mice
Hantavirus Pulmonary Syndrome
Hantavirus Pulmonary Syndrome (HPS)

- Sin Nombre Virus
- Formerly Muerto Canyon Virus
- Bunyaviridae
  - RNA virus
  - Single strand, negative sense
  - Enveloped
  - Replicates in host cytoplasm
Sin Nombre Virus
Sin Nombre Virus

- Identified SW U.S. – 1993
- Endemic in rodents
- Primarily *Peromyscus* spp.
  - White footed mouse
  - Deer mouse
- Spread by rodent urine, feces, saliva
- Inhalation, rodent bites, wound contact
Hantavirus Pulmonary Syndrome Cases by State of Residence United States – July 6, 2005

Total Cases (N=396 in 32 States)

Three cases were reported with unknown state of residence.
Distribution* of *Peromyscus maniculatus* and Location of HPS Cases as of July 6, 2005

Total Cases (N=396 in 30 States)

Hantavirus Pulmonary Syndrome

- Exposure may occur 1-5 weeks before signs
- May not see rodents or rodent droppings
Hantavirus Pulmonary Syndrome

- Prodromal period: 3-5 days
  - Fever
  - Myalgia
  - Chills
  - Headache
  - Dizziness
Hantavirus Pulmonary Syndrome

- **Day 7**
  - Cough
  - Nausea
  - Shortness of breath
  - Lung edema
  - High WBC, low platelets
  - Hospitalization within 24 hours
  - 50% Mortality rate
Hantavirus Pulmonary Syndrome
Radiographic Findings

- Bilateral interstitial infiltrates
  - moderate to rapid progression
- Bilateral alveolar infiltrates
- Pleural effusion
Interstitial Pneumonitis

- Congestion
- Interstitial infiltrate of enlarged mononuclear cells (immunoblasts)
- Intra-alveolar and septal edema
- Focal hyaline membranes
Histopathology
Lung

Absence or minimal evidence of:

- Cellular debris
- Neutrophils
- Epithelial injury
- Viral inclusions
- Fungi or bacteria by specific stains
Histopathology

Other Organs

- **Enlarged mononuclear cells (immunoblasts)**
  - Lymph nodes (sinuses and paracortex)
  - Spleen (red pulp and periarteriolar sheaths)
  - Liver (triaditis)
  - Vessels (different organs)

- **Other changes (minor)**
Hantavirus Case Definition

A febrile illness (i.e., temperature greater than 101.0 F {greater than 38.3 C}) characterized by bilateral diffuse interstitial edema that may radiographically resemble ARDS, with respiratory compromise requiring supplemental oxygen, developing within 72 hours of hospitalization, and occurring in a previously healthy person.

CDC
Hantavirus Case Definition #2

An unexplained respiratory illness resulting in death, with an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause
Case Classification

Confirmed

A clinically compatible case that is laboratory confirmed
Hantavirus Laboratory Criteria

1. Detection of hantavirus-specific immunoglobulin M or rising titers of hantavirus-specific immunoglobulin G

2. Detection of hantavirus-specific ribonucleic acid sequence by polymerase chain reaction in clinical specimens

3. Detection of hantavirus antigen by immunohistochemistry
# Nebraska Case Confirmed Hantavirus

<table>
<thead>
<tr>
<th>Date</th>
<th>Age/Sex</th>
<th>Occupation</th>
<th>Exposure</th>
<th>Result</th>
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<tbody>
<tr>
<td>July 1998</td>
<td>40 M</td>
<td>Farmer</td>
<td>Grain bins</td>
<td>Lived</td>
</tr>
<tr>
<td>June 2002</td>
<td>30 M</td>
<td>Mechanic</td>
<td>Shop mice</td>
<td>Died</td>
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<tr>
<td>June 2002</td>
<td>41 M</td>
<td>Feedlot Manager</td>
<td>Hay</td>
<td>Lived</td>
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<tr>
<td>Oct. 2002</td>
<td>50 F</td>
<td>Office Mgr</td>
<td>Mice/farm</td>
<td>Lived</td>
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<tr>
<td>Nov. 2002</td>
<td>20 M</td>
<td>HVAC</td>
<td>Repairs</td>
<td>Died</td>
</tr>
<tr>
<td>June 2003</td>
<td>45 F</td>
<td>Baker</td>
<td>House repair</td>
<td>Lived</td>
</tr>
<tr>
<td>April 2005</td>
<td>52 M</td>
<td>Rancher</td>
<td>Hay</td>
<td>Died</td>
</tr>
</tbody>
</table>
HPS Case #7

- White male 52 y.o.  68 in.  220 lb
- Garden County- Western Nebraska
- Rancher
- No drug, alcohol or tobacco issues

History
- Six week history of sinus congestion
- Allergic rhinitis
- ‘Very strong, healthy, dynamic person’
- Bag of gopher poison in back seat of pickup
HPS Case #7

4-16-2005

- Febrile 103° F, cough, weakness, described ‘horrible myalgias’
- Overnight hospitalization (Community hospital)
- IV antibiotics, Levaquin  
Dx: bacterial pneumonia
- Released to home
- Fever continued, increasing respiratory distress
HPS Case #7

- **4-20-2005**
- Community Hospital Emergency Room
- Tachypnea 150/min
- Hypoxic Oxygen saturation 70s
- Hypotensive systolic pressure 70-80 mm
- Radiographic Bilateral lung infiltrate
- WBC 47,000
- Platelets 27,000
Life Flight to University Hospital

- Temperature 96.6\(^\circ\) F
- Pulse 123
- Resp. rate 30
- Blood pressure 70/30
- Sedated, intubated
- Positive pressure ventilation
- \(O_2\) Saturation 72%
- Perihilar upper lung edema
- Friable tracheal mucosa with frothy secretions
<table>
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<tr>
<th>Test</th>
<th>Patient</th>
<th>Reference</th>
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<tr>
<td>WBC</td>
<td>70,000</td>
<td>3,800-10,800</td>
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<tr>
<td>Hemoglobin</td>
<td>19</td>
<td>13.8-17.2</td>
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<tr>
<td>Hematocrit</td>
<td>61.3</td>
<td>41-50</td>
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<tr>
<td>Platelets</td>
<td>36,000</td>
<td>130,000-400,000</td>
</tr>
<tr>
<td>Calcium</td>
<td>6.5</td>
<td>8.5-10.3</td>
</tr>
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</table>
Sin Nombre Virus Serology

- IgG titer 1:100
- IgM titer 1:6400

IgM titer $\geq$ 1:400 and IgG titer $\leq$ 1:400

‘Suggests acute infection depending on clinical history’

Optimally submit second sample for confirmation
HPS Case #7

- Patient deceased (4-21-05)
- Autopsy
  - HantaVirus Pulmonary Syndrome confirmed
  - Chronic Lymphocytic Leukemia
    - Undiagnosed
    - Possible contributing factor?
Public Health Response

- Determine patient risk factor(s)
- Search for other cases
  - Family members
  - Community
  - Epidemiologic patterns (BT)
- Educate the public
- Public Health Reports - NE, CDC
Public Education

- Rodents
  - Remove outdoor harborage
  - Seal houses against invasion
  - Remove food sources
  - Clean up rodent debris
    - Avoid aerosolization of urine/feces/saliva (wet down area)
    - Personal protection
Q Fever
The Organism

- **Coxiella burnetii**
  - Rickettsial agent
  - Obligate intracellular parasite
    - Lives in Acidic lysosomes
  - Stable and resistant in environment
  - Killed by pasteurization
  - Two antigenic phases
    - Phase 1: virulent, isolated from animals
    - Phase 2: less pathogenic
CDC Category ABC Agents

**Category A**
- Anthrax
- Botulism
- Tularemia

**Category B**
- Brucellosis
- Glanders
- Melioidosis
- Q Fever
- Viral encephalitis
- Toxins

**Category C**
- Nipah
Query Fever 1935

- Edward Derrick investigated cluster of acute febrile illness in Brisbane, Australian Abattoir workers
- Called it ‘Malady Q’
- Initially thought to be virus
- Passed disease to Guinea Pigs with blood from affected humans
Montana 1935

Gordon Davis studying RMSF

- Found ticks from Nine Mile Creek would spread disease to Guinea Pigs that was not RMSF
- ‘Nine Mile Agent’
- Rickettsial organism found in ticks
- 1950 significance related to parturition
- Cox and Burnet worked to isolate and characterize organism
Environmental Persistence

Shed in the environment in a small cell form that is very hardy (“spore-like”)

• Resistant to pH changes, desiccation, UV light

• Resistant to some common disinfectants

• Remains viable in soil, dust for months to years
  - isolated from barns, soil – culture, PCR

• Raises questions regarding:
  - environmental contamination
  - appropriate cleaning/disinfection
Electron micrograph showing an infected monkey cell with one large vacuole harboring about 20 *Coxiella burnetii* bacteria. [Credit: R Heinzen, NIAID]
Q Fever in the U.S.: 2002

Q FEVER. Reported cases — United States and U.S. territories, 2002

MMWR
Epidemiology

- **Worldwide**
  - Except New Zealand
- **Reservoirs**
  - Domestic animals
    - Sheep, cattle, goats
    - Dogs, cats
  - Birds
  - Reptiles
  - Wildlife
Epidemiology

- Occupational and environmental hazards
  - Farmers, producers
  - Veterinarians and technicians
  - Meat processors, Slaughterhouse
  - Laboratory workers
Transmission

• Ruminants most common source of human infection
  - Cattle, sheep, goats
  - Parturient fluids
    \[ 10^9 \text{ bacteria per gram of placenta} \]
• Domestic animals
  - Cats
• Wild animals (rodents)
• Birds (pigeons)
• Ticks
  - Importance debated
Transmission

- Wind-borne environmental spread
  - Can be spread several miles down-wind
- Contact with contaminated products
  - Straw
  - Fertilizer -- Manure
  - Farm equipment
- Human-to-human rare (OB/GYN, sexual)
Age Distribution of Q fever Cases in the United States, NETSS 2000-2004

p < 0.0001
Month of Illness Onset, Q fever Cases in the United States, NETSS 2000-2004
Q fever Seroprevalence in the United States

Human Seroprevalence Studies:
- persons with livestock contact 7.8%
- general population 0.8%
- Risk Ratio 10.3 [95% CI 9.0-11.8])

• Ruminant Seroprevalence Studies:
  - bovine bulk tank: 26.3%
  - cattle: 3.4%
  - sheep: 16.5%
  - goats: 41.6%

• Vet school dairy herds, antibodies in milk
  - 9/22 (38%) had titers ≥ 1:256
Current Surveillance for Q fever in the United States

• Q fever in animals is not reportable

• Human disease was made reportable in 1999
  - states report cases to CDC via NETSS
  - data available for 2000-2004
Animals and
Q Fever
Sheep, cattle, goats
- Usually asymptomatic
- Reproductive failure
  - Abortions, stillbirths
  - Retained placenta
  - Infertility
  - Weak newborns
  - Low birth weights
  - Mastitis in dairy cattle
- Carrier state
Animal Disease

- **Other animal species**
  - Dogs, cats, horses, pigs, camels, buffalo, pigeons, other fowl
  - Asymptomatic
  - Reproductive failure

- **Laboratory Animals**
  - Rats, rabbits, guinea pigs, hamsters
  - Varies from asymptomatic to fever, granulomas, or death
Morbidity and Mortality

- Prevalence unknown
  - Endemic areas
    - 18-55% of sheep with antibodies
    - 82% of dairy cattle
- Morbidity in sheep: 5-50%
Disease in Humans
Human Disease

- Incubation: 2-5 weeks
- One organism may cause disease
- Humans are dead-end hosts
- Disease
  - Asymptomatic (50%)
  - Acute <6 months
  - Chronic > 6 months
Acute Infection

- Flu-like, self limiting
- Atypical pneumonia (30-50%)
  - Non-productive cough, chest pain
  - Acute respiratory distress possible
- Hepatitis
- Skin rash (10%)
- Other signs (< 1%)
  - Myocarditis, pericarditis, meningoencephalitis
- Death: 1-2%
Chronic Disease

- 1-5% of those infected
  - Prior heart disease, pregnant women, immunocompromised
- Endocarditis
- Other
  - Osteomyelitis
  - Granulomatous hepatitis
  - Cirrhosis
- 50% relapse rate after antibiotic therapy
Risk to Pregnant Women

- Most cases asymptomatic
- Transplacental transmission

Reported complications

- In-utero death
- Premature birth
- Low birth weight
- Placentitis
- Thrombocytopenia
Prognosis

- Overall case-fatality rate: <1 - 2.4%
- 50% cases self-limiting
- Only 2% develop severe disease
- Active chronic disease
  - Usually fatal if left untreated
  - Fatality for endocarditis: 35-55%
  - 50-60% need valve replacement
Case Definition

Clinical Description
An acute febrile rickettsial disease; onset may be sudden with:

- chills
- retrobulbar headache
- weakness
- malaise
- severe sweats

May see interstitial pneumonitis on x-ray
Confirmed Case

A clinically compatible case and

- Fourfold or greater change in antibody titer to *C. burnetti* antigen by IF, microagglutination, CF, or ELISA or
- Identification of *C. burnetti* by immunostains or electron microscopy or
- Isolation of *C. burnetti* from blood
Case Classifications

- “Probable” classification not used
- “Possible” only used until confirmation is obtained; no possible case classifications are retained
Diagnosis

Serology (rise in titer)
- IFA, CF, ELISA, microagglutination
- DNA detection methods
  - PCR
- Isolation of organism
  - Risk to laboratory personnel
  - Rarely done
Treatment

- **Treatment**
  - Doxycycline
  - Chronic disease – long course
    - 2-3 years of medication

- **Immunity**
  - Long lasting (possibly lifelong)
3/25/2005

Information phone call from UNL Veterinary Diagnostic Lab to HHSS

- Goat sera #1: + > 1:20 for C. burnetii
- Goat sera #2: - @1:10
- Placenta: + PCR
- Owner complaint: goat abortions, weak kids
- Public Health risk?
“…..This is the worst luck we ever had kidding out these goats. And if that wasn’t bad enough, my wife and I have both had the ‘flu’ that just hangs on and on…”
Case #1

- Male Farmer  age 36
- Excellent health
- Southeast Nebraska
- Livestock on farm
  - 100 + Boer Goats
  - Cattle
  - Riding horses
Cases #1, #2

Nebraska

Lancaster

Lincoln
Case #1

- Onset 2/18/2005
  - Fever 103.7 °F
  - Myalgia
  - Malaise
  - Anorexia—weight loss
  - Chills
  - Sweating
  - Weakness
  - Cough
Case #1

- Did not complain of:
  - Retrobulbar pain
  - Headache

- Unusual Activity?
  - Assisted parturient goats
    - Cleaned up after parturition, abortions
Case #1 History

- 100 + Boer Goat reproducing females
  - Purchased 10 additions in early Fall from Sale barn
  - 50 does kidded in December normally
  - 50 does kidding in January/February
    - 22 does affected
      - Pre-mature births
      - Weak kids- died without ‘intensive care’
      - Retained placentas
Case #2

- Woman age 36 yr
- Elementary School Secretary
- Spouse of Case #1
- Worked with Goat does/neonates
- Excellent health
Case #2
Onset 02-05-2005

- Fever 100.1°F
- Myalgia
- Retrobulbar pain
- Malaise
- Headache
- Anorexia
- Chills
- Sweating
- Weakness
- Cough

Missed 4 days of work
Case #2

- Reported that she ‘pulled many kids’
- Nursed pre-mature neonates
- Course of disease 5 weeks
  - Examined by 3 physicians
  - Q Fever not considered
- Doxycycline therapy based on positive goat placenta PCR
# Serology Results

<table>
<thead>
<tr>
<th>Case #1</th>
<th>Male</th>
<th>I- IgG 3/9/05</th>
<th>II-IgG 3/9/05</th>
<th>I-IgG 5/1/05</th>
<th>II-IgG 5/1/05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;32</td>
<td>128</td>
<td></td>
<td>&lt;32</td>
<td>256</td>
</tr>
</tbody>
</table>

| Case #2  | Female | 128          | 2048          | 512          | 512           |

| Son      | Age 15  | No samples   | No samples   | 4096         | 1024          |

Titers $\geq 128$ suggest exposure to or infection with *C. burnetti*
Figure 4. Idealised representation of antibody responses to *C. burnetii* Phase I and II antigens during acute Q fever - as measured by immunofluorescence (IF) and by complement fixation (CFT) (modified from reference 28).
Q fever and Bioterrorism

• **Category B bioterrorism agent**
  - high morbidity
  - inhalation route of transmission
  - extreme persistence in environment

• Previous development as an agent of bio-warfare

• Accessible – obtain from environment
Why is Surveillance so difficult?

- Nonspecific clinical signs
  - resembles a variety of other common illnesses
  - self-limiting in most cases
  - poor physician recognition

- Requires laboratory confirmation for reporting
  - Serology requires paired serum specimens
    - early specimens frequently negative
    - patients rarely return to provide convalescent samples
  - Physicians must request appropriate tests
Prevention and Control

- Pasteurization of milk from cows, sheep, goats

Eradication not practical
- Too many reservoirs
- Constant exposure
- Stability of agent in environment
Prevention and Control

- **Education**
  - Sources of infection

- **Good husbandry**
  - Disposal of birth products (incinerate)
    - Lamb indoors in separate facilities
  - Disinfection
    - 0.05% chlorine
    - 1:100 Lysol

- **Isolate new animals**
Public Health Response

- Determine patient risk factor(s)
- Search for other cases
  - Family members
  - Community
  - Epidemiologic patterns (BT)
- Educate the public
- Public Health Reports
  - Reportable Disease
Tularemia

Rabbit Fever, Deer Fly Fever
The Organism

- **Francisella tularensis**
  - Gram negative
  - Intracellular pathogen
    - Macrophages
  - Survival-persistence
    - 3-4 months in mud, water dead animals
    - >3 years in frozen meat
  - Easily killed by disinfectants
  - Inactivated by heat
CDC Category ABC Agents

**Category A**
- Anthrax
- Botulism
- Tularemia

**Category B**
- Brucellosis
- Glanders
- Melioidosis
- Q Fever
- Viral encephalitis
- Toxins

**Category C**
- Nipah
Subspecies

- *F. tularensis* biovar tularensis (Type A)
  - More virulent
  - Found in North America
  - Reservoirs
    - Rabbits and hares
    - Ground squirrels
    - Ticks

- *F. tularensis* biovar palaearctica (Type B)
  - Less virulent
  - Found in Eurasia and North America
  - Reservoir
    - Muskrats, water rats
    - Voles, mice, rats
    - Other rodents
Epidemiology

- Northern hemisphere only
  - North America, Europe, Russia, China, Japan, Mexico
FIGURE 2. Reported cases* of tularemia — United States, 1990–2000

Number of Cases†
- 1
- 18
- 39
Transmission

- **Reservoirs**
  - Many mammals, ticks, and some birds
    - Rabbits, hares, beavers, muskrats,
    - Domestic animals, hard ticks
  - Ticks and rabbits most important
  - Rodent-mosquito cycle in Russia, Sweden

- **Infectious dose**
  - Small for inoculation or inhalation (10-50)
  - Large for oral ($10^8$)
Transmission

- Vector-borne
  - Ticks
    - Transovarial transmission
    - 14 species
      - *Dermacentor andersonii*
      - *Dermacentor variabilis*
      - *Amblyomma americanum*
  - Mosquitoes, flies (Sweden)
    - Less frequently
      - *Chrysops discalis* (Deer fly)
Transmission

- **Direct**
  - Contact with tissues of rabbits or other infected mammals
    - Skinning, necropsy
    - Handling contaminated skins, paws

- **Ingestion**
  - Undercooked meat
  - Contaminated water
    - Waterborne outbreaks
Transmission

- Aerosol
  - Contaminated dust
  - from hay, grain or soil
  - Laboratory testing procedures
- Bites or scratches (rare)
- Not person-to-person
Incubation
- 3-15 days
- Varies with virulence of strain and dose

Initially all forms start with
- Sudden fever
- Chills
- Headache
- Myalgia

6 clinical syndromes
- Ulceroglandular
- Glandular
- Oculoglandular
- Oropharyngeal
- Typhoidal
- Pulmonary
Human Disease

- **Ulceroglandular**
  - Most common
  - Ulcer and regional lymphadenopathy
    - Ulcer 1 week-months
- **Glandular**
  - Regional lymphadenopathy, no ulcer
  - Second most common
- 75-85% of all cases
Human Disease

- Oculoglandular
  - Conjunctiva infected
    - By contaminated fingers
    - Contaminated material splashed into eye
  - Conjunctivitis
  - Regional lymphadenopathy
- Severe form
  - Ulceration of conjunctiva
  - Ocular discharge
Human Disease

- Oropharyngeal
  - Ingestion
    - Hand-to-mouth
    - Consumption of undercooked meat or water
  - Pharyngitis, diarrhea, abdominal pain, vomiting, GI bleeding, nausea
  - Pseudomembrane may develop over tonsils
Human Disease

- **Typhoidal**
  - Acute
  - Septicemia
    - Without lymphadenopathy or ulcer

- **Pulmonary**
  - Inhalation of aerosol
  - Spread through bloodstream
  - Complications from other forms

- **Case-fatality (untreated): 30-60%**
Tularemia

Eschar from rabbit bite

‘Heaped up’ ulcer

Axillary bubo
Clinical Description

An illness characterized by several distinct forms, including the following:

- **Ulceroglandular** (cutaneous ulcer with regional lymphadenopathy)
- **Glandular** (regional lymphadenopathy with no ulcer)
- **Oculoglandular** (conjunctivitis with preauricular lymphadenopathy)
- **Oropharyngeal** (stomatitis or pharyngitis or tonsillitis and cervical lymphadenopathy)
- **Intestinal** (intestinal pain, vomiting, and diarrhea)
- **Pneumonic** (primary pleuropulmonary disease)
- **Typhoidal** (febrile illness without early localizing signs and symptoms)
Clinical diagnosis is supported by evidence or history of a tick or deerfly bite, exposure to tissues of a mammalian host of *Francisella tularensis*, or exposure to potentially contaminated water.
Laboratory criteria for diagnosis

Presumptive

- Elevated serum antibody titer(s) to \textit{F. tularensis} antigen (without documented fourfold or greater change) in a patient with no history of tularemia vaccination or
- Detection of \textit{F. tularensis} in a clinical specimen by fluorescent assay
Laboratory criteria for diagnosis

**Confirmatory**

- *Isolation of F. tularensis in a clinical specimen or*
- *Fourfold or greater change in serum antibody titer to F. tularensis antigen*
Case Classification

Probable

A clinically compatible case with laboratory results indicative of presumptive infection
Case Classification

Confirmed

A clinically compatible case with confirmatory laboratory results
Tularemia

Nebraska Mowers Get Rabbit Disease

LINCOLN, Neb., June 25, 2003

(AP) Two men who mowed over a nest of rabbits, killing some of them, and another who cleaned the mower developed a rare disease known as rabbit fever, authorities said.

The federal Centers for Disease Control and Prevention has launched an investigation into the incident. The disease, also called pneumonic tularemia, is generally treatable with antibiotics but can lead to pneumonia.

The illness is caused by a bacterium found in wild animals, particularly rodents and rabbits. People can become infected through bites from infected animals or infected insects, handling carcasses, eating contaminated food or, in rare cases, inhaling the bacterium. It is not transmitted person-to-person.
Epidemiology

- Nationally notifiable in the United States
  - About 100 cases per year
  - Summer – tick/deerfly abundance
  - Early winter – rabbit hunting season
Diagnosis

- Immunofluorescent staining
  - Tissue samples
  - Blood
- Serology
  - ELISA, Microagglutination
  - Titer: four-fold increase
- PCR
- Culture and isolation
  - Caution needed for laboratory workers
  - Biological safety level III
Treatment and Prognosis

- Antibiotic treatment 7-14 days
  - Streptomycin
  - Gentocin
  - Doxycycline, Chloramphenicol, Cipro
  - Untreated
    - Symptoms last 1-4 weeks to months
    - <8% mortality overall (all cases)
    - Case-fatality for typhoidal and pneumonic (30-60%)

- Treated
  - <1% mortality overall (all cases)

- Type A has higher case-fatality rate

- Long-term immunity
Wildlife Disease

Rabbits and hares

- Usually found dead
  - Weakness, fever, ulcers, abscesses, lymphadenopathy
- Behave strangely
  - Easily captured because they run slowly
  - Rub their noses and feet on the ground
  - Muscle twitches
  - Other: anorexia, diarrhea, dyspnea
Large Animal Disease

- Sheep
  - Outbreaks in enzootic areas
    - Following severe winter
    - Heavy tick infestations
  - Fever, weight loss, lymphadenopathy, dyspnea, diarrhea, isolate from flock, rigid gait
  - Death in young
Large Animal Disease

- **Equine**
  - Fever, depression, dyspnea, ataxia, stiffness, limb edema

- **Swine**
  - Adults: Latent
  - Young
    - Fever, dyspnea, depression

- **Bovine**
  - Appear to be resistant
Companion Animal Disease

- **Cats**
  - Fever, depression, anorexia
  - Listlessness, apathy
  - Ulcerated tongue and palate

- **Dogs**
  - Fever, anorexia, myalgia
  - Ocular and nasal discharge
  - Abscess at site of infection
Tularemia Case #1

Male  white age 13
South Central Nebraska
Healthy, enjoyed outdoor activities

- 6/15/05
  - Groin pain started
  - Ignored pain as much as possible
- 7/18/05
  - Returned from Scout campout due to intense pain
  - Admitted to Hospital
- Marked inguinal lymphadenitis
Tularemia Case #1

Nebraska

Lancaster
Tularemia Case #1

Clinical Signs

- Diarrhea
- Fever 102° F
- Headache
- Severe pain inguinal lymph nodes
- No rash
Tularemia Case #1

Test results

RMSF: Neg
Monotest: Neg
Lyme test: Neg
Cold agglutinin test: Neg
EB test: Neg
Tularemia Case #1

Lab Results

WBC 8,000-15,000

CBC

  Mild lymphopenia
  Increased reactive lymphocytes
  Mild monocytosis with mild left shift
Tularemia Case #1

**Physical Exam**

Enlarged Inguinal lymph nodes (bilateral)

4 cm x 6.5 cm

Raised, erythematous and fluctuant

No draining abscesses
Tularemia Case #1
Inguinal lymph nodes
Tularemia Case #1
Inguinal lymph nodes
Tularemia Case #1

7/18/05
Lymph Node incision (1.5”), drain, open pack

Administered Gentamycin  IV q. 8 hr.
Uneventful recovery
Tularemia Case #1

Lab Results

Francisella Antibodies 1:640 (POS)

Recalled tick bite in groin area 3-4 days before groin pain began
Tularemia Case # 2

Woman, white age 66
Extreme south-east Nebraska
Rheumatoid arthritis- long term Methotrexate usage

Farm resident
1 dog, 12 “wild farm cats”

Patient observed:
4 cats caught, ate rabbit mid-July
4 cats became ill and 3 died
Tularemia Case #2

Nebraska

Lancaster

Lincoln
7/17/05-
Cat #4
  Sick cat bites woman’s index finger
Cat dies
Body discarded
  - not tested for rabies
Tularemia Case #2

7/20/05  Vomiting and chills start
          Patient becomes ‘concerned about Rabies’

7/22/05  Hospitalized
          Uncontrollable atrial fibrillation
          Temp. 104.4 F, pulse 150,
          Systolic BP 78
          WBC 13.4
Tularemia Case # 2

7/22/05 - Began rabies PEP treatment
Discharged 3 days later with oral antibiotics

8/3/05 - Patient admitted to hospital
chills, nausea, vomiting
Temp: 104.4°F
Severely swollen index finger
Tularemia Case # 2

8/5/05 - Lance and cavitate finger abscess
Unasyn - Ampicillin and bacta-lactamase inhibitor IV qid
Dismissed 8/16/05

Culture positive for *F. tularensis* (collected 8/5/05)
Serology (collected 7/24/05) Negative
Public Health Response

- Determine risk factor(s)
- Evaluate other cases
  - Family
  - Community
  - Bio-terrorism event?
- Arrange for confirmatory testing
- Communicate findings with other Agencies
- Educate
- Reportable disease
Public Health Response

- Select Agent Rule
- Tularemia surveillance
  - Baseline
  - Environmental differences
    - Historically central Nebraska several positive animals
    - Predator testing: 6% overall seropositive
RABIES
Bite/scratch transmission: Rabies

- Viral infection
- Worldwide
- Concentrates in saliva
- Transmitted by bite or scratch (saliva) from a rabid animal
- Invariably fatal without treatment
- Primarily a disease of animals
Animal Reservoirs

- In the US predominantly maintained in wildlife
  - Terrestrial carnivores
    - Skunk
    - Raccoon
    - Fox
    - Coyote
  - Bats
Distribution of Major Terrestrial Reservoirs of Rabies in the United States

- Skunk
- Raccoon
- Fox
- Coyote
Rabies in Humans

- **Incubation 2-8 weeks**
  - 10 days to 8 months (7 years)
  - Dose, site of bite, severity

- **Symptoms**
  - Anxiety, headache, malaise, sensory alterations
  - Excitation phase
    - Hyperesthesia, light sensitivity, increased salivation, muscle spasms
    - Hydrophobia- inability to swallow
    - Aerophobia- muscle spasms of face due to wind
    - May progress to paralytic phase
  - 2-6 Day Duration
  - Death
Rabies Virus in the Body

- Rabies Virus travels from bite wound to nerves
- Virus travels up nerves to spinal cord
- Brain involvement causes typical signs
- From brain travels to innervated organs (salivary glands)
Disease in animals

- **Domestic species (dog, cat)**
  - Incubation period 10 days to > 2 months
  - Behavior changes
    - Hiding, agitated, circle nervously, startle easily
  - After 1-3 days—excitation phase
    - Dangerously aggressive
    - Abundant salivation
    - Bark becomes prolonged howl
    - Terminal convulsions
Disease in animals

- Domestic species (dog, cat)
  - “Dumb” form
    - Predominance of paralytic phase
    - Short or no excitatory phase
    - Paralysis
      - Head, extremities, generalized
  - Cats
    - Excitatory phase most common
Stray Dogs
Stray Cats
Stray Ferrets

Confine 72 hours,
If not claimed by owner,

Wild Mammals,
(Dog Hybrids, Cat hybrids considered on individual case basis)

Animal vaccinated with approved Rabies Vaccine under NE State guidelines

Confined by Owner or other responsible party for 10 days.
Veterinarian examines animal for signs of Rabies before release.

EUTHANIZE
COLLECT BRAIN
SEND TO LAB FOR RABIES TESTING

Nebraska Rabies Control Program Coordinator
Annette Bredthauer, DVM
Health Surveillance
P.O Box 95007
Lincoln, NE 68509
(402)471-2937 M-F (402) 471-2400 night/wknd
ALGORITHM FOR HANDLING AN ANIMAL EXPOSED TO A RABID ANIMAL OR WILD ANIMAL UNABLE TO BE CAUGHT AND TESTED (POTENTIALLY RABID)

Stray Dogs, Cats Or Ferrets

Other Mammals

Livestock: Cattle, Horses, Sheep, Swine

Owned Dogs, Cats, Or Ferrets

Euthanize (Test)

Not Rabies Vaccinated

Rabies Vaccinate

Not Rabies Vaccinated

Current or Overdue

Revaccinate Rabies Observe for 45 days under Owners Control

Strict Isolation for 6 months. Rabies vaccination one month before release (Pets)

Nebraska Rabies Control Program Coordinator
Annette Bredthauer, DVM
Health Surveillance
P. O. Box 68509
Lincoln, NE 68509
(402) 471-1374 M-F  (402) 471-2400 night/wknd
Disease in animals

- **Cattle**
  - Paralytic symptoms most predominant
    - Stand away from herd
    - Dilated pupils
    - Rough coat
    - Somnolence or depression
    - Stumbling
Disease in animals

- Cattle
  - Excitation more rare
    - Muscle tremor, restlessness, sexual excitement appearance
    - Hypersensitivity at site of bite
    - Muscular incoordination
    - Tonic-clonic contractions of head and neck muscles
    - Difficulty swallowing - stop ruminating
      - Present as ‘Choke’
Disease in animals

- Cattle, cont.
  - May show irritation of urogenital tract such as rectal straining
  - Unusual pitch to bellowing
  - May attack and butt any moving object
  - Death
Wildlife
Disease in animals

- **Wildlife**
  - Act out of character
  - Nocturnal animals out in daylight
  - Uncoordinated - walk in circles, stagger, compulsive actions
  - May aggressively chase people and animals
  - Often act Tame, sleepy or paralyzed
  - **Variable incubation** extended periods
    - Skunks
  - Stress may trigger onset of clinical rabies
High Risk Animals

- Wild terrestrial carnivores
  - Raccoons
  - Skunks
  - Foxes
  - Coyotes
  - Bats

All bites must be considered possible exposures.
Rabies Exposure

- Bites
- Saliva or brain tissue in contact with
  - Open wounds
  - Fresh cuts and abrasions
  - Mucous membranes
- Inhalation of aerosols (labs, caves)
- Bat found in rooms with
  - Sleeping persons
  - Unattended children
  - Elderly
  - Intoxicated or mentally impaired
Non-exposures

- Petting or touching rabid animal
- Contact with blood, urine or feces
- Contact with dried saliva
  - Rabies virus is not stable in environment
- Touching pet that had contact with rabid animal (open cuts?)
Rabies Specimen testing

- **Positive** reports phoned/Faxed to Veterinarian and Rabies Coordinator
- HHSS e-mails results to Health Depts.
- Health Dept. contacts person submitting brain
  - Questions
  - Recommendations
  - Report of Post-Exposure Treatments
Positive Rabies (FA)
Positive Rabies- Negri Body
Pre-Exposure Vaccination

- Day 0
- Day 7
- Day 21 or 28

- Intramuscular injection into deltoid muscle (arm)
Post Exposure Treatment  I.M.  
No Pre-exposure Vaccination

- Day 0  Rabies Immune Globulin Local and I.M.  + Rabies Vaccine
- Day 3  Rabies Vaccine
- Day 7  Rabies Vaccine
- Day 14  Rabies Vaccine
- Day 28  Rabies Vaccine
Rabies Incident #1

- **Day 1**
  - 4-H Steer brought to barns with other cattle
  - Drank water from 200 gallon community tank, which is also used by children to cool off

- **Day 2**
  - Steer begins to bellow and drool saliva
  - Steer stops eating and drinking
  - Vet examines steer and sends it back to farm

- **Day 3**
  - Steer returned to fair for second examination
  - Very weak and shakes while standing
  - Several 4-H youth and fathers help to unload steer and push into chute
Rabies Incident #1

- **Day 4**
  - Steer’s condition deteriorates at farm
  - Second Vet examines
  - Euthanized and submitted for rabies testing
  - Brain shipped to KSU Rabies Lab on Friday

- **Day 7 (Monday)**
  - Positive results for rabies
  - HHSS notified by FAX after hours
  - Vet notified by phone call that evening
Rabies Incident #1

- Issues— who was exposed?
  - “Concerned” individuals
    - Other 4-H cattle- direct and tank exposure?
    - People walking through cattle barns?
    - Family transporting steer?
    - 4-H youth playing in cattle drinking tank?
    - 4-H youth, parents helping to load/unload steer?
    - Veterinarians and staff (2 clinics)?
Rabies Incident #1

- Issues –
  - Liability
    - Veterinarian
    - County Fair Board
    - County Commissioners
    - Steer owner
Rabies Incident #1

Issues “Who’s in charge?”
- County commissioners
- Parents of 4-H youths
- Health Departments (2)
- Veterinarians (2)
- Medical providers (3-4)
- HHSS State level
Rabies Incident #1

- Result of no clear organization in charge
  - Duplication of efforts
  - Parents conducted ‘epidemiological’ meeting to find who felt that they were exposed (>100)
  - Commissioners under pressure developed policy of “free rabies shots”
  - Inconsistent messages released on risk and exposure
Rabies Incident #1

- **Public Health Response**
  - Empower local Health Departments- jointly
  - Issue Health Alert Network message to Vets and Medical community detailing water tank as non-exposure
  - Issue press releases to media
  - Visit with concerned people regarding potential means of exposure
Rabies Incident #1

- Post-Exposure Prophylaxis
  - Exposed
    - Family owning steer (4)
    - Veterinarians (2)
    - 4-H youth, parents loading steer on Day 3 (8)
  - Non-exposed
    - Youth, families at fair (51)
Rabies Incident #2

- Person woke to find a bat flying around the bedroom
- The Window was opened and bat flew out
Bat Bites
Rabies Incident #2

Public Health Response

- Recommend Rabies Post Exposure Prophylaxis
- Press release to local media about bats as vectors for rabies
Slide Acknowledgements

- Centers for Disease Control and Prevention
- The Center for Food Security and Public Health, Iowa State University