Zoonoses and Allergens: What Every Technician Should Know

2012 AALAS District 5 Meeting
Sarah Allison, DVM, DACLAM
University of Illinois at Urbana-Champaign
What is a Zoonosis?

- A disease that can be transmitted from animals to humans
Prevention

- Most effective approach
  - Education
  - Exposure
    - Types of exposure
  - Nature and significance of risks
  - Appropriate first aid and follow up for potential exposure
  - Reinforce information
Prevention

- Veterinary Programs
  - Comprehensive and responsive
  - All workers share responsibility for protecting their own health
  - Personal Hygiene
  - Involvement of researchers
- Personal Protective Equipment (PPE)
  - Use when handling animals and their housing and bedding materials
PPE

- Lab coat or dedicated uniform
- Disposable gown or Tyvek
- Gloves
PPE

- Face protection
- Head cap or bonnet
- Shoe covers or dedicated shoes
Animal Sources

- Animals may be obtained from a variety of sources that vary in health status
  - Commercial vendors
    - Provide high-quality laboratory animals of defined health status
    - Eliminate all or most zoonotic agents
Animal Sources

- Research may require wild-caught or animals from an undefined source
  - No documented history
  - May introduce unique population of endogenous and acquired pathogens into facility
Bacterial Diseases
Campylobacteriosis

- *Campylobacter coli, C. fetus, C. jejuni*
- Description: Gram-negative, rod-shaped bacteria, microaerophilic
- Reservoir
  - Pigs, chickens, sheep, dogs, cats, ferrets, hamsters, NHP
- Transmission
  - Fecal-oral
Campylobacteriosis

- Clinical Signs
  - Animals
    - None
    - Watery diarrhea; abortion and stillbirths; fever, anorexia, vomiting
  - People
    - None
    - Abdominal pain, fever, vomiting, diarrhea
Campylobacteriosis

- Diagnosis and Treatment
  - Fecal culture, microscopic exam; ELISA
  - Supportive care - fluids, electrolytes
- Control and Prevention
  - Good hygiene and sanitation
  - Detection and treatment of infected animals
Rat-Bite Fever

- *Streptobacillus moniliformis*, gram negative rod
- *Spirillum minus*, gram negative spiral shaped bacteria

Reservoir
- Wild or laboratory rats, mice

Transmission
- Bites
Rat Bite Fever

- Clinical Signs
  - Animal
    - None
  - People
    - Chills, fever, headache, muscle pain, weakness, swollen lymph nodes (*S. moniliformis*)
    - Red to purple rash (*S. minus*)
Rat Bite Fever

- Diagnosis and Treatment
  - Culture and isolation
  - Wash bite wounds
  - Penicillin or tetracycline
    - Tetanus prophylaxis
- Control and Prevention
  - PPE, gloves, proper restraint techniques
Leptospirosis

- *Leptospira canicola* (dogs)
- *L. hardjo, L. pomona* (pigs, sheep, goats, gerbils, hamster, rarely NHP)
- *L. icterohaemorrhagia* (rats)
- *L. interrogans* serovar *ballum* (mice)
- *L. sejroe* (dogs);
  - Spirochete bacteria
Leptospirosis

- Transmission
  - Exposure to contaminated urine, placenta, fetal tissues
  - Inhalation
  - Oral ingestion
  - Skin abrasions
Leptospirosis

- Clinical Signs
  - Animals
    - Mice—none
    - Dogs—fever, blood in urine, liver and kidney disease
    - Sheep and goats—reproductive failure
    - Squirrel monkeys—icterohemorrhagic disease, with abortion
Leptospirosis

- Clinical signs: People
  - Mild flu with fever, headaches, rash, muscle pain
  - Severe infection with involvement of liver, kidney, heart, brain

- Diagnosis and Treatment
  - Demonstration of rising antibody titers in serological tests
  - ELISA, IFA tests
  - Dark-field microscopy, PCR (urine)
  - Antibiotics, possibly IV
Leptospirosis

- Control and Prevention
  - Sanitation, waste control
  - Vaccination programs
  - Antibiotics for infected animals
    - Isolation and quarantine
  - PPE
  - Good hygiene
Salmonellosis

- *Salmonella enterica* serovar *Enteriditis*
- *Salmonella enterica* serovar *Typhimurium*
  - Facultative anaerobic gram-negative rod
- Reservoir
  - Guinea pigs, mice, rats, chickens, pigs, sheep, cats, rabbits, reptiles, NHP
- Transmission
  - Fecal-oral
Salmonellosis

Clinical Signs
- Animals
  - None
  - Septicemia, diarrhea, gastroenteritis
  - Sheep – abortion
- People
  - Gastroenteritis with diarrhea

Diagnosis and Treatment
- Stool culture
- Supportive care, fluids and electrolytes
- Antibiotics controversial
Salmonellosis

- Control and Prevention
  - Sanitation in animal housing
  - Animal waste disposal
  - Purchase of Salmonella free animals
  - PPE, gloves
Tuberculosis

- *Mycobacterium avium* complex, *M. bovis*, *M. tuberculosis*
  - Acid-fast rod-shaped bacteria
- Reservoir
  - NHP
  - *M. tuberculosis*, *M. bovis*—dogs, cats, pigs
  - *M. bovis*—sheep, goats
  - *M. avium*—pigs, chickens, pigeons

- Transmission
  - Fecal-oral
  - Inhalation of aerosols
  - Fomites
Tuberculosis

- Clinical Signs
  - Animals
    - Asymptomatic to sudden death; pulmonary disease, anorexia, chronic weight loss, swollen lymph nodes (+/- draining tracts); abscesses
  - People
    - Chronic cough, blood-tinged sputum, fatigue, fever, weight loss
Tuberculosis

Diagnosis and Treatment

- Intradermal skin test, PCR, chest x-rays, acid-fast stain of sputum
- Antimicrobials
  - Drug-resistant strains
Tuberculosis

- Control and Prevention
  - Quarantine
    - Testing and elimination of infected animals
  - Continuous surveillance
    - NHP
    - Tuberculin testing for personnel
  - Good sanitation
  - Good hygiene
  - PPE, including respiratory tract protection
Viral Diseases
B-virus infection

- *Cercopithecine herpesvirus 1*
  - aka: Herpes B, alphaherpes virus
- Reservoir
  - Macaque monkeys
- Transmission
  - Contaminated bites and scratches
  - Splashes to mucous membranes
  - Needle stick injuries
  - Contamination of broken skin with body fluids of macaques
  - Cuts from contaminated equipment
  - Contact with unfixed tissues or primary cell culture material from macaques
B-virus infection

Clinical Signs

Macaque

- Usually asymptomatic
- Lesions in oral cavity and genitalia, conjunctivitis

People

- Early stage: flu-like illness (fever, chills, nausea, vomiting, dizziness), headaches, sinusitis
  - Vesicles may form near skin wounds
- Life-threatening progression—altered vision, seizures, respiratory failure, death
B-virus infection

- Diagnosis and Treatment
  - Serology, virus isolation, PCR
  - Prompt and sufficient disinfection of injury sites
  - Follow-up care with knowledgeable medical professional
  - Antiviral therapy

- Control and Prevention
  - PPE
    - Protect eyes and mucous membranes from macaque secretions
  - Safe handling and restraint procedures
Hantavirus infection

- Hantaan virus; Seoul virus
  - Bunyavirus
- Reservoir: Rats and mice; other wild rodents
- Transmission
  - Virus shed in urine, feces, saliva of persistently infected rodents for months
  - Inhalation of infective aerosols from rodent droppings
  - Wound contamination
  - Conjunctival exposure
  - Ingestion
  - Rat cell lines
Hantavirus Infection

- Clinical Signs
  - Rodents
    - None
  - People
    - Signs related to strain of virus
      - Hemorrhagic Fever and Renal Syndrome (HFRS)—Acute onset of fever, lower back pain, possible hemorrhage and kidney failure.
      - Hantavirus pulmonary syndrome (Sin Nombre Virus)—fever, muscle pain, gastrointestinal dysfunction, respiratory distress, death
Hantavirus Infection

- **Diagnosis and Treatment**
  - ELISA, IFA, RT-PCR
  - IV fluids, bed rest, +/- IV antiviral medication

- **Control and Prevention**
  - Good hygiene
  - Disinfection of contaminated waste and work surfaces
  - Respiratory tract protection
  - Exclude wild rodents from laboratory facilities
  - Screen rodents and rodent-derived cell lines
Lymphocytic Choriomeningitis Virus Infection (LCMV)

- **Arenavirus**
- **Reservoir**
  - Mice (Athymic and SCID), rats, hamsters, guinea pigs, NHP
- **Transmission**
  - Parenteral inoculation, ingestion, inhalation, splash contamination of mucous membranes with infective secretions (urine, feces, saliva)
  - Contact with contaminated bedding
  - Immortalized hamster cell lines
Lymphocytic Choriomeningitis Virus Infection

**Clinical Signs**

**Animals**
- Depends upon age, strain and dose of virus, route of inoculation

**People**
- None
- Flu-like illness with fever, headache, muscle pain; can progress to meningitis
  - Hazard for pregnant women
Lymphocytic Choriomeningitis Virus Infection

- Diagnosis and Treatment
  - Serology
  - Supportive care
- Control and Prevention
  - Exclude wild rodents from facilities
  - Screen rodents
  - Test rodent-derived cell lines
  - PPE, gloves for handling rodents and their tissues
Rabies

- Rhabdovirus
- Reservoir
  - Dogs, cats, ferrets, livestock, NHP
- Transmission
  - Bite of rabid animal
  - Inoculation of infective saliva into fresh wounds or mucous membranes
Rabies

- Clinical Signs
  - Animals
    - “Furious” to “paralytic” depending on area(s) of CNS affected
      - Hydrophobia, agitation, confusion, ataxia, paralysis
  - People
    - Headache, fever, malaise, encephalomyelitis, and death due to respiratory paralysis
Rabies

* Diagnosis and Treatment
  * Rabies observation of animals
  * Detection of viral antigen in brain by use of the direct fluorescent antibody test
  * Supportive care; no specific treatment guidelines.
Rabies

- Control and Prevention
  - Vaccination of dogs, cats and ferrets
  - Quarantine, euthanasia, and diagnostic testing of animals with clinical signs
  - Consider pre-exposure immunization
  - Immediate and thorough post exposure wound disinfection
    - Post exposure prophylaxis and concurrent administration of rabies vaccine
Protozoal Diseases
Cryptosporidiosis

- Cryptosporidium parvum, C. canis, C. felis
  - Coccidian protozoan
- Reservoir
  - Cats, dogs, NHP, sheep, pigs, ferrets, chickens, frogs
- Transmission
  - Fecal-oral, possibly airborne
Cryptosporidiosis

**Clinical Signs**

**Animals**
- None
- Intractable diarrhea
  - Severe in immunocompromised animals

**People**
- None
- Profuse, watery diarrhea
  - Protracted illness in immunocompromised persons
Cryptosporidiosis

- Diagnosis and Treatment
  - Microscopic detection; intestinal biopsy; increase in serum antibody titers
  - Supportive care

- Control and Prevention
  - PPE, sanitation, good hygiene
Toxoplasmosis

- *Toxoplasma gondii*
  - Intracellular coccidian protozoa
- Reservoir
  - Cats (definitive host); mice, rats, dogs, sheep, goats, pigs, chickens (intermediate hosts)
- Transmission
  - Fecal-oral, ingestion of infective oocysts from sources contaminated with cat feces
Toxoplasmosis

- Clinical Signs
  - Animals
    - None in adult cats (usually)
    - Abortions and stillbirths in sheep, goats, and pigs
  - People
    - Asymptomatic to mild flu-like illness
      - Can progress to more serious signs including fever, pneumonia, lymphadenopathy, chorioretinitis
    - Severe illness in immunosuppressed and pregnant women
Toxoplasmosis

- Diagnosis and Treatment
  - Clinical signs of disease, detection of increased titers, isolation of *T. gondii* from blood or bodily fluids
  - No treatment recommended, unless immunosuppressed with symptoms
Toxoplasmosis

- Control and Prevention
  - Feed cats commercial cat food
  - Dispose of cat feces daily
  - House cats indoor and away from other species
  - PPE, gloves, good hygiene
Fungal Disease
Dermatomyositis

- Saprophytic fungi
  - *Trichophyton mentagrophytes*—guinea pigs, rabbits
  - *T. verrucosum*—sheep and goats
  - *Microsporum canis*—guinea pigs, rabbits, cats, dogs, NHP

- Transmission
  - Direct contact with skin lesions
  - Spores persist in environment
Dermatophytosis

- Clinical Signs
  - Animals
    - None
    - Lesions may be on or about the head, patchy areas of hair loss, redness, crust possible, itchy
Dermatophytosis

Clinical Signs

People

- Flat, spreading, ring-shaped lesions
- Margin is reddish, vesicular, or pustular and may be dry and scaly with crusts
Dermatophytosis

- Diagnosis
  - Appearance of characteristic lesions
  - Fluorescence under UV light (*M. canis* only)
  - Skin scrapings mounted in 10% KOH
  - Culture on fungal media
Dermatophytosis

- Treatment
  - Thorough bathing with soap and water
  - Daily topical application of fungicide
  - +/- systemic fungicides

- Control and Prevention
  - PPE, gloves, sanitation
Summary

- Know your risks
- Consult health care provider and occupational health service with any concerns
  - Report exposures
  - Follow up
- PPE
- Hygiene
- Sanitation
Laboratory Animal Allergy
Laboratory Animal Allergy (LAA)

- Significant, occupational disease
  - May affect up to one-third of personnel exposed to laboratory animals
    - 10% eventually develop occupation-related asthma
- Higher risk
  - Up to 73% with pre-existing allergies develop LAA
Who is at risk?

- Technicians
- Researchers
- Veterinarians
- Others with prolonged, close association with animals or their secretions
- Those who handle bedding/food
LAA

- Classic IgE mediated reaction
- Exposure to allergen
  - Allergen processed by immune cells
- Sensitization
  - Allergen binds to IgE molecules
  - Release of histamine and other chemical mediators
  - Mediators causes symptoms
LAA: Symptoms

- Nasal
- Itchy eyes
- Rashes
- Occupation-related asthma
  - Cough
  - Wheezing
  - Shortness of breath
    - Chronic symptoms
LAA: Symptoms

- Hives
  - Allergen(s) in direct contact onto skin
  - Scratches by dogs and cats
  - Latex gloves
- Anaphylaxis
  - Itching, hives, swelling of face, lips, tongue, difficulty breathing
  - Rarely, sensitized to animal’s saliva, develop anaphylaxis when bitten
How much exposure causes LAA?

- LAA allergens are potent
  - Low levels of inhaled allergen, perhaps a few micrograms per year, may cause allergies
    - Nanogram amounts may cause symptoms in sensitized persons
  - Symptoms usually occur within minutes
Sources of allergens

Rats—urine and saliva

Mice—urine

Guinea pig—saliva, dander, urine, and fur
Sources of allergens

Rabbit—fur, minor components in urine and saliva

Cat—saliva, sebaceous glands of the skin

Dog—saliva, hair, skin

Pig—nitrogenous wastes
Exposure control

- Prevent or minimize occupational exposure to laboratory animal allergens
- Factors in allergic disease
  - Intensity or concentration of allergen exposure
  - Frequency
  - Duration
  - Routes of entry
Exposure control of occupational hazards

- Engineering controls
  - Proper facility design
  - Ventilation
- Administrative controls
  - Work practices
  - Training
- PPE
Engineering controls

- Material change or substitution
  - Animals, bedding
- Process change or substitution
  - Automation (ie. robotics)
- Cleaning methods
  - Avoid dry sweeping
  - Vacuum with HEPA
Engineering Controls

- Isolation or enclosure
  - Filter tops
  - IVC
- Use animal transfer or cage change stations
- Cubicles or modules
**Bedding Disposal**

- Transport dirty cages in closed system
  - Filter tops or enclosed cart
  - Drape with cover cloth or plastic sheet
- Decontaminate before and after use
- Keep activity in room to minimum
  - Avoid rapid arm movements
  - Keep doors shut
  - Leave on for 5 minutes after use
Administrative Controls

- Facility zoning
- Animal Density
- Job rotation
- Proper use and maintenance of equipment
- Good housekeeping
- Personal hygiene
- Proper handling of waste and contaminated clothing
- Training and education
PPE

- Goal is to limit exposure to you and those around you
  - Gown, lab coat, or uniform
  - Hair bonnets
  - Gloves
  - Shoe covers

- Remove PPE in the animal room or facility
PPE

- Respiratory Protection
  - Dust/mist masks
  - Full face mask with HEPA filter
  - PAPR
PPE

0 Work Practices
  0 Avoid wearing street clothes while working with animals
  0 Leave work clothes at the workplace to avoid potential exposure problems for family members
  0 Proper personal hygiene (hand washing, showering) after exposure
Summary

- Know the potential risks
- Follow recommendations for work practices and PPE
- Know the symptoms
  - Contact OHS and health care provider for evaluation