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Overview

• Occupational injuries and illnesses within swine production facilities
• Common zoonotic diseases from pigs
• Recent issues
  – Streptococcus suis
  – Influenza
  – MRSA

Occupational Illness and Injury

• Agriculture as a profession has one of the highest annual injury rates
  – Typical causes for injuries - falls, machinery, and animals

  • Agriculture ranked 2nd among industries for occupational deaths

    Nat. Safety Council 2004

University of Minnesota Survey (2006)

• 24% of producers reported that work related injuries or illnesses have increased
• Most frequent employee injuries and illnesses:
  – Cuts (56%)
  – Needle Sticks (40%)
  – Back Injuries (41%)
• No significant difference in reported injuries/illnesses between small and large operations

Taylor 2006 MPH

Other Issues for Swine Workers

• Increased prevalence of respiratory symptoms over community controls
• Potential for zoonotic Diseases
Zoonoses - Definition

- Those diseases and infections which are naturally transmitted between animals and man
  - World Health Organization (1982)
- Defining criteria
  - Pathogen that has a nonhuman vertebrate reservoir (such as dogs and rabies)
  - Transmission from animals to humans
  - Recognized infectious disease syndrome in susceptible people
- Key word is “between”

Some Potential Zoonotic Diseases/Agents from Swine*

- Campylobacter
- Dermatophytes
- Erysipelas
- Leptospirosis
- Roundworms
- Salmonella
- Toxoplasma gondii

*Focused on swine production in the United States

Recent Diseases of Concern

- Streptococcus suis
- Influenza
- MRSA

Background: Streptococcus suis

- Causes a wide range of diseases in pigs, including meningitis, septicemia, pneumonia, endocarditis, and arthritis
- First human case was reported in Denmark in 1968
- Prior to 2005, 200 cases have been reported worldwide (most from European and Asian countries)
- S. suis infection is the porcine version of human group B strept disease (Sriskandan S. PloS Medicine 2006;3:595-7)

Streptococcus suis: an emerging zoonotic pathogen

- In July 2005, the largest outbreak of human S. suis occurred in Sichuan province, China
- 204 people were infected; 38 died
- Previously, two outbreaks were reported from Jiangsu province in 1998 and 1999
- Repeated intensive outbreaks of human S. suis have raised public concern

Common Symptoms

- Acute Complaints
  - High fever
  - Headache
  - Chills
  - Vomiting
- Complications
  - Hearing loss
  - Ataxia coma
  - Severe myalgia
  - Ecchymosis

Types of Infections (Human)

- Meningitis (purulent)
- Septicemia and septic shock
- Arthritis
- Endocarditis
- Pneumonia
- Peritonitis

Epidemiology

- Human infection is mainly caused by direct contact with carrier/sick pigs or raw pork contaminated with S. suis
- Transmission occurs via wounds or mucous membranes
- At risk groups include: pig farmers, abattoir workers, meat-processing workers, and veterinarians
- Immunocompromised and asplenic individuals are at increased risk

Common Factors from Documented Outbreaks

- History of S. suis disease among pigs in the region
- Nearly all the patients had contact with sick pigs
  - Slaughtered sick pigs
  - Skin abrasions or cuts
- In the 2005 outbreak, 61 (28%) of the farmers had streptococcal toxic shock syndrome; 38 (62%) died

Questions?

- Could this be an issue in the United States?
- Main infectious source is sick pigs
  - In China, there was a need for improved pig raising conditions (feed, ventilation, and housing)
  - Reason for on-farm prevention and control measures
  - Vaccination?
- Appropriate slaughter practices
  - Don’t slaughter sick pigs
- Cover wounds, wash hands, clean utensils
- Thorough cooking

Recent Human S. suis Infection from the United States

- 59 year old, previously healthy male farmer presents with a sudden onset of fever and confusion
- Presented with high fever, elevated WBC, and had evidence of bacteria from cerebral spinal fluid
  - CSF – cloudy, Gram stain = gram positive diplococci
  - Blood and CSF cultures – S. suis
- Are cases missed?

Comments

- It appears that strains from the Chinese outbreaks are different than US S. suis strains
- Has a new, highly virulent strain of S. suis emerged?
- Emphasizes a need for good animal and human disease surveillance systems to alert farmers and the public when zoonotic outbreaks occur
Influenza

Influenza A viruses are endemic causing disease in humans, horses, pigs, cats, dogs, ferrets and birds.

Influenza A are classified by their surface proteins (e.g. H5N1):
- Hemagglutinin (H)
- Neuraminidase (N)

Influenza Viruses

Role of Pigs

- Swine have also been considered to be prime intermediate hosts (“Mixing vessels”)
- Intermingling of pigs, poultry and people sets the stage for emergence of new influenza virus strains
- However, none of the 3 major human influenza outbreaks last century (1918 (H1N1), 1957 (H2N2), 1968 (H3N2)) originated from pig

Occupational Disease

- Relatively common but usually mild illness with limited person to person transmission
- Increased occupational risk for avian influenza was documented from more intensive poultry exposure (i.e. butchering and exposure to ill poultry)
  - Bridges CB, et al J Inf Dis 2002;185:1005-1010
- Study documented past influenza infection in a duck hunter and 2 DNR workers
  - Gill et al. EID 2006;12:1284-1286

Serologic Evidence of Swine Influenza

Farm Residents and Employees

- Persons working on swine operations were likely to have antibody titers to swine influenza viruses than to urban controls (p<0.0001)
- Presence of antibodies, does not necessarily mean illness
- “Swine farmers may serve as a sentinel population to evaluate the emergence of new influenza viruses”
  - Olsen C, et. al. EID 2002;8:814-819
H1N1 in Minnesota and South Dakota Fair Pigs

- During 2008-9, 124 show participants and 149 pigs were enrolled in an influenza study
- No influenza virus identified in 2008
- In 2009, 7 influenza isolates were recovered (6 were H1N1 2009)
- Evidence of circulating H1N1 in people during this time

Recommendations

- Government agencies (USDA and CDC) are interested in monitoring changing influenza virus
- OSHA has provided some guideline to protect workers and pigs (enclosed)
- Keep ill workers out of the barn

MRSA

Methicillin-resistant Staphylococcus aureus

- Leading cause of pneumonia, surgical wound, and bloodstream infections in hospitalized patients
- MRSA infections are documented in hospitalized patients and residents of long-term care facilities (HA-MRSA)
- 1990’s: a new manifestation of MRSA emerged among cases with no history of hospitalization - community-associated infections (CA-MRSA)

MRSA in Animals

- MRSA was isolated from cows with mastitis (Devriese et al., 1972)
- Since then MRSA has been found in a variety of domestic species:
  - Dogs
  - Cats
  - Horses
  - Sheep
  - Pigs
  - Marine mammals

Human Nasal Colonization of Staph aureus, United States

- The prevalence of Staph aureus colonization in 2003-2004 was 29%
- The prevalence of MRSA colonization was 1.5%
- Majority of isolates were health-care associated strains (USA100 and USA800)

| Gorwitz RJ et al. JID 2008:197:1226 |

| MRSA in Animals | Gorwitz RJ et al. JID 2008:197:1226 | 28 | 29 |
MRSA and Pigs

- Pig farming is a risk factor for nasal colonization (Armand-Lefèvre, 2005; Aubry-Damon 2004)
- Majority of the isolates from pigs have been non-typable by smal PFGE – Classified as sequence type 398 (ST398)
- Higher rates of colonization found in veterinarians, especially swine practitioners
- Mostly asymptomatic…rare clinical infections in pigs

MRSA and Pigs

- Unclear how this strain emerged
- Retail meat studies have documented MRSA in 3.1% of pork samples (human or pig source?)
- What is the role of food-borne transmission?

MRSA and Food Products

- *Staph aureus* is frequently found in food and has traditionally been associated with “food poisoning”
- With the emergence of a new strain in pigs (ST398), several surveys have been done:
  - 264 (12%) of 2217 samples (Dutch)
  - 47 (39%) of 120 retail meats (USA)
  - 31 (8%) of 402 retail meats (Canada)

MRSA and Food Products

- MRSA strains do not have enterotoxins; hence “food poisoning” has not been demonstrated
- Development of invasive disease after ingestion of contaminated food is rare – one documented case in a hospitalized patient
- There is a potential for becoming colonized with MRSA during handling or ingestion of contaminated food – This is a minimal risk if food is cooked and properly handled

Summary

- Injuries account for the majority of occupational risks on swine operations
- High profile topics like influenza and MRSA should stimulate employers to talk to staff about employee health
  - Access to health care
  - Sick leave options

Recommendations

- Provide instruction and means for good hand washing
- If employees are ill, potentially with influenza they should not be working with pigs
- Encourage seasonal flu vaccination of workers
- Workers should use personal protective equipment when handling potentially infectious material (e.g. feces, urine, abscesses, etc)