Viral Diseases of Swine
(Non-enteric)

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Today’s Theme

PORKY FOR PRESIDENT

I ♥ BABE

WHEN PORK GOES BAD
Porcine Reproductive and Respiratory Syndrome (PRRS)

- The most economically important swine disease
- Genus: *Arterivirus*; family *Arteriviridae*
- Enveloped, ssRNA virus
- Related to equine viral arterivirus virus
- Two major subgroups:
  - Type 1 (European)
  - Type 2 (North American)
- Marked heterogeneity between and within types
- Porcine high fever disease (PHFD)—Novel type 2 strains cause of Chinese epidemic in 2005
PRRS—Reproductive Syndrome

- All parities affected
- Fever, anorexia, mild respiratory disease, “blue ears”
- Initially, abortions at any stage of gestation
- Later: early farrowing, third trimester abortions, stillborn & mummified pigs
  - Most PRRS viruses do not cross placenta until 3rd trimester
- Initial abortions: due to fever, illness of dam, fetuses virus negative
- Later abortions: virus infected fetuses; not all infected
- High death losses in nursing piglets
  - Weak
  - Dyspnea
  - Anorexia
PRRS Abortions—initial stages
PRRS Blue Ear—initial stages
Third trimester abortions--after initial stage
Third trimester abortions—after initial stage
PPRRS--hemorrhage in umbilical cord
PRRS—mesocolonic edema in neonatal piglets
PRRS—Respiratory Syndrome

• Naive Herd or new strain: all ages affected
• Stabilized herd
  – Endemic
  – Sow herd immune
  – Nursery/grower finisher pigs affected
• Dyspnea, fever, anorexia, lethargy
• Increased incidence of secondary bacterial diseases
Normal Pig Lung

Source: Pathology lecture (4th year vet students), contributed by Pat Halbur.
Respiratory Syndrome

Interstitial pneumonia: gross changes can be subtle
Respiratory Syndrome
Gross changes can be subtle
Respiratory Syndrome

Interstitial pneumonia can be severe
Histo: Necrotic cells in alveoli, peribronchiolar and vascular lymphocytes
Variation in microscopic lesions
(both photos the same pig)
Variation in amount of virus
Blue Ear in Grower/Finisher Pig
Porcine Circovirus type 2 (PCV2)

- Genus: *Circovirus*, Family: *Circoviridae*
- PCV2 first identified in 1991
- Exploded in North America in 2005-06
- Smallest self replicating viruses infecting animals
- ssDNA, nonenveloped
- Two serotypes of porcine circoviruses: PCV1 & PCV2
- Porcine Circovirus Associated Diseases
  - Porcine multisystemic wasting syndrome
    - PCV2 associated pneumonia
    - PCV2 associated enteritis
  - Acute pulmonary edema
  - Porcine dermatitis and nephropathy syndrome
  - Reproductive failure
Porcine Multisystemic Wasting Syndrome (PMWS)
PMWS

Enlarged lymph nodes, grey-tan lung not fully collapsed
PMWS

Enlarged lymph nodes

Pinpoint white spots on kidney
Histo: lymphoid depletion with replacement by macrophages
PCV2—Lymphoid depletion
Diagnosis: Gross and microscopic pathology plus large amount of virus in affected tissues

Intestine: PCV2 IHC

Liver: PCV2 IHC
PCV2--Acute Pulmonary Edema

Unexpected death of well-doing pigs
PCV2--Acute Pulmonary Edema
Unexpected death of well-doing pigs
PCV2—Acute Pulmonary Edema
Valvular Endocarditis
Important Differential PCV2 Pulmonary edema
Valvular Endocarditis

Important Differential PCV2 Pulmonary edema
Porcine Dermatitis and Nephropathy Syndrome (PDNS)
PDNS—Swollen edematous kidney

Kidneys are from pen mates
PDNS—Petechial hemorrhages
This kidney went to Plum Island
PDNS—Splenic infarcts
PDNS—Spenic infarct & hemorrhagic lymph nodes
Basic pathology: Necrotizing glomerulonephritis & systemic vasculitis

Kidney—acute glomerulonephritis

Kidney—fibrinoid vasculitis
PDNS Vasculitis

Skin

Adrenal capsule
PDNS—Vasculitis

Spleen

Lung
Porcine Dermatitis and Nephropathy Syndrome (PDNS)

- Cause never proven
- Typical case: very high PCV2 Ab titer, very low virus load
- Typical PMWS case: high viral load, low Ab titer
- A few reported PDNS cases negative for PCV2
- Theorized as type III antigen-antibody reaction
  - Immune complexes deposited in glomeruli and vessels
  - Activation of complement
  - Neutrophil recruitment
  - Necrotizing glomerulonephritis and vasculitis
- PDNS almost completely disappeared with advent of PCV2 vaccination
- Diagnosis: pathology and rule out other causes, esp. classical swine fever
  - Identification of PCV2 not required
PCV2—Reproductive failure
PCV2—Reproductive failure
Porcine Parvovirus

- Small ssDNA virus, nonenveloped
- Ubiquitous in swine
- Important cause of reproductive failure
- Problem of first parity gilts
- Farrow at term—no abortions
- “If you do not have mummies, you do not have parvo.”
Porcine Parvovirus
Porcine Parvovirus
Swine Influenza

- *Influenzavirus A*
- ssRNA virus with segmented genome
  - 8 gene segments
  - Allows reassortment
- Pigs susceptible to mammalian and avian viruses
- Classical SIV = H1N1
- 1998—H3N2 viruses appeared
  - Triple reassortant viruses
  - Genes from swine, human, avian viruses
- Currently, H1N1, H3N2, H1N2 viruses common in pigs
- Same H and N types circulate in humans
- Replicates in respiratory epithelium
Swine Influenza
Swine influenza
Swine Influenza
Swine Influenza
Pseudorabies—Aujeszky’s Disease

- *Suid Herpesvirus* 1
- dsDNA virus, enveloped
- Abortions in all parities
- CNS disease
  - >90% mortality in nursing piglets
  - Mortality typically < 10% by 8-9 weeks
  - Often no CNS signs in finishing and adult pigs
- Respiratory symptoms
  - Often in conjunction with CNS by 3-6 weeks old
  - Often only symptoms in finisher/adult pigs
- Can go unnoticed in adults if no pregnant females
- **Commercial pigs in U. S. declared free in 2004**
Psuedorabie
Hepatic necrosis in liver of neonate
Pseudorabies—Neonatal pig

Source: Pathology lecture (4th year vet students), contributed by Pat Halbur.
Pseudorabies
Necrosis in tonsil
Swine Pox

• Genus: *Suipoxvirus*; Family: *Poxviridae*
• DNA viruses that replicate in cytoplasm
• Worldwide, but uncommon in U.S.
• Transmission:
  – mechanical by insects—esp. *Haematopinlus suis*
  – Pig-to-pig
  – Environment to pig
• Rare vertical transmission
• Macules to papules to vesicles to umbilicated pustules
Swine Pox
Swine Pox
Swine Pox

*Haematopinus suis*
Swine pox with secondary Staphylococcus hyicus – greasy pig disease
Swine Pox

Rare vertical transmission
Classical Swine Fever (CSF) (Hog Cholera)

- Genus: *Pestivirus*; Family: *Flaviviridae*
- Enveloped, ssRNA virus
- Related to:
  - Bovine viral diarrhea virus
  - Border disease virus
- Last case in U. S. in 1976
- Virus in all body secretions
- Survives well if protected by protein—in meat, blood, feces, etc.
- Classic lesion—generalized hemorrhages
- Most severe lymphopenia of any swine disease
- Clinically indistinguishable from African Swine fever
Classical Swine Fever
Cyanosis
Classical Swine Fever

Cyanosis
Classical Swine Fever
Skin cyanosis and hemorrhages
Classical Swine Fever—Hemorrhages

Skin

Spiral colon
Classical Swine Fever
pulmonary hemorrhage
Classical Swine Fever—Hemorrhages
Lymph nodes
Classical Swine Fever
Renal Petechiae
Classical Swine Fever
Renal Infarcts
Chronic CSF
Button ulcers in colon
African Swine Fever (ASF)

- Genus *Asfivirus*; Family: *Asfarviridae*
- Enveloped, dsDNA virus
- Survives months in frozen, dried, cured, and uncooked meat
- Transmission:
  - Pig to pig, direct and indirect
  - Uncooked pork products
- The only DNA arbovirus
- Widespread hemorrhages
- Clinically indistinguishable from CSF
African Swine Fever
Hyperemia
African Swine Fever—hemorrhages

Skin

Lungs
African Swine Fever—hemorrhages
lymph nodes
intestinal serosa
ASF—Hemorrhage in lymph nodes
African Swine Fever

enlarged spleen
African Swine Fever
enlarged spleen
Classical and African Swine Fever Differentials
Porcine dermatitis and nephropathy syndrome (PDNS)
Salmonella choleraesuis

Cyanosis
Salmonella choleraesuis

Button ulcers
Salmonella choleraesuis
Porcine high fever disease
Highly pathogenic PRRS virus (China)
Bacterial Septicemia

• Bacterial septicemia
  – *Salmonella* spp. esp. *choleraesuis*
  – *Actinobacillus* spp, esp *suis*
  – *Erysipelothrix rhusiopathiae*
  – *Streptococcus* spp.
  – *Staphylococcus hyicus*

• Electrocution
Bacterial septicemia
*Actinobacillus suis*
Bacterial Septicemia

*Haemophilus parasuis*
Vesicular Diseases
Why they are important!

Taiwan, 1997

England, 2000
Vesicular Diseases

- Clinically indistinguishable viral diseases that cause vesicles in and around the mouth and feet
- Foot and mouth disease (FMD)
- Swine vesicular disease (SVD)
- Vesicular stomatitis (VS)—only one currently in U. S.
- Vesicular exanthema of swine—eradicated from the world since 1950s
- New cause: *Senecavirus A* (Seneca Valley virus)
Vesicular Diseases

• Other vesicular diseases important because of FMD
• Swine are amplifier host for FMD virus
  – Produce and excrete 1,000 to 3,000 times more virus than cattle of sheep
• Cattle—indicator host—most susceptible
• Sheep—maintenance host—mildest disease, easily missed
• Carrier state (> 28 days) in cattle and sheep; not pigs
Vesicular Disease
Vesicular Disease
Vesicular Disease

Vesicles on tongue uncommon with FMD
Vesicular Disease
Vesicular Disease
Vesicular disease
Seneca Valley Virus
Photos from Dr. Mark FitzSimmons, Protein Sources

- Genus: *Senecavirus A*
- Family: *Picornaviridae*
- Same family as FMD and SVD viruses
- Identified in vesicular disease in pigs
- Sporadic since 1980s
- Recent increased incidence
- Originally North America
- Seen in other parts of world
- Oncolytic for certain neuroendocrine cancers
Seneca Valley virus (*Senecavirus A*)
Seneca Valley virus (*Senecavirus A*)
Seneca Valley virus (*Senecavirus A*)
Seneca Valley virus (*Senecavirus A*)
Porcine Cytomegalovirus
Inclusion body rhinitis

• Suid herpesvirus 2
  – Genus *Cytomegalovirus*, subfamily *Betaherpesvirinae*
• Ubiquitous in pig world
• Rhinitis with sneezing in pigs < 10 weeks old
• Usually subclinical
  – Large intranuclear inclusions in nasal glands
• Rarely viremia and death in neonates
  – Intranuclear inclusions in kidneys
• Fetal infection and abortion in susceptible females
  – Inclusions in endothelial cells
  – Edema in fetuses
Porcine Cytomegalovirus
Inclusion body rhinitis
Cytomegalovirus
Renal inclusions in neonate
Adenovirus
7 day piglet

- Multiple serotypes of adenovirus isolated from pig
- Systemic infection
- Inclusions most often seen in epithelium of small intestinal villi and renal collecting ducts
- Not known to be pathogenic
Adenovirus inclusions
small intestine
Adenovirus in renal collecting duct epithelium