Classical Swine Fever

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Classical Swine Fever

Classical Swine Fever is also called Hog Cholera

“The most typical feature of CSF: it is so atypical.”

Dr Bill White
Classical Swine Fever
Classical Swine Fever

CSF is a highly contagious viral disease of swine.
Mortality varies from almost zero to 100%.

Only the domestic pig and wild boar are susceptible naturally.
“Hog cholera, also known as swine fever, is a disease native to America. It is highly contagious and its prevalence led to the first notice of an animal disease by the federal government in 1860.”

http://www.lib.iastate.edu/spcl/manuscripts/MS389.html
Hog Cholera epidemic in Minnesota in 1913

http://www.extension.umn.edu/administrative/information/components/crisis01.html

Classical Swine Fever - 2006
1976 Last US outbreak

1978 US declared “Hog Cholera” free
Breeding sows infected by low virulent strains usually abort,

...but may produce ‘late onset’ piglets that shed virus for 6-12 months before dying.
Classical Swine Fever

...can survive for months in refrigerated meat and for years in frozen meat
Many Expressions

- Occurs in acute, subacute, chronic, persistent (‘late onset’) or inapparent forms.
- Clinical forms closely match virulence of the viral strain and susceptibility (age) of the pig.
Classical Swine Fever

- Etiology
- Host range
- Incubation
- Clinical signs
- Transmission
- Diagnosis
- Differential Diagnosis
Etiology

- Only one serotype
- Lipid enveloped virus
- Virus family Flaviviridae, Virus genus *Pestivirus*
Etiology

Related Pestiviruses:
- Bovine Viral Diarrhea (BVD)
- Border Disease Virus of Sheep, Reindeer and Giraffe
Host Range

Domestic swine and European wild boar are the only natural reservoir of classical swine fever virus

http://www.krykiet.com/polish_wildlife.htm
Host Range

Collared Peccary is only mildly susceptible.

aka Javelina
Incubation

- 3-4 days average, 3-15 days range depending on strain, route and dose
- 2-14 days (O.I.E.)
- The Severe Acute form:
  2-6 days incubation; death at 10-20 days post infection
Syndromes

Virulence, immune status, age, breed, and pregnancy figure in the clinical picture.

Highly virulent strains: prevalent decades ago - causes Peracute and Classic Acute disease
Syndromes

- Moderately virulent strains: prevalent today - causes Subacute Disease

- Low virulent strains: prevalent today - causes Chronic Disease and Carrier Sow Syndrome/Persistent Infection
Syndromes

- Seroconversion only after 2-3 weeks
  - CSF virus is immunosuppressive like BVD in cattle

- Cellular tropism of virus
  - Endothelial, lymphoreticular, macrophages, some epithelial
Acute Disease
(Classic Disease)

Mortality: approaches 100%.

Viral shedding: 10-20 days until antibodies
Acute Disease

**Clinical Signs**

High Fever: 106-108°F (>41°C)
Depression
Conjunctivitis
Constipation, then Diarrhea
Skin hemorrhages/Cyanosis
Acute Disease

- Pile up for warmth
- Anorexic and gaunt
- Staggering gait
- Convulsions
- Abortion
- Death 10-20 days post infection
Acute Disease

Pathology
- Severe tonsilitis
- Severe leukopenia
- Hemorrhagic swollen lymph nodes
- Hemorrhages renal cortex
- Petechiation of the bladder, larynx, epiglottis, heart, intestinal mucosa, skin
- Splenic infarcts
- Necrotic gastroenteritis
- Encephalitis
Subacute Disease

Mortality: reduced

Viral shedding: until death.
Subacute Disease

Clinical signs with subacute disease are similar to acute disease, but considerably less severe.

*As with Acute CSF, the disease is clinically and pathologically consistent with a generalized septicemia
Subacute Disease

Fever for 2-3 weeks
105-106°F
(>41°C)

Death within 30 days post infection
Chronic Disease

Mortality: High; Invariably die in 1-3 months

Viral Shedding: May shed virus for months

Long term carriers of virus in tissues: lymph nodes, lung, spleen.
Chronic Disease

Low virulent strain or infection of vaccinated herd.

Three clinical phases:

- **Initial**: resembles Subacute
  - Fever
  - Anorexia
  - Depression
  - Leukopenia
- **Second**: improve, look ~normal
- **Final**: ‘runts’ with ‘Initial’ Phase signs.
Lesions

Button ulcers in cecum and colon (caused by bacteria)

Calcification rib cartilage

Glomerulonephritis
‘Carrier Sow Syndrome’

Mortality: In pregnant sow disease goes unnoticed. Sow may shed virus for months especially at farrowing.

High Mortality: In piglets infected congenitally or post-natally. Piglets look healthy at birth, shed virus for 6-12 months before dying.
‘Carrier Sow Syndrome’
Clinical Signs

- Clinical Signs in Sows
  - Usually mild (fever)
  - or subclinical.
‘Carrier Sow Syndrome’
Clinical Signs

Clinical Signs in Piglets
- Stillbirths, deformities, mummies,
- born dead, or congenital tremors.
- Some are born healthy:
- become persistent shedders to maintain CSF in breeding herd;
- are immuno-tolerant but will eventually die of ‘late onset’ disease at 6-12 months of age.
Congenital Form of CSF

- Weak "Shaker" piglets
- Persistently infected
  - Viremic - seronegative piglets
- Life-long viremia
- Will in time lead to complications and death
Classical Swine Fever
Clinical Signs

- HOT, SICK PIGS
Huddling

Classical Swine Fever - 2006
Neurological Signs
Clinical Signs

- Constipation followed by diarrhea
- Reproductive disorders
Clinical Signs

Physical exam to view tonsils
Clinical Signs

- Tonsillar necrosis
Tonsil Necrosis and Severe Hemorrhage
Tonsil Necrosis
Severe depression
Skin hyperemia & hemorrhage

Classical Swine Fever - 2006
Conjunctivitis
Conjunctivitis

European Wild Boar

Classical Swine Fever - 2006
High Mortality in Piglets
Mottled LN
Mottled Lymph Node
Mottled Lymph Nodes
Lymph node necrosis
Splenic infarcts
Spleen lesions
Spleen

Classical Swine Fever - 2006
Spleen
Renal petechiation
Renal lesions
Renal lesions
Renal lesions
Chronic CSF:
Button Ulcers in Cecum
Congenital infection with CSFV

Aborted and mumified fetuses.

Detection of CSF in pig breeding operations might be particularly difficult to detect, since the symptoms in adult pigs may be very mild and can be caused by many other pathogens. Thus an investigation for CSFV should be carried out in any case of reduced fertility index, when any other risk factors for CSF (e.g., area where CSF occurs in wild boar) are present and/or other diseases of the reproductive tract have been excluded.
Transmission

The main source of infection is the PIG, either live animal contact or uncooked pig products.
Transmission

- Mechanical transmission
- Fomites very important
- Veterinarians and farm workers
- Discarded infected pig meat
Transmission

- VERY CONTAGIOUS
- Causes devastating epidemics
Transmission

- **Direct Transmission**
  - Contact between sick and healthy animals: all tissues, excretions, secretions, semen and blood (oronasal).
  - Transplacental infection: Carrier Sow Syndrome.
  - Airborne spread to neighbors possible if high density pig farms.

- **Indirect Transmission**
  - Feeding uncooked garbage with infected meat.
  - Fomites: vehicles, equipment, boots, clothes.

How is CSFV often introduced into a new country?  **Garbage!**

How does CSFV travel once established?  **Movement/Fomites**
Stability of CSF Virus

- Survives well in cool, moist & protein rich environments
  - E.g. Stored Meat
- Can survive some forms of meat processing
  - Survives curing and smoking
- Partially resistant to heat
  - Readily killed by cooking
- Inactivated at pH < 3.0 or > 11.0
- Susceptible to organic solvents (ether, chloroform)
- Inactivated by most disinfectants: 1-2% NaOH suitable
Route of Infection of CSF

- Ingestion: e.g. contaminated swill
- Contact with the conjunctiva
- Mucous membranes
- Skin abrasions
- Insemination
  - Contaminated semen caused 1967 outbreak in the Netherlands

All secretions and excretions are infectious
Environmental Persistence: Moderately Fragile

- Sensitive to desiccation & UV
- Stable at pH 3-11
Environmental Persistence: Moderately Fragile

Survival in Pork Products

- Up to 85 days in chilled pork.
- >4 years in frozen pork.
- 313 days in Parma hams and 140-252 days in Serrano and Iberian hams.
- Readily killed by cooking e.g. 30 min at 65°C.
Parma ham — *prosciutto di Parma* — is a type of Italian raw, salted and dried ham, produced in Parma region. It is one of the most famous varieties of cured hams.
Environmental Persistence: Moderately Fragile

- **Survival in environment**
  - Months in contaminated pig pens in temperate climates.
  - 15 days in liquid phase of manure slurry.
Classical swine fever 2004
Geographic Distribution

- Distributed nearly worldwide
- Higher prevalence
  - East & Southeast Asia, India, China, South and Central America
- Africa???
- Eradicated in:
  - U.S.
  - Australia
  - New Zealand
  - Canada
  - Parts of Europe

Threat to Puerto Rico and U.S.
Disease Control Measures
Immunity & Vaccines for CSF

- Good immunity post-infection
- MLV vaccines available
  - Lapinized vaccines
  - Cell culture vaccines
  - Yearly dose (Safe in pregnant gilts)
- Marker sub-unit vaccines
  - DIVA strategy
- E2 Vaccine and Erns ELISA
Diagnosis

- History
- Clinical signs
- Post Mortem findings
  - Hemorrhage in lymph nodes, kidneys, tonsils, etc.
  - Splenic infarcts: nearly pathognomonic
- Histopathology
  - Degeneration and necrosis of endothelial cells
  - LN: lymphocytic depletion & reticular hyperplasia
- Laboratory testing: required for confirmation
Laboratory Testing for CSF

- **Virus isolation**
  - In Swine Cell Cultures; Inoculation in Live Pigs to confirm.

- **Antigen Detection**
  - Direct Fluorescent Antibody Test (DFAT)
  - Monoclonal antibody-Avidin Biotin Complex (ABC)

- **Nucleic Acid Detection**
  - Polymerase Chain Reaction (PCR) – Conventional & Real-time

- **Antibody Detection**
  - ELISA
  - Immunoperoxidase Test (IPT)
  - Virus Neutralization Test
Direct FA test for Classical Swine Fever

Nonspecific staining of crypt in non-infected tonsil

Crypt of CSF-infected tonsil
ABC Immunoperoxidase Test for Classical Swine Fever

No staining in tonsil of negative control

Cytoplasmic staining in tonsil of CSF-infected pig
Differential Diagnosis

- African Swine Fever
- Pasteurella
- Haemophilus
- Salmonellosis (septicemic)
- Erysipelas
- Eperythrozoonosis
Differential Diagnosis

- Poisoning, e.g. Coumarin (hemorrhage), Salt (CNS)
- Pseudorabies virus (PRV)
- Porcine Reproductive and Respiratory Syndrome (PRRS)
- Porcine Dermatitis and Nephropathy Syndrome (PDNS)
- Post-weaning Multisystemic Wasting Syndrome (PMWS)
Image Watermarks
Online References

- Center for Food Security and Public Health (2004): www.cfsph.iastate.edu
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