

Menangle

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Menangle

Pig Paramyxovirus Infection,
Porcine Paramyxovirus
Infection

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Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to Take



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In today's presentation we will cover information regarding the organism that causes Menangle virus infection and its epidemiology. We will also talk about the economic impact the disease could have. Additionally, we will talk about how it is transmitted, the species it affects, clinical signs, necropsy findings, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease as well as actions to take if Menangle virus infection is suspected.

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The Organism

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The Organism

- Paramyxoviridae
 - *Rubulavirus*
- Affects swine, humans
- Not highly contagious
 - Spreads slowly throughout the herd
- Poor survival in the environment

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Menangle virus is one of several recently discovered RNA viruses (e.g. Nipah, Hendra, and Tioman) in the family Paramyxoviridae. Menangle virus is in the genus *Rubulavirus*; other members of this genus include Newcastle (chickens) and the human mumps viruses. Menangle virus infections have only been reported in pigs in New South Wales, Australia; however, two humans were also affected during the outbreak. The virus does not appear to be highly contagious, but tends to spread slowly throughout the population. The virus does not appear able to survive in the environment for any length of time.

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Importance

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Economic Impact

- New South Wales, Australia, 1997
 - Reduced farrowing rates
 - Reduced litter number and size
 - Mummified and stillborn piglets
 - Pseudopregnancy in sows
 - Strong immunity develops post-infection
- Decreased animal inventory resulted in economic losses

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In 1997, a reproductive disease outbreak in New South Wales, Australia, led to the discovery of a new Paramyxovirus, called Menangle virus. The virus had great economic impact due to production losses. During the outbreak, farrowing rates decreased from an expected 82% to as low as 38%. Additionally, the number of live piglets declined in 27% of litters. A total of 45% of sows farrowed litters with a reduced number of live piglets and an increased number of mummified and stillborn piglets. Although some infected sows returned to estrus 28 days following mating, others remained pseudopregnant for up to 60 days after mating, thereby delaying further breeding. Fortunately, all postnatal pigs seroconverted to the virus within 10 to 14 days and developed a strong immunity to the virus. Persistent infections in swine do not occur and once the infection is endemic in the herd, no further reproductive failures occur.


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Epidemiology

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History

- 1997: New South Wales, Australia
 - 2,600 sow intensive piggery
 - 4 breeding units
 - 21 week period
 - Mummified fetuses and stillborn piglets
 - Reduced farrowing rates
 - Reduced number and size of litters



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From April to October 1997, reproductive problems occurred within a 2,600 sow intensive piggery (4 breeding units) in New South Wales, Australia. Pathological examinations revealed mummified and congenitally deformed piglets. Epidemiological studies showed reduced farrowing rates and a decline in the number and size of litters during the outbreak. Through preventative and control measures, the outbreak was contained to this limited area. To date, only this single outbreak has occurred; there have been no reports of the virus anywhere else in the world.

[Map from Australian Tourism Net at <http://www.atn.com.au/nsw.htm>. WA-western Australia, NT-northern territory, SA-south Australia, QLD-Queensland, NSW-New South Wales, ACT-Australian Capital territory (Canberra), VIC-Victoria, TAS-Tasmania]

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Transmission

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Reservoir

- Fruit bats (flying foxes)
 - *Pteropus poliocephalus*
 - *P. alecto*
 - *P. conspicillatus*
 - *P. scapulatus*
- Native to Australia
- Seropositive before and during 1997 outbreak



The grey-headed flying fox
(*Pteropus poliocephalus*)

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Fruit bats (also known as flying foxes) are considered the primary reservoir for Menangle virus. A large breeding colony of gray-headed (*Pteropus poliocephalus*) and little red (*Pteropus scapulatus*) flying foxes roosted within 200 meters of the affected piggery. Menangle virus appears to circulate asymptotically in fruit bat populations. In one survey, 33% of *P. poliocephalus* (gray-headed flying fox), 55% of *P. alecto* (black fruit bat), and 40% of *P. conspicillatus* (spectacled fruit bat) were seropositive in Australia. No antibodies were found in fifteen *P. scapulatus* (little red flying fox) living near the affected farm. Additionally, serology obtained prior to the outbreak also indicated these animals had been infected with the virus.

[Photo: Grey-headed flying fox (*Pteropus poliocephalus*) Courtesy of G.B. Baker, School of Resources, Environment and Society – The Australian National University at <http://sres.anu.edu.au/associated/batatlas/grey.html>]

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Transmission

- Bat to pig
 - Fecal-oral suspected
- Pig to pig
 - Oral-fecal suspected
- Human
 - No known contact with fruit bats
 - Very close contact with infected pigs

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Transmission from fruit bats to pigs is hypothesized to have occurred by the fecal-oral route. Fruit bats were observed flying over the farrow to weaning operation buildings when departing their roost at dusk and when returning to the roost at dawn. Paths around the buildings which housed the pigs were contaminated with fruit bat feces and pigs moved on these paths (Love et al 1998). The virus may have spread between pigs by the oral-fecal route; two remote farms that experienced disease received finishers from the index farm (Love et al 1998). Although two humans (piggery workers) were also infected during the 1997 outbreak, the exact route of transmission is unknown. Both individuals had very close contact with the infected swine. Another 250 persons in close contact with the infected swine were not affected by the Menangle virus.


[Source: Love RJ, Philbey AW, Kirkland PD et al. (2001) Reproductive disease and congenital malformations in pigs caused by Menangle virus. *Australian Veterinary Journal* 79:190-196.]

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Animals and Menangle

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S 1 i d e 1 3	<h3>Clinical Signs</h3> <ul style="list-style-type: none">• Incubation period unknown<ul style="list-style-type: none">– Seroconvert in 10 to 14 days• Reproductive<ul style="list-style-type: none">– Fetal mummification and stillbirths– Reduced farrowing rate, abortions– Reduced number and size of litters• No clinical signs in postnatal pigs• Other animal species seronegative <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	<p>Although the incubation period for Menangle virus infection is not currently known, pigs seroconvert to the virus in 10 to 14 days. The virus causes disease in developing fetuses. Fetal mummification and stillbirths, some having deformities of the skeletal or nervous systems, are most commonly seen. Arthrogryposis, brachygnathia, doming of the skull, and scoliosis or kyphosis can also be seen. Additionally, there is a reduction in the farrowing rate, as well as the number and size of litters. No clinical signs have been seen in postnatal pigs of any age. A variety of wild and domestic animals (cattle, sheep, birds, rodents, cats, and dogs) in the vicinity of the affected piggery tested seronegative for the virus.</p>
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S 1 i d e 1 4	<h3>Post Mortem Lesions</h3> <ul style="list-style-type: none">• Severe degeneration of brain and spinal cord• Arthrogryposis• Brachygnathia• Domed cranium• Histopathology<ul style="list-style-type: none">– Degeneration, necrosis of nervous tissue– Inclusion bodies– Nonsuppurative myocarditis  <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	<p>Post mortem examination of the affected piglets revealed severe degeneration of the brain or spinal cord (was almost absent in some), arthrogryposis, brachygnathia, kyphosis, and occasionally fibrinous body cavity effusions and pulmonary hypoplasia were seen. The cranium of some piglets was slightly domed in some cases. Histological examination of the brain and spinal cord revealed extensive degeneration and necrosis of the gray and white matter with infiltrations of inflammatory cells. Neurons contain intranuclear and intracytoplasmic inclusion bodies. Nonsuppurative myocarditis was found in some piglets.</p>
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[Photo: Affected litter at farrowing showing mummified fetuses and stillborn piglets with deformities from Australian Veterinary Journal 2001;79:192-8]

S 1 i d e 1 5	<h3>Morbidity/ Mortality</h3> <ul style="list-style-type: none">• Farrowing percentage reduced from 82% to 38%• Number of live piglets per litter declined• No further reproductive failure once disease is endemic• No disease in postnatal pigs <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	<p>During the single 1997 outbreak (Australia), Menangle virus affected the reproductive potential and productivity of swine herds. Farrowing percentages decreased from an expected 82% to as low as 38% during the peak of the outbreak. Additionally the number of live piglets per litter declined from a mean of 9.7 to 8.1 during the outbreak. Once infection was endemic in the herd, no further reproductive failures occur. No disease was observed in postnatal animals of any age.</p>
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S 1 i d e 1 6	<h3>Differential Diagnosis</h3> <ul style="list-style-type: none">• Classical swine fever• Porcine reproductive and respiratory syndrome• Porcine parvovirus infection• Aujeszky's disease (pseudorabies)• Blue eye paramyxovirus (La Piedad Michoacan)• Japanese encephalitis• Leptospirosis• Brucellosis <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	<p>Differential diagnoses for Menangle virus infection include classical swine fever, porcine reproductive and respiratory syndrome, porcine parvovirus, Aujeszky's disease (pseudorabies), blue eye (La Piedad Michoacan) paramyxovirus, Japanese encephalitis, leptospirosis (particularly <i>L. interrogans</i> serovar <i>Pomona</i>), and brucellosis (<i>B. suis</i>).</p>
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S l i d e 1 7	<p style="text-align: center;">Sampling</p> <ul style="list-style-type: none">• Before collecting or sending any samples, the proper authorities should be contacted• Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease <p style="text-align: right;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.</p>
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S l i d e 1 8	<p style="text-align: center;">Diagnosis</p> <ul style="list-style-type: none">• Clinical<ul style="list-style-type: none">- Increase in mummified, stillborn piglets• Laboratory Tests<ul style="list-style-type: none">- Serology - antibody (sows)<ul style="list-style-type: none">• Virus neutralization, ELISA- Virus isolation (piglet)<ul style="list-style-type: none">• Definitive diagnosis• Brain, lung, myocardial tissue <p style="text-align: right;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>The most notable clinical signs of Menangle infection are the increased proportion of mummified and stillborn piglets. Serum from farrowing sows can be tested for antibody specific to Menangle virus by virus neutralization or ELISA testing. Neutralizing antibodies may also be found in fluids from the body cavities of some stillborn and aborted fetuses. Virus isolation and electron microscopy may be needed for definitive diagnosis. Menangle virus is non-hemagglutinating and nonhemadsorbing, unlike some other paramyxoviruses that can cause reproductive failure in swine. Tissue samples from the brain, lung, and myocardium of piglets are preferred, but samples from the kidney and spleen can also be used.</p>
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S l i d e 1 9	<p style="text-align: center;">Treatment</p> <ul style="list-style-type: none">• No treatment• Once infected, no further reproductive failures occur• No vaccine <p style="text-align: right;"><small>Center for Food Security and Public Health, Iowa State University, 2011</small></p>	<p>Currently there is no treatment for Menangle virus infection; however, once pigs seroconvert to the virus, reproductive failures no longer occur. There is no vaccine available against Menangle virus infection.</p>
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S l i d e 2 0	<p style="text-align: center;">Menangle in Humans</p>	
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S 1 i d e 2 1	Public Health Significance <ul style="list-style-type: none">• Two human cases<ul style="list-style-type: none">– Sudden fever, malaise, chills, drenching sweats, headache, myalgia– Followed by spotty, red, non-pruritic rash– No coughing, vomiting, or diarrhea– Recovered in 10-14 days <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	During the 1997 Menangle virus infection outbreak, 2/250 workers exposed to the infected pigs developed signs and were found to be seropositive for the virus. One of the seropositive workers had frequent prolonged contact with birthing pigs, while the other individual performed necropsies on infected pigs without wearing gloves or protective eyewear. Both individuals presented with a sudden onset of malaise, chills, drenching sweats, fever, severe headache, and myalgia, but no coughing, vomiting, or diarrhea were noted. Within 3 to 4 days both developed a spotty, red, non-pruritic rash. Both recovered after 10 to 14 days.
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S 1 i d e 2 2	Prevention and Control
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S 1 i d e 2 3	Recommended Actions <ul style="list-style-type: none">• IMMEDIATELY notify authorities• Federal<ul style="list-style-type: none">– Area Veterinarian in Charge (AVIC) http://www.aphis.usda.gov/animal_health/area_offices/• State<ul style="list-style-type: none">– State veterinarian http://www.usaha.org/StateAnimalHealthOfficials.pdf• Quarantine <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	If you suspect a case of Menangle virus infection, state or federal authorities should be notified immediately. Animals suspected with Menangle should be isolated, and the farm should be quarantined until definitive diagnosis is determined.
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S 1 i d e 2 4	Prevention and Control <ul style="list-style-type: none">• Avoid contact between fruit bats and swine• Endemic population<ul style="list-style-type: none">– Remove pigs ages 10-16 weeks– Restock with unexposed pigs or pigs known to be immune to the virus• No vaccine <small>Center for Food Security and Public Health, Iowa State University, 2011</small>	Avoidance of contact between bats and pigs is essential. Whenever possible, pig farms should not be built near fruit bat colonies. Flowering or fruiting trees should not be grown near pig farms as they may attract bat activity. Wire screens can help prevent contact with bats when pigs are raised in open-sided pig sheds. Run-off from the roof should be kept from entering pig pens. In addition, good biosecurity measures may keep Menangle virus and other infections from spreading between farms. In an outbreak situation, infection will most likely have spread through the population before the first affected litters are farrowed.
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To eradicate the disease from an endemic population, pigs ages 10–16 weeks should be isolated or removed from the population (most pigs become infected at 12–16 weeks of age, after colostral immunity wanes) or the herd should be restocked with unexposed pigs or pigs known to be immune to the virus. Currently there is no vaccine for Menangle available.

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Prevention and Control

- Reduce occupational exposure for swine workers
 - People conducting necropsies or assisting at births
 - Wear gloves, goggles, and other personal protective clothing
 - Wash contaminated skin immediately
- Avoid contact with bats

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As a routine precaution, gloves and other protective clothing should always be used when conducting necropsies, assisting at births, or in any other situation where body fluids and tissues could contact skin. Good hygiene can also reduce the risk of zoonotic infections. People who are exposed to infected animals should wear protective clothing, impermeable gloves, masks, goggles, and boots. Contaminated skin should be washed promptly and thoroughly.

It is not known whether Menangle virus infections can be acquired by contact with bats or their body fluids; however, there is no evidence that human cases have occurred except during this outbreak. Nevertheless, contact with bats should be avoided whenever possible, and any wounds that could have become contaminated should be washed.

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Additional Resources

- APHIS-Center for Emerging Issues
 - http://www.aphis.usda.gov/animal_health/emergin_gissues/downloads/menangle.pdf
- CSIROOnline (Commonwealth Scientific & Industrial Research Organisation)
 - www.csiro.au
- Communicable Diseases Network Australia
 - www.health.gov.au

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Additional Resources

- World Organization for Animal Health (OIE)
 - www.oie.int
- U.S. Department of Agriculture (USDA)
 - www.aphis.usda.gov
- Center for Food Security and Public Health
 - www.cfsph.iastate.edu
- USAHA Foreign Animal Diseases ("The Gray Book")
 - www.usaha.org/pubs/fad.pdf

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Acknowledgments

Development of this presentation was funded by grants from the Centers for Disease Control and Prevention, the Iowa Homeland Security and Emergency Management Division, and the Iowa Department of Agriculture and Land Stewardship to the Center for Food Security and Public Health at Iowa State University.

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