

## ***Streptococcus suis* Meningitis in Swine Worker, Minnesota, USA**

**To the Editor:** *Streptococcus suis* is a major bacterial pathogen in swine worldwide. Historically, cases in humans have occurred sporadically, mostly in Asia (1,2). However, an outbreak in China involved 215 human cases and 39 deaths (3). Only 3 human cases of *S. suis* disease were documented in the United States before 2011: 2 domestically acquired cases in New York and Hawaii, and 1 case in a person in California who was probably exposed in the Philippines (4). We describe a case of *S. suis* disease in a swine worker in Minnesota, USA.

The case-patient was a previously healthy 60-year-old man (truck driver). On December 14, 2011, severe headache and chills developed, which he attributed to the onset of influenza. He had a history of migraine headaches, and used prescription medications to treat his headache. However, on December 15, he awoke with a severe headache that was unresponsive to treatment. Despite having to stop his truck several times because of the severe headache, he successfully completed his delivery route.

Early on December 16, his wife drove him to a nearby emergency department after he did not respond to ordinary commands. The patient had reduced coordination and behaved aggressively. His blood pressure was 92/52 mm Hg. He underwent intubation for 24 hours for airway protection, and a lumbar puncture was performed.

Cerebrospinal fluid (CSF) had a leukocyte count of 10,501 cells/mL (99% neutrophils), a protein level of 509 mg/dL, and a glucose level of 38 mg/dL. A few gram-positive diplococci were observed in CSF. Complete blood count showed a leukocyte count of 14,800 cells/mL (92% neutrophils),

a hemoglobin level of 14.1 g/dL, and a platelet count of 157,000/mL. *Streptococcus suis* was isolated from CSF and 2 of 4 blood cultures. Identification of *S. suis* was confirmed by using 16S rRNA gene sequencing at the Minnesota Department of Health.

The patient was given decadron, ceftriaxone, ampicillin, vancomycin, and acyclovir. During hospitalization, antimicrobial drugs were tapered until he received only ceftriaxone. Major symptoms were severe headache and nausea. He was discharged in good condition on day 10 of hospitalization and then completed a 14-day course of ceftriaxone.

There are 35 known serotypes of *S. suis* (1). Of these serotypes, serotype 2 is most commonly identified in infected swine and humans (2). The *S. suis* isolate from this patient was identified as serotype 2 by coagglutination test at the International Reference Laboratory at the Université de Montréal (5). The sequence type was identified by PCR as type 25, a common type in North America (6,7). The isolate was positive by PCR for the gene encoding virulence-associated factor muraminidase-released protein and negative for genes encoding virulence-associated extracellular factor and suilysin (8). The isolate was genotyped by enterobacterial repetitive intergenic consensus PCR and compared with 750 swine isolates in the University of Minnesota Veterinary Diagnostic Laboratory database (9). The obtained fingerprint matched that of 15 *S. suis* isolates from swine meningitis cases in Minnesota and Indiana during 2006–2010.

The patient worked for a trucking company that transports swine throughout the Midwest. His daily work required traveling to swine farms in Minnesota and making occasional trips to South Dakota and Iowa. His job was to load slaughter-weight swine into the truck and deliver them to regional slaughterhouses. Approximately 1 month before illness onset, he report-

ed moving swine from a farm on which the farmer reported pneumonia, a rare yet reported manifestation of *S. suis* infection in swine.

The patient reported always wearing coveralls, boots, and gloves while loading and unloading swine, but he wore a dust mask only occasionally. He had no recent foreign travel and no skin breaks. However, absence of open wounds has been noted in previous case-patients (10).

The reported incubation period for *S. suis* infection in humans ranges from hours to weeks, and open wounds are associated with shorter incubation periods (2). Case-patients in the United States reported known risk factors, including handling ill swine or slaughtering and processing swine for meat (4). In this instance, the patient only loaded and unloaded slaughter-weight swine from his truck. He reported transporting swine that had pneumonia, which is common in finishing stages of swine production. However, although *S. suis* can cause pneumonia, this disease in finishing swine is probably caused by other common pathogens such as *Pasteurella multocida*, *Mycoplasma hyopneumoniae*, influenza virus, and porcine reproductive and respiratory syndrome virus. A definitive source of infection for this patient was not identified. This case demonstrates a rare but potentially under-recognized occupational hazard for workers in the swine industry in the United States.

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## References

1. Segura M. *Streptococcus suis*: an emerging human threat. *J Infect Dis.* 2009;199:4–6. <http://dx.doi.org/10.1086/594371>
2. Wertheim HF, Nghia H, Taylor W, Schultz C. *Streptococcus suis*: an emerging human pathogen. *Clin Infect Dis.* 2009;48:617–25. <http://dx.doi.org/10.1086/596763>
3. Yu H, Jing H, Chen Z, Zheng H, Zhu X, Wang H, et al. Human *Streptococcus suis* outbreak, Sichuan, China. *Emerg Infect Dis.* 2006;12:914–20. <http://dx.doi.org/10.3201/eid1206.051194>
4. Fittipaldi N, Collis T, Prothero B, Gottschalk M. *Streptococcus suis* meningitis, Hawaii. *Emerg Infect Dis.* 2009;15:2067–9. <http://dx.doi.org/10.3201/eid1512.090825>
5. Gottschalk M, Higgins R, Boudreau M. Use of polyvalent coagglutination reagents for serotyping of *Streptococcus suis*. *J Clin Microbiol.* 1993;31:2192–4.
6. King SJ, Leigh JA, Heath PJ, Luque I, Tarradas C, Dowson CG, et al. Development of a multilocus sequence typing scheme for the pig pathogen *Streptococcus suis*: identification of virulent clones and potential capsular serotype exchange. *J Clin Microbiol.* 2002;40:3671–80. <http://dx.doi.org/10.1128/JCM.40.10.3671-3680.2002>
7. Fittipaldi N, Xu J, Lacouture S, Tharavichitkul P, Osaki M, Sekizaki T, et al. Lineage and virulence of *Streptococcus suis* serotype 2 isolates from North America. *Emerg Infect Dis.* 2011;17:2239–44. <http://dx.doi.org/10.3201/eid1712.110609>
8. Silva LM, Baums C, Rehm T, Wisselink H, Goethe R, Valentin-Weigand P. Virulence-associated gene profiling of *Streptococcus suis* isolates by PCR. *Vet Microbiol.* 2006;115:117–27. <http://dx.doi.org/10.1016/j.vetmic.2005.12.013>
9. Versalovic J, Koeuth T, Lupski JR. Distribution of repetitive DNA sequences in eubacteria and application to fingerprinting of bacterial genomes. *Nucleic Acids Res.* 1991;19:6823–31. <http://dx.doi.org/10.1093/nar/19.24.6823>
10. Gottschalk M, Segura M, Xu J. *Streptococcus suis* infections in humans: the Chinese experience and the situation in North America. *Anim Health Res Rev.* 2007;8:29–45. <http://dx.doi.org/10.1017/S1466252307001247>

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## **Streptococcus suis and Porcine Reproductive and Respiratory Syndrome, Vietnam**

**To the Editor:** *Streptococcus suis*, an opportunistic pathogen of swine, is an emerging zoonotic pathogen among humans (1). In Vietnam, *S. suis* is the leading cause of human acute bacterial meningitis (2). Infection in humans is associated with direct exposure to infected pigs or infected raw or undercooked pork products (3). Of the 35 *S. suis* serotypes, only a limited number are pathogenic for pigs, and clinical cases in humans have most frequently been attributed to serotype 2 (SS2) (1). In Vietnam during September 2006–November 2007, the carrier rate of *S. suis* among slaughterhouse pigs was 41% (222/542); SS2 was the most frequently identified serotype in 14% (45/317) of *S. suis* isolations (4).

Porcine respiratory and reproductive syndrome (PRRS) is a major disease affecting the swine industry globally; the severity of PRRS in pigs can be increased by co-infection with *S. suis* (5). In 2010, PRRS outbreaks in swine were reported in 49 of 63 Vietnamese provinces (online Technical Appendix Figure, [wwwnc.cdc.gov/EID/article/19/2/12-0470-Techapp1.pdf](http://wwwnc.cdc.gov/EID/article/19/2/12-0470-Techapp1.pdf)) (6). To understand the potential implications of swine PRRS out-

breaks for human *S. suis* disease, we investigated co-infections of *S. suis* and PRRS virus (PRRSV) in sick pigs in 3 provinces of Vietnam during the PRRS outbreaks in 2010 (online Technical Appendix Figure).

We sampled 108 farms reporting pigs that had a clinical syndrome consistent with PRRSV infections in the provinces of Thai Binh (May), Tien Giang (July), and Soc Trang (July). Samples were blood from sick febrile pigs and postmortem tissue from freshly culled pigs. To confirm swine PRRS outbreaks, we performed reverse transcription real-time PCR on 1 randomly selected plasma sample from each farm (7). A total of 103 (95%) plasma samples from 103 farms tested positive for PRRSV (Chinese genotype). We additionally selected 3 PRRSV-positive farms per province for comprehensive PRRSV screening of all 42 sampled pigs; 100% of samples from the 9 farms were PRRSV positive. After swine outbreaks ended, blood samples from 52 healthy pigs from 10 farms that had no recent history of PRRS were collected from Tien Giang Province (March 2011). None of the 52 plasma samples from the 10 control farms tested positive for PRRSV.

We investigated the presence of SS2 in blood and tissue samples from pigs on PRRS- and non-PRRS-affected farms by bacterial culture (online Technical Appendix Table). A total of 534 specimens from sick pigs yielded 9 (1.7%) SS2 isolates. One (2%) of 52 specimens from the healthy control pigs yielded a non-SS2 *S. suis* isolate. *S. suis* has been proposed to contribute to the spread of antimicrobial resistance genes to other human pathogenic streptococci (8). The antimicrobial susceptibility results of 9 SS2 isolates by disk diffusion (9) revealed a high prevalence (6/9, 66%) of resistance to tetracycline, tobramycin, enrofloxacin, and either marbofloxacin or chloramphenicol.

PCR amplification of the *16SrD-NA* gene (10) and the *cps2J* gene (2)