

Case Report

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Received 18 May 2012
Accepted 29 November 2012

Human meningitis caused by *Streptococcus suis*

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Streptococcus suis is an important swine pathogen worldwide, which can be transmitted to human beings by direct contact; therefore, *S. suis* infections occur mainly in people who handle pigs or pork. We present a case of a patient with *S. suis* meningitis who worked as a butcher in a meat processing plant for 5 years. The 35-year-old man was admitted to the Department of Infectious Diseases in T. Browicz Memorial Central Infectious Disease and Observation Hospital in Bydgoszcz, Poland, with suspected bacterial meningitis. According to his medical history, the patient had been injured during the processing of pork. A microbiological examination of the cerebrospinal fluid and blood revealed *S. suis* as a single aetiological factor of this infection. The patient was empirically administered cefotaxime (2.0 g at 8-h intervals) and penicillin (9 million U at 8-h intervals). The patient made a complete recovery and his inflammatory markers normalized. Only the hearing deficit of his right ear did not disappear. An otolaryngologist recommended a 4-week steroid therapy. The patient was not examined because he did not report to the clinic. To our knowledge this is the first described case of human meningitis caused by *S. suis* in Poland.

Introduction

Streptococcus suis is an important swine pathogen worldwide, which can be transmitted to human beings by direct contact; therefore, *S. suis* infections occur mainly in people who handle pigs or pork, such as pig farmers, abattoir workers, meat processing workers, people who transport pork, meat inspectors, and veterinary practitioners (Mai *et al.*, 2008; van de Beek *et al.*, 2008; Strangmann *et al.*, 2002). *S. suis* causes arthritis, meningitis, pneumonia, septicaemia, endocarditis and septic shock in both pigs and humans (Staats *et al.*, 1997). Outbreaks of *S. suis* infection in humans are uncommon. The first human case was reported in Denmark in 1968 (Arends & Zanen, 1988). Since that time, an increasing number of human cases have been reported in many countries, especially in Asia (China, 332 cases; Vietnam, 293; Thailand, 118; Japan, 7) and Europe (Netherlands, 41; UK, 15; Denmark, 12; France and Germany, 7; Spain, 6; Belgium, Croatia and Greece, 2) and some individual cases have been reported in other countries (Wertheim *et al.*, 2009). Serious outbreaks of *S. suis* infections in humans, which occurred in China in 2005, emphasized the importance of *S. suis* as an emerging zoonotic agent. We report the first described case of human meningitis caused by *S. suis* in Poland.

Case report

A 35-year-old man was admitted to the Department of Infectious Diseases in T. Browicz Memorial Central Infectious Disease and Observation Hospital in Bydgoszcz, Poland, with suspected bacterial meningitis. For a period of 24 h prior to admission, the patient had felt lethargic, developed a severe headache, vomiting, dizziness and had a high temperature (39 °C) with shaking chills. He reported no other symptoms suggestive of a focal infection. There was no other relevant past medical history. He worked as a butcher in a meat processing plant for 5 years. According to his medical history, the patient had been injured during the processing of pork. The patient had pyrexia of 39.8 °C and was haemodynamically stable on examination. His heart rate was 110 min⁻¹ and blood pressure was 105/55. He had symptoms of meningism, with positive Kernig's and Brudzinski's signs. He also had hearing problems. There was no other focal neurology. The findings of other clinical examinations were normal. The results of laboratory tests are presented in Table 1. An initial investigation revealed raised inflammatory markers. An HIV test was negative and chest X-ray and an abdominal ultrasound were normal. A lumbar puncture revealed colourless and clear cerebrospinal fluid (CSF). The patient was empirically administered cefotaxime (2.0 g at 8-h intervals) and penicillin (9 million U at 8-h intervals). He became apyrexial within 24 h of admission.

The CSF and two blood culture samples were sent to the Department of Microbiology of Dr A. Jurasz University

Table 1. Laboratory investigation

Blood		CSF	
Blood total white cell count (WCC)	$17.6 \times 10^9 \text{ l}^{-1}$	CSF WCC	1910 mm^{-3}
Neutrophils	$16.8 \times 10^9 \text{ l}^{-1}$	WCC differential	92 % neutrophils, 8 % mononuclear cells
C-reactive protein	190 mg l^{-1}	Protein	304 mg dl^{-1}
Glucose	149 mg dl^{-1}	Glucose	49 mg dl^{-1}

Hospital in Bydgoszcz, Poland. The CSF bacterial antigen latex test was negative for Group B streptococci, *Haemophilus influenzae* type b, *Streptococcus pneumoniae*, *Neisseria meningitidis* groups A, B, C, Y, W135 and *Escherichia coli* K1. The samples of the CSF and blood cultures showed positive microbial growth after 20 and 30 h, respectively. Direct and indirect Gram-stained CSF smears showed Gram-positive cocci arranged in pairs and short chains. In the CSF culture there were α -haemolytic streptococci, subsequently identified as *S. suis* biotype II using the VITEK2 GP colorimetric card that was read with the VITEK 2 compact automated system (bioMérieux). The identification was done in approximately 5 h. The strain has been identified with 95 % probability and the *S. suis* biochemical number was 051053364713771. The organism was also identified by mass spectrometry in the MALDI Biotyper (Bruker) (Werner *et al.*, 2012), which revealed a matched pattern to *S. suis* DSM 9684 with the score value >2.5 . The same identification was obtained for species cultured from blood samples. Antimicrobial susceptibility testing was carried out according to the European Committee on Antimicrobial Susceptibility Testing recommendations (Hryniewicz *et al.*, 2011). *S. suis* strains were resistant to clindamycin (but no inducible resistance was observed) and susceptible to the other antimicrobial agents (penicillin G [MIC=0.016 $\mu\text{g ml}^{-1}$], ampicillin, cefotaxime [MIC=0.094 $\mu\text{g ml}^{-1}$], imipenem, vancomycin [MIC=0.25 $\mu\text{g ml}^{-1}$] and teicoplanin [MIC=0.94 $\mu\text{g ml}^{-1}$]).

The patient completed a 3-week course of intravenous antibiotic therapy. Further laryngological and radiological investigations were performed. The magnetic resonance imaging of temporal bones revealed that scans of temporal bones and cerebellopontine angle were normal. On the basis of laryngological examination, the patient was diagnosed with right-sided sensorineural hearing loss with a decreased conductive hearing component.

The patient made a complete recovery and his inflammatory markers normalized. Only the hearing deficit of his right ear did not disappear. An otolaryngologist recommended a 4-week steroid therapy (4 mg Dexaven at 12-h intervals for 21 days, followed by 30 mg prednisone, with a dose reduction). He was discharged 35 days after admission and prescribed oral steroids. After hospitalization a medical follow-up visit to a laryngological clinic was recommended. The patient was not examined because he did not report to the clinic.

Discussion

Streptococcosis is currently a major health problem in pigs worldwide, causing considerable economic losses. *S. suis* appears as a commensal organism in the upper airways, especially on the tonsils and in the nasal cavity, as well as in the reproductive and digestive tracts of pigs. This bacterium probably enters the bloodstream via small wounds or through inhalation and people at high risk are those who have close contact with pigs or pork (Breton *et al.*, 1986). Arends & Zanen (1988) reported that *S. suis* type 2 was isolated from the tonsils of 34 men who had been in a slaughterhouse. Pig breeders and abattoir workers are estimated to be 1500 times more likely to develop streptococcal meningitis than people who do not deal with pigs or pork. As far as our case is concerned we have a clinical history of the patient who reported to have been injured during the processing of pork.

Patients with *S. suis* meningitis suffer from hearing loss more often than patients with other causes of bacterial meningitis and the reason for this is unknown (van de Beek *et al.*, 2008; Mai *et al.*, 2008; Lun *et al.*, 2007; Nguyen *et al.*, 2007). Key studies (Kay, 1991) on guinea pigs have shown a direct invasion of the cochlea by *S. suis*. MRI imaging studies on humans with bacterial meningitis also suggested the involvement of the cochlea and the severity of this involvement was proportional to the degree of hearing loss (Dichgans *et al.*, 1999). Dexamethasone sodium phosphate (as an adjuvant therapy) was found to reduce the risk of severe hearing loss and neurological sequelae in adults with bacterial meningitis (Nguyen *et al.*, 2007). A routine use of adjunctive dexamethasone therapy is recommended in adults with suspected bacterial meningitis according to guidelines (Heyderman, 2005; van de Beek *et al.*, 2006). In our case, it was not possible to assess the effects of this therapy as the patient did not report to the clinic for the purpose of a follow-up visit.

S. suis strains isolated from our patient were resistant to clindamycin and susceptible to the other antimicrobial agents. Szczotka *et al.* (2007) tested the antimicrobial susceptibility of Polish field *S. suis* strains collected from pigs between 1996 and 2005 and showed that there was a high level (100 %) of susceptibility to β -lactams among the tested strains. However, Pejsak *et al.* (2005, 1998) and Pejsak & Kolodziejczyk (2001) repeatedly demonstrated the presence of *S. suis* strains isolated from pigs that were resistant to penicillin, though the percentage of these

strains did not exceed 10 %. High susceptibility to β -lactam antibiotics suggests that they can be used in empiric therapy until the diagnosis is confirmed by a laboratory.

The above described case should increase the clinical awareness of human *S. suis* infection in Poland, especially among individuals who deal with pigs and pork products. Moreover, it should be taken into account that the large consumption of pork and extensive breeding of pigs in Poland means that streptococcosis is expected to pose a growing problem in a few years' time.

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