

STREPTOCOCCUS SUIIS INFECTION : CLINICAL FEATURES AND DIAGNOSTIC PITFALLS

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Abstract. Eight cases of *Streptococcus suis* (*S. suis*) infection between 1993-1999 were retrospectively studied. There were 6 cases of meningitis and 2 cases of endocarditis. Acute meningitis with early sensorineural hearing loss was the characteristic feature and the most common presentation of *S. suis* infection. *S. suis* endocarditis is a rare presentation in Thailand. This organism was often mistaken for *Streptococcus pneumoniae* or *Streptococcus viridans*. In this study, this was true in five cases in whom *S. suis* was identified later. However, the rapid diagnosis of *S. suis* meningitis may rely on Gram stain of the CSF in the setting of acute meningitis with hearing loss. These cases were treated with intravenous penicillin or ampicillin with a mean duration of 4 weeks. This treatment was very effective and there was no relapse among these patients.

INTRODUCTION

Streptococcus suis (*S. suis*) was identified in 1966 by Elliot. In 1968, the first case of *S. suis* infection in a human was reported in Denmark by Perch *et al* (1968) and over 100 cases have been reported since then (Sanford and Tilker, 1982; Chau *et al*, 1983; Arends and Zanen, 1988). In humans, the disease predominantly presents as acute meningitis (88% of all cases reported) (Kay *et al*, 1995). The mortality of 11-12% for *S. suis* infection is lower than the 25% mortality associated with adult bacterial meningitis in general (Durand *et al*, 1993). However, the characteristic and also the most serious complication of *S. suis* meningitis is the development of severe sensorineural hearing loss which is likely to remain permanent. Unilateral, or more commonly, bilateral hearing loss has been documented in 47% of the European and 64% of the Asian cases (Kay *et al*, 1995). Young pigs are probably infected via the nasopharyngeal airway but the portal of entry in humans is uncertain. The associa-

tion of human infection with pigs or pork products contact has been noted in the early description of the disease. The occupational exposure to pigs or pork was documented in 88% and 42% in Europe and Hong Kong, respectively (Kay, 1991). This was documented in approximately 50% of the cases in an earlier report from Ramathibodi Hospital in Bangkok (Phuapradit *et al*, 1987).

In Thailand, the first two cases were reported from Ramathibodi Hospital in 1987 (Phuapradit *et al*, 1987). Another six cases were reported in 1993 (Pootong *et al*, 1993) and in 1997 a further three cases were reported (Leelarasamee *et al*, 1997). Between 1981-1993, sixty-one cases were reported from Hong Kong (Arends and Zanen, 1988; Kay *et al*, 1995). It is uncertain whether the disease is rare in Thailand or under-recognized. In many published reports, the organism was mistaken for *Streptococcus pneumoniae* (*S. pneumoniae*) and *Streptococcus viridans* (*S. viridans*). In this study, we report our further experience with *S. suis* infection in Ramathibodi Hospital from 1993-1999.

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PATIENTS AND METHODS

All patients with positive cultures for *S.*

suis in Ramathibodi Hospital during the period January 1993 to December 1999 were included in the study. All clinical specimen cultures were performed by standard microbiological methods at the Division of Microbiology, Department of Pathology in this hospital. The medical records of the patients with clinical diagnoses of bacterial meningitis from January 1993 to December 1999 were retrieved from the Division of Medical Statistics. These cases were reviewed to identify *S. suis* infection and then information was extracted. The study data included clinical profiles, laboratory data, baseline characteristics such as sex, age, occupational exposure, underlying diseases and treatment outcome. The diagnosis of *S. suis* infection in this review was based on isolation of the organism from the cultures of cerebrospinal fluid and/or blood.

RESULTS

Between 1993-1999, 175 patients with bacterial meningitis were treated at Ramathibodi Hospital. There were 8 cases of *S. suis* infection. Six cases (75%) were *S. suis* meningitis, which is 3.42% of all bacterial meningitis. Two cases (25%) were *S. suis* endocarditis (cases 6,7; Table 1). Seven cases were male and one was female. The ages ranged from 19 to 75 years and the mean age was 39.5 years. Four patients (50%) were from the central region and the others came from other regions of the country. Only two cases (25%) had a history of close contact with pigs or pork products. Two patients had ventricular septal defect (VSD) but others had no underlying illness.

Four cases were diagnosed as acute meningitis on admission. One case presented with acute arthritis of the knee and ankle joints on admission and then developed meningitis later in hospital. One case was diagnosed as subacute meningitis. Two cases with underlying VSD were diagnosed as subacute bacterial endocarditis.

The onset of meningitis was rather acute.

The mean duration of illness prior to admission was 4.8 days (range 2-7 days). Only one case (case 8) had subacute onset of about 2 weeks. All patients with acute meningitis presented with fever, headache, neck stiffness and sensorineural hearing loss. The mean onset of sensorineural hearing loss was 3.8 days after the onset of meningitis (range 2-7 days). The deafness was of bilateral involvement and associated with tinnitus and vertigo at the onset of hearing loss. Labyrinthitis was shown by magnetic resonance imaging (MRI) in 2 cases (cases 2 and 4). Hearing loss was not present in the patient who had subacute meningitis. However, he did complain of tinnitus. The complications of *S. suis* infection in this study were oculomotor nerve palsy, right hemiparesis, subarachnoid hemorrhage from ruptured mycotic aneurysm and skin lesion (hemorrhagic blebs at the nose and upper lip). This skin lesion was also reported in a patient in a previous study (Phuapradit *et al.*, 1987).

Two patients with VSD presented with fever and progressive dyspnea. The mean duration of fever was 2.5 weeks. An echocardiogram also showed aortic regurgitation with vegetation in both patients.

All patients with acute meningitis had CSF pleocytosis. The mean CSF cell count was 2,428 cell/mm³ with polymorphonuclear predominance. The mean CSF protein and glucose concentrations were 277.2 mg/dl and 19.8 mg/dl, respectively. Gram-positive cocci could be identified in four out of five cases (80%). The patient with subacute meningitis (case 8) had CSF pleocytosis with mononuclear predominance. His CSF protein concentration was moderately increased and his CSF glucose concentration was slightly low (Table 1).

S. suis was initially cultured from blood and CSF in 3 cases. However, the isolation of *S. viridans* from blood or CSF had been reported by mistake in another five cases in whom *S. suis* was identified later. All isolated *S. suis* were sensitive to penicillin.

Seven patients were treated with large doses of intravenous penicillin (18-24 million units per day) for 2-6 weeks. The mean du-

Table 1
Clinical and laboratory details of all patients.

Patient	1	2	3	4	5	6	7	8
Year admitted	1993	1996	1996	1997	1997	1998	1998	1999
Month admitted	May	Aug	Nov	May	Aug	Feb	Oct	Jul
Sex	M	M	M	F	M	M	M	M
Age	56	29	75	59	23	19	20	35
Occupation	employee	farmer	farmer	housewife	goldsmith	gardener	homeless	farmer
Presenting symptoms	fever,vertigo	fever,headache	fever,headache	drowsiness	fever,arthritis	fever (3 weeks)	fever (2 weeks)	fever,headache
Neck stiffness	yes	yes	yes	yes	yes	no	no	yes
Hearing loss	BL	BL	BL	BL	BL(mild)	no	no	no
Vertigo	yes	yes	no	CNE	no	no	no	no
Joint involvement	no	no	no	no	yes	no	yes	no
Diarrhea	no	yes	no	no	no	no	no	no
Other complication	CN III palsy	stroke	no	no	no	SAH	no	skin rash
CSF protein (mg/dl)	450	165	370	126	275	not done	not done	203
CSF glucose (mg%)	23	2	11	23	40	not done	not done	31
CSF WBC (cell/mm ³)	1,930	379	1,600	110	8,120	not done	not done	234
CSF PMN(%)	90	73	75	100	98	not done	not done	1
CSF Gram stain	Negative	Gram+ve cocci	Gram+ve cocci	Gram+ve cocci	Gram+ve cocci	not done	not done	negative
CSF culture	<i>S. suis</i>	<i>S. viridans</i> *	<i>S. suis</i>	<i>S.v.-->S. suis</i>	<i>S. suis</i>	not done	not done	<i>S.v.-->S. suis</i>
Hemoculture	<i>S. suis</i>	<i>S. suis</i>	<i>S. suis</i>	<i>S.v.-->S. suis</i>	<i>S. suis</i>	<i>S.v.-->S. suis</i>	<i>S.v.-->S. suis</i>	NG

BL = bilateral; CNE = could not evaluate; SAH = subarachnoid hemorrhage; *S.v.* = *Streptococcus viridans*; *not further identified; NG = no growth
Cases 1-5, 8 = *S. suis* meningitis; Cases 6, 7 = *S. suis* endocarditis

ration of penicillin administration was 4 weeks. Ampicillin (12 grams per day) was given to one patient. All patients recovered from meningitis after the treatment was completed. However, the deafness was permanent.

One patient with subacute bacterial endocarditis (case 6) received intravenous penicillin G 18 million units per day for 4 weeks plus intravenous gentamicin 1 mg/kg/day during the first 2 weeks. In case 7, who had aortic valve replacement, intravenous penicillin 18 million units per day and intravenous gentamicin 1 mg/kg/day were planned to continue for another 3 and 2 weeks, respectively. Nevertheless, the treatment was not completed since he was discharged against advice.

DISCUSSION

Meningitis is the most common presenting feature of *S. suis* infection. The characteristic complication of *S. suis* meningitis is deafness, which is likely to remain permanent. It has been documented in 100% of previously reported cases (Phuapradit *et al*, 1987). In this series, all patients with acute meningitis were permanently and bilaterally deaf. However, there was no hearing impairment in the patient who presented with subacute meningitis. Kay elucidated the mechanism of the deafness in 1991, when he discovered that hearing loss in guinea pigs with experimental *S. suis* meningitis was due to suppurative labyrinthitis as evidenced by histological examination (Kay, 1991). Deafness was caused by the invasion of the organism of the cochlea from the subarachnoid space via the cochlea duct. Inflammation of the cochlea and labyrinth was demonstrated by MRI in 2 cases. At this moment, the portal of entry of the organism is still unclear. Transmission through the skin via a cut, infected wound or abrasion is thought to be the most frequent route, but only 2 cases (25%) in this series had a history of close contact with pigs or pork before the illness. This may be due to a lack of detailed history-taking of occupational exposure by the physician or there may be another mechanism of transmission,

such as the respiratory or oral routes.

S. suis endocarditis is a rare presentation in Thailand. In our series, VSD in both patients was proven by echocardiogram, which demonstrated vegetation at the aortic valves. Initially, *S. viridans* was mistakenly identified in both cases. One patient was treated with intravenous gentamicin 1 mg/kg/day for 2 weeks and intravenous penicillin G 18 million units per day for 4 weeks. He was then discharged but unfortunately he was admitted again with subarachnoid hemorrhage from ruptured mycotic aneurysm one week later. Another patient underwent aortic valve replacement and closure of VSD. Subsequently, he was treated with intravenous gentamicin 1 mg/kg/day for 2 weeks and intravenous penicillin G 18 million units per day for only 22 days; then he refused to continue and was discharged against advice. However, he showed clinical improvement at follow-up one week later.

Over 100 cases have been reported from many countries; most of them came from Northern Europe and Southeast Asia. However, it is still absent from some parts of the world, despite the fact that the natural hosts of the organism are pigs, which are present worldwide. The reason for this is probably underdiagnosis among clinicians and the mistaken identification of other groups of streptococcus species, especially *S. viridans*. All 3 cases reported by Siriraj Hospital were first reported as *S. viridans* before subsequent identification of *S. suis*. In our series, *S. viridans* was also reported from the blood or CSF culture in 5 cases (62.5%) initially. The CSF finding in acute meningitis showed the same features as those of bacterial meningitis. The rapid diagnosis of *S. suis* meningitis may rely on Gram stain of the CSF specimen and this method was shown to be 80% effective for the diagnosis in this series. If Gram-positive cocci are seen in the CSF of patients who present with acute meningitis with tinnitus and vertigo, *S. suis* should be considered as a likely pathogen. Intravenous penicillin G should be administered immediately, before deafness takes place.

All of the isolated strains of *S. suis* were

sensitive to penicillin. Intravenous penicillin G is the drug of choice and should be given as early as possible to prevent hearing complication. Although the clinical response of *S. suis* meningitis and bacteremia to penicillin treatment is excellent, deafness is usually permanent once it has already occurred before the start of treatment. These cases were treated with intravenous penicillin 18-24 million units or ampicillin 12 grams per day for 2-6 weeks. The mean duration of treatment was 4 weeks. The treatment with penicillin was very effective. There was no relapse among these patients.

We think that *S. suis* infection is not rare in Thailand nor even the world, in spite of the fact that very few cases have been reported in the world literature. This low prevalence may be partly due to difficulties in differentiating *S. suis* from other *Streptococcus* species, particularly *Streptococcus viridans*.

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