



(CASE REPORT)



## Sudden sensorineural hearing loss related to *Streptococcus suis* meningitis

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GSC Advanced Research and Reviews, 2024, 19(01), 165–169

Publication history: Received on 14 March 2024; revised on 22 April 2024; accepted on 25 April 2024

Article DOI: <https://doi.org/10.30574/gscarr.2024.19.1.0160>

### Abstract

**Background:** *Streptococcus suis* meningitis is caused by *Streptococcus suis*, gram positive bacteria which is a pathogen mainly in pigs. It is an emerging zoonosis globally with highest incidence in Southeast Asia. The main risk factors are contact with infected pigs and consumption of raw or moderately cooked pork. Bilateral sudden sensorineural hearing loss is a remarkable symptom in this disease. Early initiation of antibiotic and systemic corticosteroids is recommended to improve clinical outcome and reduce complications. Even so, despite adequate treatment, sensorineural hearing loss related to *S. suis* meningitis is usually irreversible. We report two male patients consulted to otorhinolaryngology department regarding decreased hearing in both ears. Both patients were previously admitted because of altered mental status, accompanied with fever and headache. History of eating traditional Balinese pork dish before the onset was noted. Pure-tone audiometry revealed bilateral sensorineural hearing loss in both patients. Diagnosis of *S. suis* meningitis was established and treatment was prompted. Clinically, both patients showed improvement but evaluation audiometry showed no remarkable improvement in hearing threshold. Therefore, transmission avoidance, infection prevention, hygiene practice and educational activities are essential.

**Keywords:** Sensorineural hearing loss; *Streptococcus suis*; Meningitis; Deafness

### 1. Introduction

Sudden sensorineural hearing loss is defined as sensorineural hearing loss in one or both ears that occurs rapidly within a 72-hour period, with pure-tone audiometry showing a decrease in hearing of > 30 dB in at least 3 consecutive frequencies<sup>1</sup>. Sudden deafness affects 5 to 30 per 100,000 adults, with incidence of 5-27 per 100,000 people annually in the United States. A study in Germany showed an incidence of 160 per 100,000 people annually<sup>1,2</sup>. Sudden sensorineural hearing loss is a medical emergency which needs timely diagnosis and treatment, because it might lead to permanent hearing loss<sup>3</sup>.

*Streptococcus suis* meningitis is meningitis caused by *Streptococcus suis* infection, transmitted through handling or processing contaminated pigs and consumption of contaminated pork. Over the years, cases of *S. suis* infections in humans have significantly increased. Majority of cases were found in Southeast Asia<sup>4</sup>. In Bali, pig handling, slaughtering, and pork consumption is high because it is a local delicacy and is also a part of Balinese Hindu ceremonial rituals and festivity. Quite a few Balinese traditional dishes incorporate raw pig blood or raw pork meat as ingredient, such as “red lawar”, a minced pork dish mixed with raw pig blood and vegetables<sup>5</sup>.

The symptoms of *S. suis* meningitis are typically similar to other bacterial meningitis<sup>7</sup>. It is reported that almost two thirds of *S. suis* meningitis patients experience hearing loss, and sensorineural hearing loss is the most common sequelae of this disease<sup>4,6</sup>.

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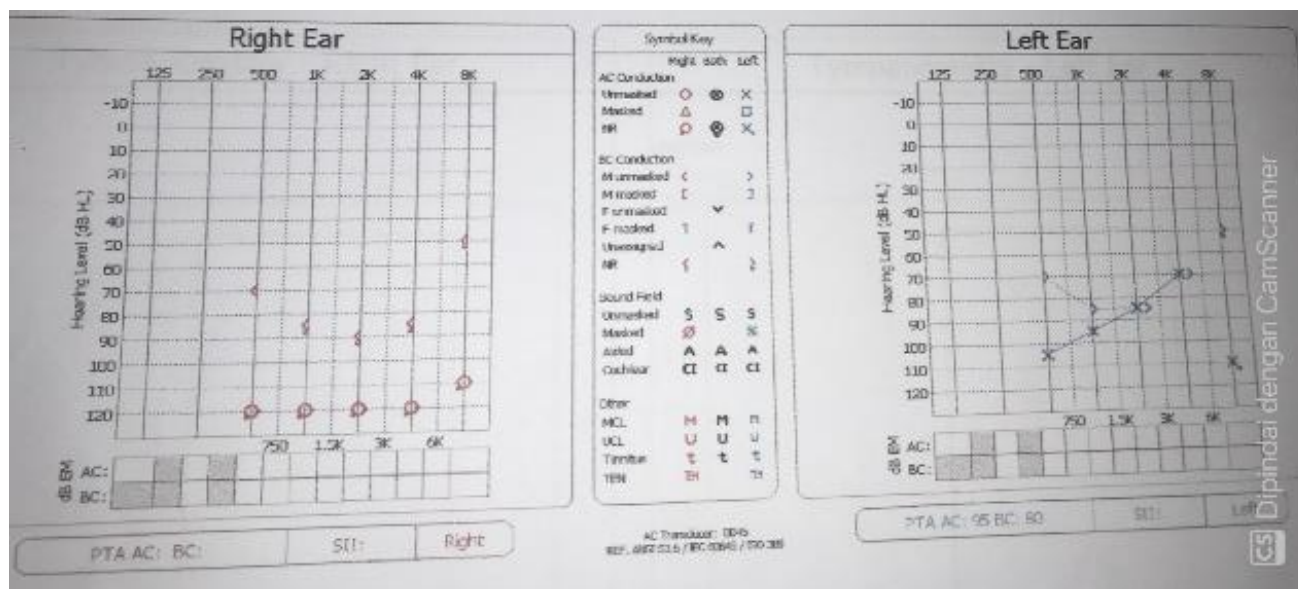
This report present two cases of sudden sensorineural hearing loss related to *S. suis* meningitis.

## 2. Case description

### 2.1. Case 1

A 49 years old Balinese man was consulted by neurology department with sudden decreased hearing in both ears since 1 day prior to examination. Patient also complained of tinnitus in both ears. Three days earlier, he experienced severe headache, neck stiffness, and fever, followed by altered mental status. History of seizure was denied. There was no history of prior diseases. The patient frequently consumed pork dishes and red lawar, and the last time he had the food was 1 week prior the admission.

Upon examination, the patient was alert, afebrile, with normal vital signs. Physical, otoscopy and rhinoscopy examination were normal. Tympanometry revealed type A results on both ears. Audiometry revealed profound sensorineural hearing loss on both ears, with no response on right ear and 95 dB hearing threshold on left hear.



**Figure 1** Audiometry Result

Complete blood count showed leukocytosis ( $27,8 \times 10^3/\mu\text{L}$ ), thrombocytopenia ( $123 \times 10^3/\mu\text{L}$ ), and increased C-reactive protein (178,9 mg/dL). Other laboratory examination and chest x-ray showed no abnormalities. On spinal fluid examination, None and Pandy reaction was positive and *S. suis* bacteria was isolated from the specimen.

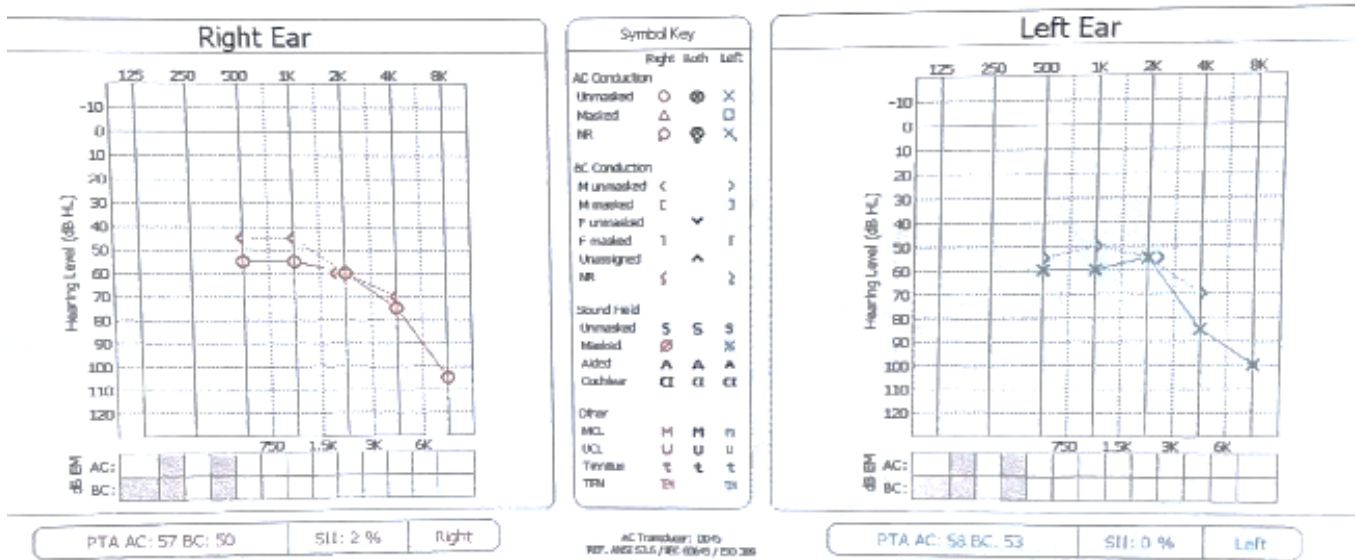
Diagnosis of profound bilateral sudden sensorineural hearing loss related to *S. suis* meningitis was made. Patient was treated with ceftriaxone (2 g every 12 hours for 21 days), dexamethasone (10 mg every 6 hours intravenously for 5 days), acetaminophen (1000 mg every 8 hours intraorally), omeprazole (40 mg every 12 hours intravenously), pentoxifyllin (400 mg every 8 hours intraorally), mecobalamin (500 mcg every 8 hours intravenously), and given oxygenation 4 litres per minute.

After 21 days of antibiotic, patient showed clinical recovery and laboratory result improvement, and was discharged. Pure tone audiometry was reevaluated but showed no improvement in hearing threshold.

### 2.2. Case 2

A 40 years old Balinese man was consulted by neurology department with sudden decreased hearing in both ears since 1 day prior to examination. Patient also complained of dizziness everytime he tried to sit. Five days earlier, he experienced severe headache, neck stiffness, fever, and diarrhea, followed by altered mental status. History of seizure was denied. There was no history of prior diseases. The patient frequently consumed pork dishes, and the last time he had the dish was 1 week prior the admission.

After the patient regained his consciousness, he was consulted for hearing loss. He was alert, no more feverish, with normal vital signs. Physical, otoscopy and rhinoscopy examination were normal. Tympanometry revealed type A results on both ears. Audiometry showed moderate-severe sensorineural hearing loss on both ears (right 61,25 dB and left 65 dB).



**Figure 2** Audiometry Result

Complete blood count showed leukocytosis ( $25,33 \times 10^3/\mu\text{L}$ ), thrombocytopenia ( $74 \times 10^3/\mu\text{L}$ ), hypokalemia (3,12 mmol/L) and increased C-reactive protein (287 mg/dL). Other laboratory examination showed no abnormalities. On spinal fluid examination, glucose was low (11% from blood glucose) and *S. suis* bacteria was isolated from the specimen. Head CT scan was conducted and showed slight leptomenigeal enhancement in the right frontotemporal and left parietal regions, cerebral edema, and calcification in the right-left choroid plexus and pineal body.

The patient was then diagnosed with moderate-severe bilateral sudden sensorineural hearing loss related to *S. suis* meningitis. Patient was treated with ceftriaxone (2 g every 12 hours for 21 days), methylprednisolone (125 mg every 6 hours intravenously, tapered off according to clinical condition), acetaminophen (1000 mg every 8 hours intraorally), omeprazole (40 mg every 12 hours intravenously), betahistine (12 mg every 12 hours intraorally), vitamin B1 (50 mg every 24 hours intraorally), vitamin B6 (10 mg every 24 hours intraorally), vitamin B1 (50 mg every 24 hours intraorally), potassium chloride (600 mg every 12 hours intraorally) and given oxygenation 4 litres per minute. The patient was also given hyperbaric oxygen therapy (HBOT).

After 21 days of antibiotic and 10 courses of HBOT, patient showed clinical recovery and laboratory result improvement, and was discharged. However, he still felt impaired hearing. Pure tone audiometry was reevaluated and showed slight improvement in hearing threshold (moderate sensorineural hearing loss on both ears, 57,5 dB on right ear and 53,75 dB on left ear). The patient was planned for hearing aid fitting.

### 3. Discussion

We described two cases of sudden sensorineural hearing loss related to *S. suis* meningitis in Bali. It is an emerging zoonosis globally with highest incidence in Southeast Asia<sup>5,7</sup>. *S. suis* meningitis is an inflammation of the meninges, caused by *S. suis* infection<sup>1</sup>. *S. suis* is a gram positive, facultative anaerobic bacteria, which is a pathogen mainly in pigs and mostly found in respiratory and digestive tracts<sup>8</sup>.

The main risk factors of *S. suis* meningitis in human is contact with infected pigs and consumption of raw or moderately cooked pork<sup>11</sup>. Route of transmission is hematogenous and intestinal<sup>10,12</sup>. Contact with pathogen through damaged skin or mucous membrane allows the bacteria to penetrate the mucosal/epithelial barrier and entered the bloodstream. Due to its invasiveness, *S. suis* can cross brain microvascular endothelial cells (BMECs), blood-brain barrier (BBB) and/or the blood-cerebrospinal fluid barrier<sup>8,12</sup>. In this case report, both patients had a history of pork dishes consumption around 1 week before onset of the symptoms.

All patients were male who presented with classic triad of meningitis (headache, fever, and altered mental status) and bilateral sensorineural hearing loss which ranged from moderate-severe to profound. *S. suis* infection was confirmed with CSF culture. This corresponds with recent literatures which stated male predominance and bilateral hearing loss as one of the most remarkable clinical feature in *S. suis* meningitis<sup>4,7,10,12</sup>. *S. suis* infection should be considered when patients that showed signs of bacterial meningitis also complained of hearing loss<sup>9</sup>.

The mechanism of hearing loss in *S. suis* meningitis is not clearly understood. Current researches hypothesized that the pathogenesis involve direct infection to cochlea<sup>7,11,12</sup>. *S. suis* bacteria entered the subarachnoid space, which enables the bacterium to cross the cochlear aqueduct and migrates to the perilymph through the action of its exotoxin<sup>4,7,8</sup>. It triggers the cascading inflammatory response, leading to formation of osteoid matrix and fibrosis, which eventually cause ossification of the cochlea<sup>7,10,12</sup>.

Treatment for *S. suis* meningitis is similar to other bacterial meningitis<sup>4</sup>. Early initiation of antibiotic and systemic corticosteroids is recommended to improve clinical outcome and reduce complications<sup>7</sup>. Even so, despite adequate treatment, sensorineural hearing loss related to *S. suis* infection is usually irreversible<sup>6</sup>. As seen in this case report, both patients showed no remarkable improvement despite adequate antibiotics, corticosteroid, and other adjuvant therapy such as vasodilator and neuroprotective agent. The second patient who underwent hyperbaric oxygen therapy showed less than 15 dB improvement in hearing threshold.

Thus, other than timely diagnosis and management, transmission avoidance and infection prevention through hygiene practice and implementation of personal protective equipments when handling pigs or pork should be established. Education for high risk populations should be routinely included in health promotional activities.

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#### 4. Conclusion

*S. suis* meningitis have a high incidence in regions with high pig handling activities and pork consumption. Bilateral sudden sensorineural hearing loss is a remarkable clinical symptom in this disease. Timely diagnosis and management are essential to improve clinical outcome. However, despite adequate treatment, sensorineural hearing loss related to *S. suis* meningitis is usually irreversible. In this case report, evaluation pure tone audiometry showed no significant improvement in patient's hearing threshold. Therefore, transmission avoidance, infection prevention, hygiene practice and educational campaigns in high risk populations are essential.

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#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

There is no conflict of interest regarding this study.

##### *Statement of ethical approval*

The consent form has been obtained from the patient.

##### *Statement of informed consent*

Authors have obtained informed consent from all patients regarding this case report.

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