

Case Report

Endogenous endophthalmitis following staphylococcus aureus meningitis

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Abstract: Endogenous endophthalmitis is a rare complication of acute meningitis. A healthy 82-year-old woman suddenly developed septic bacteremia and meningitis owing to *Staphylococcus aureus* (methicillin-susceptible *Staphylococcus aureus*); she presented with a high fever and drowsiness. Improvement of these initial symptoms unveiled impaired bilateral visual acuity. Detailed ophthalmological assessments diagnosed it as probable endogenous endophthalmitis, which was immediately treated with vitrectomy. Subsequently, the patient totally recovered without any neurologic or ophthalmic sequela.

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Key words : endophthalmitis, *Staphylococcus aureus*, bacterial meningitis

Introduction

The mortality rate of bacterial meningitis in adults has markedly decreased to 20%. This destructive disease could result in various sequela including hearing loss and impaired cognitive function, sometimes with the impediment to rehabilitation into society¹⁻³⁾. Endogenous endophthalmitis accompanied by bacterial meningitis is an extremely rare condition that must be immediately detected and treated properly because of the risks of severe visual impairment. We report a rare case of an 82-year-old woman with bacterial meningitis complicated by bilateral endogenous endophthalmitis.

Case report

In August 2017, an 82-year-old woman, who showed no impairment in activities of daily living without external support, developed a 39°C fever in the evening after she had worked outside in the yard that morning. The medical history of the patient included bilateral cataract, treated surgically in 2012 following vitrectomy in the right eye because of infection; there had been no growth in the vitreous culture. The patient was brought to our hospital; however, she was diagnosed with heat illness upon physical examination. The following day, she returned to our hospital by ambulance with a disturbance in consciousness and 40°C fever. A blood test showed a normal leukocyte count

(7,900/ μ l; normal range 3,000–7,000/ μ l) and an elevation of C-reactive protein (6.5 mg/dl; normal range 0–0.5 mg/dl); urine test revealed pyuria, and blood and urine cultures were taken for microbiological examination. With these data, she was diagnosed with urinary tract infection and administered 2 g of ceftriaxone. On the second day after admission, although her temperature had lowered, she reported neck stiffness; she was then examined by our team.

In our physical examination, the patient lacked readiness to answer questions due to confusion and showed neck stiffness without any other neurological findings. She exhibited tachycardia with a heart rate of 96 beats/min, fever (40.3°C), slightly high blood pressure (141/68 mmHg), and an oxygen saturation of 92% on room air. Lumbar puncture was performed; cerebrospinal fluid (CSF) analysis showed normal cerebrospinal pressure (95 mmH₂O; normal range 50–180 mmH₂O), an elevated leukocyte count (1,056/ μ l; normal range 0–5/ μ l), mononuclear cell 251/ μ l, multi-nucleated cell 805/ μ l, an elevated protein level (95 mg/dl; normal range 15–45 mg/dl), and a normal glucose level (59 mg/dl; corresponding blood glucose level 148 mg/dl). Blood culture detected methicillin-susceptible *Staphylococcus aureus* (MSSA) and CSF culture was negative. Thoracoabdominal CT scan did not show any signs of infectious focus. Brain diffusion-weighted MRI showed multiple small high signal debris in the limbic cortex and the limbic cerebellum suggesting acute secondary cerebral

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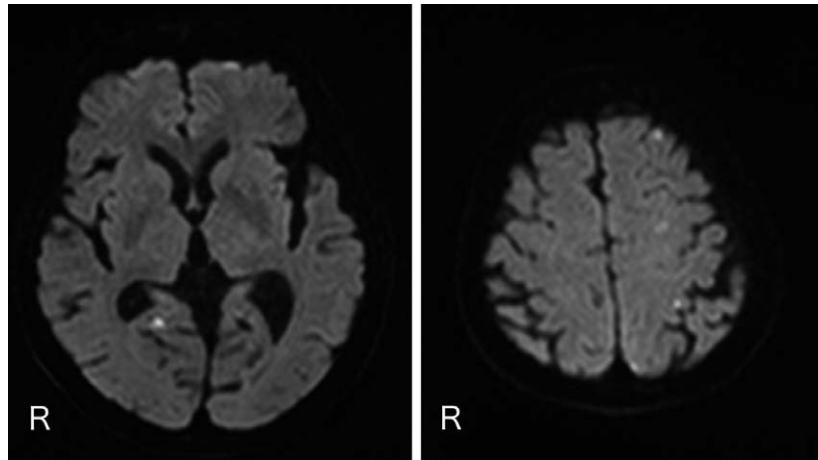


Fig. 1 Brain MRI.

Brain diffusion-weighted MRI shows several small high debris in the limbic cortex and limbic cerebellum, suggesting acute multiple cerebral infarction. There are no other imaging findings typical of meningitis in contrast enhancement of the meninges and high-signal lesion in Brain FLAIR image.

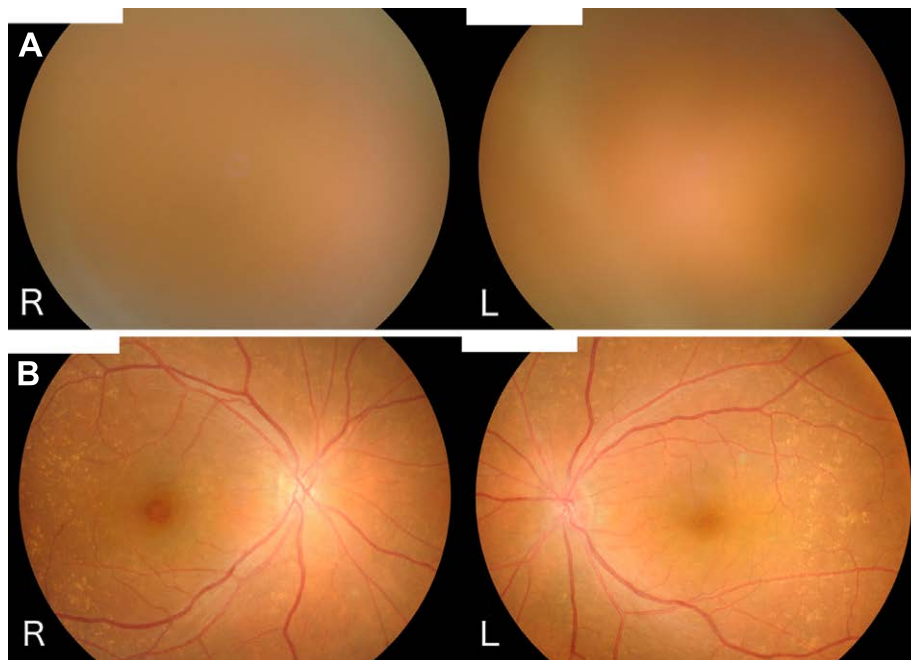


Fig. 2 Ophthalmoscopic findings.

A) The day of the operation (Day 5). B) 3 weeks after the operation. Ophthalmoscopic examination on the day of the operation demonstrates dense vitritis with severe opacity, without focal abnormalities. The findings 3 weeks after the operation show dramatic improvement.

infarction without findings of either active tympanitis or sinusitis (Fig. 1). Cervical and lumbar spine MRI did not show any signs of spondylitis. Transthoracic echocardiography did not show any signs of vegetation.

We diagnosed her with bacterial meningitis and initiated empiric treatment with meropenem (2 g q8h div). Although the patient became alert on the third day after admission, she reported visual impairment, and could only perceive light; her

vision had been 20/20 after cataract surgery in 2012. Ophthalmoscopy revealed inflammation in bilateral anterior chambers and opacities in the vitreous, supporting a diagnosis of bilateral endogenous endophthalmitis. At that time, it was unclear whether the endogenous endophthalmitis was infectious; vitrectomy was performed on the fourth day after admission for diagnostic treatment. The patient's vision after vitrectomy was 20/400 in the right eye and 20/100 in the left eye (Fig. 2). Culture of

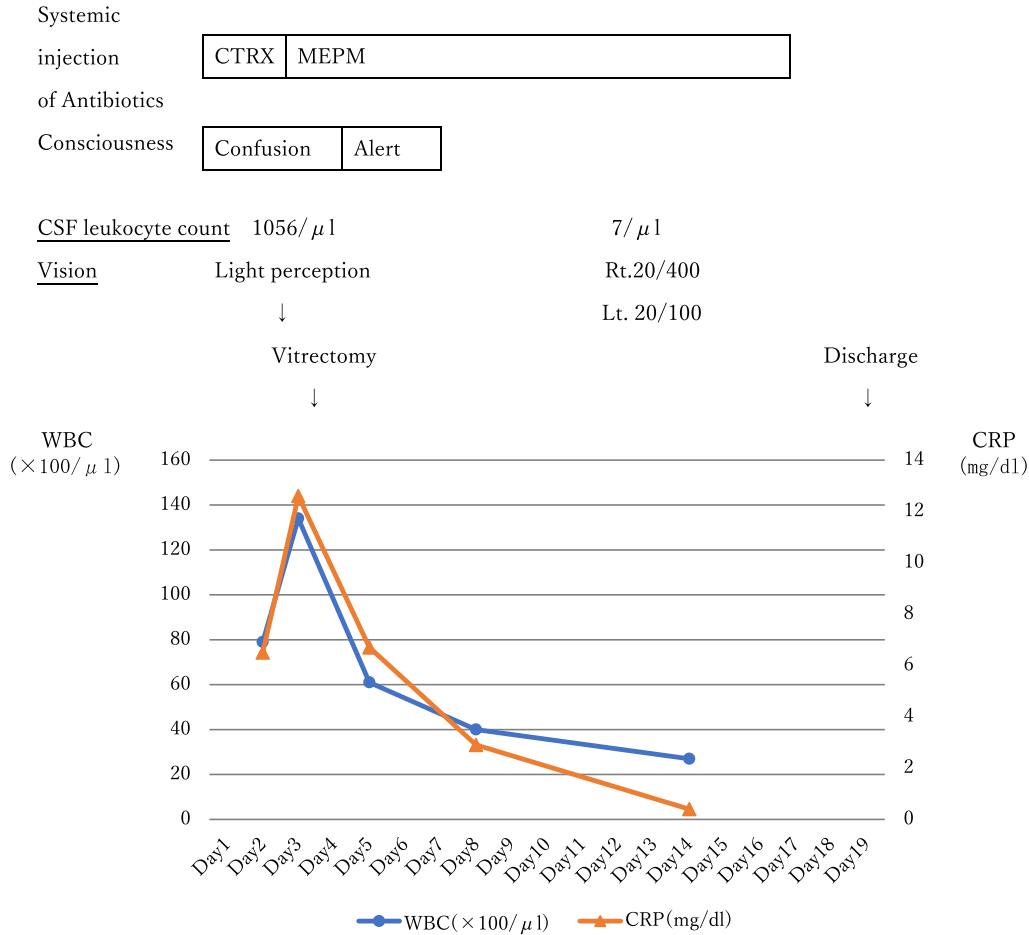


Fig. 3 Clinical courses of meningitis and endophthalmitis.

The figure shows the improvement in the results of the blood test and consciousness after antibiotic therapy and vitrectomy. The vision of the patient was preserved after vitrectomy and improved to 20/20 in the right eye and 20/13 in the left eye, at 3 months after the operation. CTRX; Ceftriaxone, MEPM; Meropenem.

vitreous fluid found MSSA. The surgical findings were retinal occlusive vasculitis, white lines of peripheral retinal blood vessels, macular retinal hemorrhage and multiple exudative lesions. These preoperative and operative findings, as well as bacterial cultures, resulted in the final diagnosis of bilateral endogenous endophthalmitis, accompanied by bacterial meningitis. Thereafter, her general condition improved steadily. On the thirteenth day after admission, lumbar puncture was again performed; CSF analysis found normal cerebrospinal pressure (60 mmH₂O), a normal leukocyte count (7/μl: mononuclear cell 7/μl, multi-nucleated cell 0/μl), a normal protein level (27 mg/dl), a normal glucose level (47 mg/dl; corresponding blood glucose level 89 mg/dl). A blood test on the same day showed an improvement as well: normal leukocyte count (2,700/μl) and a normal C-reactive protein level (0.4 mg/dl) (Fig. 3). The patient was discharged after a total of 18 days. On final examination, no neurological deficit remained.

Discussion

S. aureus is a rare causative pathogen of bacterial meningitis in adults in Japan, which contributes to the onset of approximately 5% of cases¹⁾. In contrast, in Western countries and Europe, this pathogen is the causative agent in up to 25% of cases of endogenous bacterial endophthalmitis⁴⁾. In our case, bacterial meningitis was accompanied by endogenous endophthalmitis. However, to our knowledge, there has been no studies regarding the frequency of the complications of bacterial meningitis and bacterial endophthalmitis. The patient recovered without any neurological and ophthalmic sequelae because of early diagnosis and treatment, including systemic antibiotic treatment and surgery.

Meningitis caused by *S. aureus* can sometimes occur subsequent to neurosurgery including in association with cerebrospinal fluid catheters and penetrating trauma, or sometimes secondary to infectious endocarditis and spondylitis caused by *S. aureus*^{5,6)}. For

patients who have not undergone either neurosurgery or trauma, common bacterial meningitis caused by *S. aureus* is most likely to be accompanied by sinusitis, pneumonia, or osteomyelitis.

In our case, although CSF culture taken 1 day after antibiotic therapy was negative, blood culture (2/2 sets) on the first day after admission detected *S. aureus* (MSSA); culture of vitreous fluid also detected *S. aureus* (MSSA). Notably, bacteremia caused by *S. aureus* (MSSA) accompanies bacterial meningitis and endophthalmitis. However, the patient did not undergo either neurosurgery or trauma and had no imaging findings suggestive of other infectious foci, including sinusitis, pneumonia, or osteomyelitis; urine culture did not detect *S. aureus*. It was highly unlikely, therefore, that any common infection would be accompanied by septic bacteremia and meningitis, caused by *S. aureus*. The route of infection of *S. aureus* is unknown in the present case, to our knowledge.

Endophthalmitis is classified as either endogenous or exogenous, depending on the route of infection. Exogenous endophthalmitis results from direct inoculation as a complication of neurosurgery, penetrating trauma, foreign bodies, or corneal ulceration, as well as following a breach of ocular barriers during periocular infection⁷. Endogenous endophthalmitis, which results from bacteremic or fungaemic seeding of the eye, is rare. Only 5 to 15% of all endophthalmitis cases are endogenous⁸. Endogenous endophthalmitis occurs when pathogens disseminate through blood and into the internal ocular spaces through the blood-ocular barrier. Notably, 64% of endogenous endophthalmitis cases are caused by fungus, whereas 34% are caused by bacteria⁹. Endogenous endophthalmitis is most frequently associated with an underlying medical condition: compromised host, malignancy, or intravenous drug abuse. Patients with diabetes mellitus comprise 30–90% of cases of endogenous endophthalmitis^{10,11}. Endophthalmitis is generally accompanied by ophthalmalgia and impaired visual acuity¹². In our case, the patient did not complain of impaired visual acuity because of drowsiness; however, improvement of the level of consciousness subsequently unveiled the ophthalmic abnormality. Infectious endophthalmitis seldom occurs bilaterally. It was not clear whether the endogenous endophthalmitis was infectious; thus, vitrectomy was performed. One-quarter to one-third of such cases may have a delayed diagnosis, estimated as up to 3 days in length⁸. Since ocular and systemic symptoms of endophthalmitis are typically non-specific, early diagnosis relies on the alertness of the ophthalmologists and other physicians. Physicians are advised to assess the eyes of septic patients, especially those who are unconscious¹³.

Liver abscess is the most common source of infectious endophthalmitis (approximately 19% of cases); meningitis is a rare source (approximately 6% of cases)^{9,10}. Among compromised hosts who develop septic bacteremia associated with infectious focus, liver abscess can be frequently associated with the onset

of infectious endophthalmitis^{9,14–16}. The most frequent pathogen is *Klebsiella pneumoniae*, followed by *S. aureus*. Historically, visual outcomes following endogenous endophthalmitis have been very poor, particularly when the causative pathogen is identified as a *Klebsiella* species^{14,15}.

Our case is rare because of the association of infectious endophthalmitis with meningitis without any underlying medical condition. Early diagnosis and treatment are frequently assumed to contribute to a good prognosis; however, to the best of knowledge, there has been no study regarding the correlation between prognosis and the period from the onset to the diagnosis of bacterial endophthalmitis. With respect to the treatment of bacterial meningitis, the concurrence of infectious endophthalmitis should be considered.

※The authors declare there is no conflict of interest relevant to this article.

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