CASE REPORT

Successful intervention for overwhelming postsplenectomy infection caused by non-vaccine pneumococcal serotype 23A

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Abstract

The spleen plays an important role in the body’s immune defense against invasive infections, particularly those caused by encapsulated bacteria. Encapsulated bacterial infection in asplenic patients is a medical emergency called overwhelming postsplenectomy infection (OPSI) and has a mortality rate of 50–70%. Here, we report the case of a 51-year-old Asian man who complained of emesis and diarrhea as primary symptoms. He rapidly progressed to coma and was eventually diagnosed with OPSI (pyogenic ventriculitis/spondylitis) caused by non-vaccine pneumococcal serotype 23A. Aggressive management, including empiric antibiotic therapy, a staircase approach for intracranial pressure-targeted therapy and laminectomy/laminoplasty, resulted in a good recovery. Our report highlights that non-vaccine pneumococcal serotypes can cause disease in vaccinated patients.

INTRODUCTION

The spleen is crucial in regulating immune homeostasis through its ability to link innate and adaptive immunity to protect against infections, particularly those caused by encapsulated bacteria (e.g. Streptococcus pneumoniae, Haemophilus influenzae and Neisseria meningitidis). In patients with hyposplenism who have undergone splenectomy, overwhelming postsplenectomy infection (OPSI) is defined as fulminant sepsis, meningitis or pneumonia mainly caused by S. pneumoniae, H. influenzae type b and N. meningitidis. OPSI is considered a medical emergency, and only a prompt diagnosis and immediate treatment can reduce mortality. The clinical course of OPSI is measured in hours rather than in days. The mortality rate is 50–70%, and most deaths occur within the first 24 h [1–3].

Ventriculitis, a complication of meningitis, is a rare cerebral infection that has been referred to as ependymitis, intraventricular abscess, ventricular empyema and pyocephalus [4, 5]. Pyogenic ventriculitis (PV) is an uncommon but very severe intracranial infection related to ruptured brain abscesses, ventricular catheterization, trauma or meningitis. PV requires a rapid diagnosis and immediate therapy because of its high mortality rate [4, 5].
Conjugate pneumococcal vaccines have had a major effect on reducing the burden of invasive pneumococcal disease (IPD). However, rapid expansion in some non-vaccine serotypes and penicillin resistance have been undermining the benefits of the vaccines for the last 1–2 years [6, 7].

Here, we report a case of a patient who had previously undergone splenectomy who initially complained of emesis and diarrhea and then experienced a significant reduction in blood pressure within 3 h. The patient lapsed into coma and experienced respiratory arrest at ~4 h after transfer to our hospital due to OPSI caused by non-vaccine pneumococcal serotype 23A.

CASE REPORT

A 51-year-old Asian man visited a night emergency clinic due to emesis and diarrhea and experienced a significant reduction in blood pressure despite the administration of i.v. fluids. The patient was transferred to our emergency department at ~3 h after his arrival at the clinic. His relevant medical history included splenectomy at the age of 18 due to a traffic accident injury.

He was lucid and his Glasgow Coma Scale (GCS) score was GC5 (E4V5M6) on arrival. No abnormalities, except for blood pressure at 80/70 mmHg (↓), were noted in his physical and neurological findings, which included the following: eyeball tenderness: negative; jolt accentuation: negative; and neck rigidity: negative. Therefore, the patient had no signs or symptoms of suspected meningitis.

The baseline laboratory results are summarized in Table 1.

| Laboratory                          | Patient | Reference values |
|------------------------------------|---------|------------------|
| White blood cell (WBC) (/μl)       | 22 000  | 3500–9800        |
| Hemoglobin (g/dl)                  | 13.2    | 11.3–4.2         |
| Platelet count (/μl)               | 7.9 × 10^4 | 13.0–40.0       |
| Blood urea nitrogen (mg/dl)        | 51      | 8–23             |
| Creatinine (mg/dl)                 | 5.1     | 0.30–0.80        |
| Sodium (mEq/l)                     | 140     | 135–149          |
| Potassium (mEq/l)                  | 4.9     | 3.6–5.4          |
| Chloride (mEq/l)                   | 102     | 98–108           |
| Total protein (g/dl)               | 6.4     | 6.5–8.3          |
| C-reactive protein (mg/dl)         | 26.2    | 0.00–0.30        |
| Procalcitonin (ng/dl)              | 46.8    | 0.00–0.05        |
| Total bilirubin (mg/dl)            | 0.87    | 0.20–1.30        |
| Aspartate aminotransferase (IU/l)  | 68      | 8–40             |
| Alanine aminotransferase (IU/l)    | 57      | 5–45             |
| Lactate dehydrogenase (IU/l)       | 335     | 119–240          |
| Alkaline phosphatase (IU/l)        | 164     | 104–338          |
| γ-Glutamyl transpeptidase (IU/l)   | 164     | 12–48            |
| Prothrombin time-international normalized ratio | 1.53 | 0.00–1.25 |
| Activated partial thromboplastin time (s) | 52.7 | 25.0–40.0 |
| Fibrin degradation products (μg/ml) | 338.4  | 0.0–10.0 |

Based on the improvements in laboratory findings as well as renal function, the patient was extubated on Day 5 (Fig. 1). As his GCS score did not improve from GCS6 (E3V2M1), the patient was transferred to a highly specialized hospital on Day 6. His level of consciousness finally improved to GCS14 (E1V1M1), followed by respiratory arrest, which was likely due to meningitis. After emergency airway management, the patient was monitored under continuous deep sedation (Richmond Agitation Sedation Scale –5 to –4) using propofol and midazolam with an analgesic, fentanyl and mild hyperventilation (PaCO2 25–30 mmHg) to prevent an increase in intracranial pressure. Administration of ceftriaxone (2 g q12 h) and ampicillin (1 g q6 h) was initiated, and meropenem was then terminated (Fig. 1). After stabilizing the patient’s vital signs, lumbar puncture was attempted but failed due to a bloody liquid obtained. Two sets of blood cultures yielded penicillin-resistant S. pneumoniae (PRSP), of which minimum inhibitory concentration (MIC) for penicillin G was 0.25 μg/ml, at 4 days after admission (Day 5). Note that S. pneumoniae strains are classified into two categories based on susceptibility to penicillin; PRSP is defined as having the MIC for penicillin G of 0.12 μg/ml or greater [8].

Based on the improvements in laboratory findings as well as renal function, the patient was extubated on Day 5 (Fig. 1). As his GCS score did not improve from GCS6 (E3V2M1), the patient was transferred to a highly specialized hospital on Day 6. His level of consciousness finally improved to GCS14 (E4V4M6) on Day 8, but ceftriaxone (2 g q12 h) was continued due to complications of PV (Fig. 2) and pyogenic spondylitis (PS) (Fig. 3), which were found on Days 6 and 17, respectively. Magnetic resonance imaging (MRI) revealed hyperintense (diffusion-weighted) and hypointense (apparent diffusion coefficient (ADC) map) lesions with a fluid–fluid level in the bilateral lateral ventricles (Fig. 2) and hypointense (T1-weighted) and hyperintense (T2-weighted) lesions in the L4–5 vertebral bodies and the disc space (Fig. 3). These findings suggested that the patient had PV and PS [4, 5]. The patient was discharged on Day 62 after laminectomy/laminoplasty and fully recovered except for right sensorineural hearing loss.

Cerebrospinal fluid (CSF) analysis on Day 6 showed a cloudy liquid with elevated protein (1.6 g/l) and a leukocyte count of 1120/μl, 79% of which were neutrophils. The pneumococcal serotype was identified as 23A, which is not included in the current conjugated or polysaccharide pneumococcal vaccines.
The patient was finally diagnosed with OPSI (PV and PS) caused by non-vaccine pneumococcal serotype 23A.

**DISCUSSION**

When an asplenic patient develops a bacterial infection, early administration of broad-spectrum antibiotics is the foundation for preventing further morbidity and mortality [1–3]. In particular, the timing of the initiation of antibiotic therapy in patients with bacterial meningitis is critical because delays in antibiotic therapy of >6 h after admission have been associated with unfavorable outcomes at discharge [9]. Accordingly, empiric therapy including meropenem followed by ceftriaxone and ampicillin for sepsis was applied in our case.

Central nervous system complications of OPSI may occur frequently. Infected fluid from the meninges that passes into the spinal cord, i.e. CSF, may cause PS. Furthermore, backflow of CSF from the extraventricular spaces into the intraventricular space is considered a possible route of infection leading to PV. This is a potential explanation for the observation that PV is often associated with meningitis [4, 5].

Adjuvant dexamethasone therapy reportedly has beneficial effects on bacterial meningitis [10]. The recommended administration regimens for dexamethasone are 15–20 min before or at the same time as the first dose of antibiotic [10], though the efficacy of adjuvant dexamethasone after the administration of antibiotic(s) remains unclear. Because we utilized meropenem immediately after initial laboratory findings and then ceftriaxone and ampicillin after clinically suspected meningitis, we missed the optimal chance for the dexamethasone regimen. Therefore, we alternatively utilized a staircase approach for intracranial pressure-targeted therapy, from intubation to increased sedation to induced hypocapnia, i.e. mild hyperventilation [11].

The rapid spread of non-vaccine serotypes causing IPD has become problematic to public health [6, 7]. In particular, the
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Figure 3: MRI on Day 17 showed (a) hypointense signals in the L4–5 vertebral bodies and the disc space (arrow, T1-weighted sagittal image); (b) hyperintense signals in the L4–5 vertebral bodies and the disc space (arrow) with an epidural mass (*, T2-weighted sagittal image).

prevalence of serotype 23A, which causes IPD in adults, rapidly increased from 0.7% in fiscal year 2010 to 5.7% in fiscal year 2016 in Japan [7]. Therefore, high-valency pneumococcal vaccines that include emerging serotypes may be required.

In summary, two major learning points presented in this report are as follows: (i) aggressive management in patients with OPSI is required for a good recovery, (ii) non-vaccine pneumococcal serotypes can cause disease in vaccinated patients.

CONFLICTS OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

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There is no source of funding to report for this case report.

ETHICAL APPROVAL

No ethical approval was required, as this was a clinical case.

CONSENT

Patient permission was obtained prior to writing this report.

GUARANTOR

Dr Toshiki Ito.

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