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Case Report

Meningococcal pneumonia in Japan: A case report and literature review

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ABSTRACT

Neisseria meningitidis often causes meningitis and meningococcemia; however, meningococcal pneumonia is quite rare. Herein, we report a case of non-invasive meningococcal pneumonia initially misdiagnosed as pneumonia due to *Moraxella catarrhalis* on the basis of a Gram stain in a 43-year-old woman with asthma, type 2 diabetes mellitus, and schizophrenia. She visited our hospital following a 3-day history of fever, productive cough, and shortness of breath. Since her sputum smear revealed Gram-negative diplococcus and the chest radiograph showed infiltration in the lower right lung field, her initial diagnosis was pneumonia caused by *M. catarrhalis*. However, the next day, the sputum culture colonies were unlike those of *M. catarrhalis*, and matrix-assisted laser desorption/ionization time of flight mass spectrometry analysis revealed the pathogen to be *N. meningitidis*. As a result, we administered the appropriate treatment and ensured adequate infection prevention and control measures including, droplet precautions and prophylaxis provided to close contacts. Secondary infection did not occur. Although meningococcal pneumonia is not common, physicians should consider *N. meningitidis* when Gram-negative diplococci are observed in respiratory specimens, as *N. meningitidis* cannot be distinguished from *M. catarrhalis* with Gram staining alone. Moreover, it is also important to monitor the appearance of the pathogenic colonies and to closely coordinate with laboratory technicians to determine appropriate treatments. In this article, we review the previous case reports of meningococcal pneumonia reported in 1984–2015 in Japan, summarizing the clinical characteristics and comparing previous reviews of the literature.

1. Introduction

Neisseria meningitidis (*N. meningitidis*) was first identified in the cerebrospinal fluid (CSF) of a patient with meningitis in 1887 by Weichselbaum [1]. *N. meningitidis* is a Gram-negative diplococcus that can cause life-threatening infectious diseases such as meningitis and meningococcemia worldwide. Children aged 5 years and under, adolescents and young adults aged 16 through 21 years, and adults aged 65 years and over are particularly susceptible [2,3]. Additionally, anatomical or functional asplenia, complement deficiency, and human immunodeficiency virus infection are known risk factors for meningococcal diseases [4]. There are 13 serogroups classified by their capsular polysaccharides: A, B, C, E-29, H, I, K, L, W-135, X, Y, Z, and Z′. Most meningococcal diseases are caused by the A, B, C, X, Y, and W-135 serogroup [5]. *N. meningitidis* only colonizes humans: it has never been isolated from other animals or the natural environment [6]. After spreading through the saliva and respiratory secretions of patients or asymptomatic carriers, *N. meningitidis* attaches to the nasopharynx with adhesion proteins. The pilus of this organism enables its adherence to the endothelial cells of the mucous membrane, and also enables it to invade into the bloodstream [6]. *N. meningitidis* can breach the blood-CSF barrier via the transcellular route by exploitation of host cellular signaling pathways [7]. Although this pathogen often causes meningitis and meningococcemia,

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meningococcal pneumonia is quite rare [8]. Of note, *N. meningitidis* cannot be distinguished from *Moraxella catarrhalis* (*M. catarrhalis*), one of the common causative pathogens of pneumonia, using Gram stain alone. From the standpoint of public health and patient management, the differential identification of these two pathogens is critical. Here, we describe an illustrative case of non-invasive meningococcal pneumonia, and compare the details of our case with other previous case reports in Japan and another previous review article.

2. Case report

A 43-year-old Japanese woman with bronchial asthma, type 2 diabetes mellitus, and schizophrenia visited our hospital complaining of a 3-day history of fever, productive cough, and shortness of breath. She had no history of traveling abroad and no recent contact with sick individuals. She exhibited no respiratory distress, and her vital signs were as follows: blood pressure was 110/68 mmHg, heart rate was 115/min, body temperature was 37.1 °C, respiratory rate was 21 breaths/min, and oxygen saturation was 98% in room air. The physical examination revealed no crackles or wheezes in the lungs. Laboratory data revealed a leukocyte count of 6900/mm^3 (neutrophil 50.4%, lymphocyte 41.7%), C-reactive protein level of 1.11 mg/dL, hemoglobin level of 11.9 g/dL, platelet count of 310,000/mm^3, urea nitrogen level of 7 mg/dL, creatinine level of 0.84 mg/dL, and serum glucose level of 195 mg/dL. Since her sputum smear predominantly revealed Gram-negative diplococci (Fig. 1) and a chest radiograph showed infiltration in the lower right lung field (Fig. 2), the initial diagnosis was pneumonia due to *M. catarrhalis*. She was prescribed cefcapene-pivoxil (CFPN-PI) and returned home, as her general condition was not severe.

However, the next day, the appearance of the sputum culture colonies was completely different from that of *M. catarrhalis* (Fig. 3). Due to prior suspicions that this pathogen might be *N. meningitidis*, the colonies were analyzed using matrix-assisted laser desorption/ionization time of flight mass spectrometry identifications (MALDI-TOF MS) generated via the VITEK MS system (v2.0, bioMérieux, Durham, NC). Results promptly identified *N. meningitidis* on the same day. This patient was diagnosed as meningococcal pneumonia because Gram-negative diplococcus was predominant in the sputum smear and no other bacteria except for *N. meningitidis* were cultured from her sputum.

In response to this result, oral CFPN-PI was switched to intravenous ceftriaxone (CTRX) upon hospitalization. Since she had a severe cough and close contact with family and health-care workers, we decided to implement infection control procedures, such as isolation of the patient and droplet precautions. In addition, prophylaxis was administered in the form of rifampicin or ciprofloxacin and was prescribed to 26 individuals who had close contact with the patient: her husband and son, 7 attending physicians, 12 nurses, 3 laboratory technicians, and 2 radiological technicians. No secondary infections occurred.

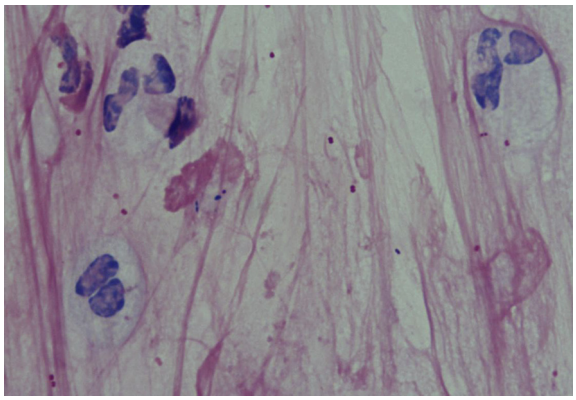

Fig. 1. Sputum smear for case patient. Photomicrographs of a Gram-stained sputum specimen showed Gram-negative diplococci which were indistinguishable from *Moraxella catarrhalis* (magnification; ×1000). The sputum was graded as P3 by the Miller and Jones sputum classification.

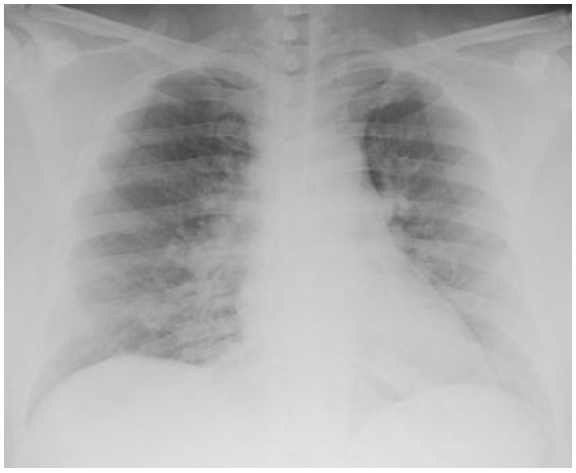

Fig. 2. Chest X-ray on admission. Infiltration was observed in the lower right lung field.

Subsequently, two sets of blood cultures performed on admission yielded negative findings. CSF was not evaluated because her mental status was normal and meningeal signs and symptoms were not observed. The identification result obtained using MALDI-TOF MS was confirmed with biochemical testing using the automated VITEC®2 system (bioMérieux, Lyon, France) on the following day. Those results also indicated that the pathogen was *N. meningitidis*. Antimicrobial susceptibility testing revealed the minimum inhibitory concentrations of penicillin and levofloxacin (LVFX) to be < 0.063 μg/mL and <1 μg/mL, respectively. Frequent administration of antibiotics was intolerable for this patient because of her schizophrenia; therefore CTRX was switched to oral LVFX following the results of drug sensitivity testing. The patient was treated with antibiotics for 7 days in total, and no recurrence occurred. Afterwards, the serogroup of *N. meningitidis* isolated in the present case was identified as Y or W-135 based on the agglutination test. The source of infection could not be determined.

3. Discussion

Since *N. meningitidis* is not a common cause of community-acquired pneumonia (CAP), this case was initially misdiagnosed as pneumonia due to *M. catarrhalis*. Both bacteria are Gram-negative, coffee bean shaped diplococci, and it is usually difficult to distinguish them using the Gram stain alone [9]. However, during bacterial culture, the characteristics of each colony are completely different. *N. meningitidis* colonies appear grey and unpigmented on chocolate agar, and their surfaces are smooth, round, and convex with a clearly defined edge. On the other hand, *M. catarrhalis* colonies are generally gray to white, and opaque, with a smooth surface on the agar, as shown in Fig. 3. Physicians should consider the possibility of *N. meningitidis* when Gram-negative diplococci are observed in the smears of respiratory samples, and coordinate with the laboratory staff to check the appearance of growing colonies on the agar plate.