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Short report

Fulminant septic shock due to community-acquired pneumonia caused by *Legionella pneumophila* SG1 Olda OLDA ST1. Case report

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ABSTRACT

Legionellers' desease accounts for 1–8 % of cases of severe community-acquired pneumonia (CAP). *Legionella* spp. Is the causative organism that can result in respiratory failure, multi-organ dysfunction, sepsis, and death. Therefore, rapid diagnosis and efficient treatment are crucial. We report the clinical and microbiology study of a patient with community-acquired pneumonia caused by *Legionella pneumophila*, with fatal outcome. After death, the strain causing the infection was identified as *Legionella pneumophila* serogroup 1, Olda OLDA phenotype and sequence-type 1. This is the first reported case of septic shock and death associated with an isolate of these characteristics.

Introduction

Legionnaires' disease (LD) accounts for 1–8 % of severe community-acquired pneumonia (CAP) [1,2]. *Legionella spp.*, the causative organism, can lead to respiratory failure, multi-organ dysfunction, sepsis and death, so rapid diagnosis and fast and efficient treatment are critical. However, it is crucial to consider the risk factors associated with the patient, as almost any strain of Legionella could be potentially harmful, particularly in vulnerable populations such as the elderly, oncology patients, and immunocompromised patients.

Lpne can be classified by immunological detection with monoclonal antibodies of the Dresden panels [3]. It is already known that the most virulent isolates of *Lpne* SG1 have been associated with the Pontiac group (MAb3/1 positive), whereas the Olda group is the most frequent isolate of environmental sources [4,5]. We report here the case of a patient who died 72 h after admission to the emergency department (ED) due to septic shock caused by CAP resulting from *Legionella pneumophila* serogroup 1 Olda OLDA sequence type 1 (ST1) infection. We present the case according to the CARE recommendations [6].

Case report

Upon arrival at the emergency department, a 78-year-old male with type 2 diabetes mellitus, a history of tobacco use, chronic kidney disease, and a recent diagnosis of high-grade CD 20+ follicular lymphoma, stage IV, presented with dyspnoea and fever. The patient had experienced repeated episodes of bronchoaspiration due to gastric and oesophageal lymphatic compression.

His condition worsened in a few hours leading up to their admission to the ED. At the time of arrival, the patient was stuporous, febrile, blood pressure of 126/59 mmHg, heart rate of 140 bpm, and O_2 saturation of 88 % with FIO_2 100 %. Initial blood tests revealed elevated acute phase reactants (CRP 400 mg/L and procalcitonin 20 ng/mL). A chest radiograph displayed condensation in the right lower lung lobe and bilateral effusion (Fig. 1). Clinical samples were collected to diagnose CAP. Empirical treatment with amoxicillin/clavulanic acid was initiated based on the primary clinical suspicion of a new episode of bronchoaspiration. Non-invasive mechanical ventilation (NIV) was necessary, with early failure, the patient was transferred to the intensive care unit (ICU).

The lung ultrasound revealed extensive consolidation in the base of the right lung with bilateral pleural effusion. A drainage thoracostomy was performed, and serohematous fluid was obtained for microbiological investigation.

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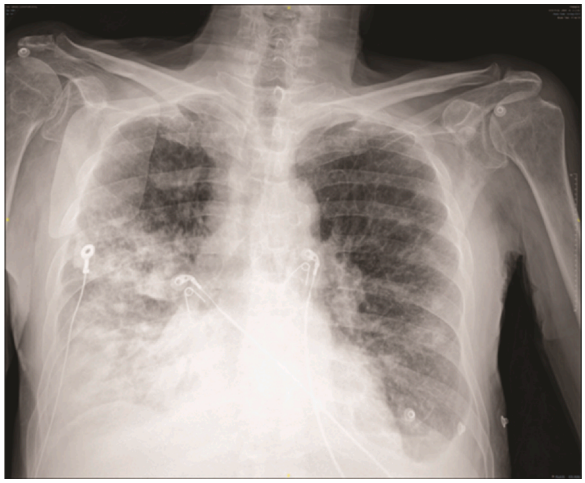

Fig. 1. Shows the chest x-ray taken upon the patient's admission to the Emergency Department.

Upon admission to the ICU, sedoanalgesia and protective mechanical ventilation were required. Bronchoaspirate specimens were cultured, and treatment was optimized with balanced crystalloids and vasoactive support. Empirical antibiotic therapy was extended to include cotrimoxazole, meropenem, amikacin, linezolid, and isavuconazole while awaiting microbiological results.

Positive UAT for *Legionella* was reported 5 h after admission. Treatment was promptly initiated with levofloxacin (500 mg/12 h iv), azithromycin (500 mg/24 h) and rifampicin (600 mg/24 h), adjusted for an estimated creatinine Cl l < 30 mL/min, and dosage of antibiotics were adjusted to RRT as the situation evolved.

However, the patient's condition deteriorated in the following hours, leading to acute renal failure and metabolic acidosis with hyperlactacidemia. Renal replacement therapy was required. The patient's analytical data showed a worsening of the infection, including leucopenia (3.5×10^3/µL), creatinine at 2.62 mg/dL, urea at 181 mg/dl, total bilirubin at 3.2 mg/dL, ultrasensitive procalcitonin at 148 ng/mL, C-reactive protein at 501.8 mg/mL, arterial pH at 7.19, and arterial lactate at 3.3 mmol/dL.

Despite the established measures, he experienced multi-organ failure, including haemodynamic, renal, and respiratory distress syndrome with persistent hypoxaemia. Attempts were made to improve his condition with cisatracurium perfusion and prone decubitus ventilation, but they were unsuccessful and died 72 h after admission.

The molecular microbiology panel based on PCR technique (BIOFIRE FILMARRAY® Pneumonia Plus) was only positive for *Lpne,* confirming the previous *Lpne* results from UAT. Other microbiological results were negative (blood, pleural fluid and fungal cultures; detection of *Mycobacterium tuberculosis* by direct complex PCR of DNA and detection of mycobacteria by acid-fast bacilli testing).

A specimen of a bronchial aspirate was received at the Legionella Reference Laboratory. The isolate was sub-cultured and confirmed to be *Lpne* SG1.

Phenotypic characterization of SG1 was performed by immunoaglutination (Legionella latex test kit, Oxoid, UK) and confirmed using monoclonal antibodies (MAb) Lp1 [3]. Additionally, the OLDA subgroup was described (MAb 3/1 negative, MAb 8/4 positive, MAb 26/1 positive). This resulted in *Lpne* SG1 Olda OLDA being identified as the bacteria responsible for the patient's disease.

Genotypic characterization was performed by Sequence-Based Typing (SBT) according to the ESGLI protocol [7]. The ST was obtained from the ESGLI Legionella SBT database, and the allelic profile corresponding to ST1 was obtained.

Review of cases identified in our laboratory in the period 2004–2022

Since 1983, the Legionella Reference Laboratory (CNM-ISCIII) in Spain has received samples from hospitals and public health laboratories throughout the country. Between 2004 and 2022, 843 *Lpne* SG1 were isolated from human samples, of which 116 belonged to the Olda group (13.7 %). Out of the 116 patients infected with the identified Olda group bacteria, 12 died (10.3 %). The patients who died were characterised phenotypically and genotypically. Of the 12 cases, 10 belonged to the OLDA subgroup ST1. In addition, ST1 was the most frequently found in clinical samples, mainly in the Pontiac Philadelphia subgroup (n = 52).

Discussion

A study conducted in Spain found that 85 % of patients with community-associated LD were hospitalized, with 11.7 % requiring intensive care, and a mortality rate of 4.4 % [8]. Empirical antibiotic treatment may not be effective against *Lpne* and disease progression could result in a fatal outcome. Early diagnosis of LD is crucial for effective treatment. Therefore, it is important to base the diagnosis on UAT results and the patient's clinical manifestation, particularly any impairment of consciousness. The fatal course of this patient may have been influenced by the severity of his condition and the immunosuppressive treatment, and also by the initial antibiotic approach, which was adjusted to the most likely clinical scenario and did not include coverage for Lpne. Prompt administration of the correct antibiotic treatment is essential to avoid fatal decline in the patient's health. Current guidelines recommend routine testing for urinary antigen in adults with severe CAP [9].

CAP in LD is mainly associated with the Pontiac group, which has the highest virulence in clinical samples. In contrast, the Olda group is the most common phenotype in environmental samples [4,5]. ST1 was the most frequently occurring genotype among P*hiladelphia* subgroup of clinical isolates [10] as well as OLDA subgroup in the environmental isolated.

Among the clinical isolates of the Philadelphia subgroup [10] and the environmental isolates of the OLDA subgroup, ST1 was the most frequently occurring genotype. Therefore, LD caused by bacteria of the Olda group is uncommon, as observed in only 13.7 % of the samples received at the Legionella Reference Laboratory.

We present the first fulminant sepsis shock reported case associated with *Lpne* SG1 Olda OLDA ST1, although available laboratory data suggest that this is not an isolated case, albeit rare. This case highlights the importance of obtaining fully characterised clinical isolates. The availability of these fully characterised isolates will provide essential information for effective epidemiological surveillance. In the future, widespread studies on whole genome sequencing (WGS) may shed more light on the global epidemiology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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