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Case Report Open Access

End-Stage Renal Patient Treated by ECMO and SLED in Legionnaires' Disease

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Abstract

Legionnaires' disease is an important cause of community-acquired pneumonia. Although uncommon, disease outbreaks of public health significance still happen nowadays. Several outbreaks have been occurred in various European countries but the most recent one occurred in Portugal. It was one of the largest of the world and began in November 2014 in Lisbon. We know that mortality might be higher in people who have pre-existing medical conditions. The chronic kidney disease population is predisposed to adverse infectious events but it's not considered up to this moment a main risk factor or of bad prognostic to the Legionella infection. The authors present a case report of a sporadic smoker young patient with chronic kidney disease who had a catastrophic presentation of *Legionella pneumophila* infection requiring simultaneous use of two extracorporeal techniques.

Keywords: Chronic kidney disease; Disease outbreaks; Extracorporeal membrane oxygenation; Legionella; Sustained low-efficiency dialysis

Introduction

Legionnaires' disease (LD) may be a severe systemic illness caused by an aerobic gram negative bacillus, *Legionella pneumophila* (LP), involving multiple organs, principally in the respiratory tract. The global incidence of LD is therefore difficult to quantify. Data from studies in Europe suggest that 2–5% of cases of community-acquired pneumonia are actually LD, which is around ten times higher than reports received through even the best national surveillance systems [1,2]. Most cases occur in older people and predominantly in men [3-9]. Although most cases of LD occur sporadically, clusters warranting investigation and point source outbreaks can occur, sometimes with substantial implications for public health. Any source of aerosol generation has the potential to transmit *Legionella spp* [10,11]. In the outbreak occurred in November 2014 in Vila Franca de Xira, Lisbon, Portugal, one of the world's largest – 375 cases, it was found that the strain of bacteria isolated from a cooling tower in a local factory was the same strain that was identified in the bronchial secretions of patients. The recent major outbreaks emphasize the need for further research to support early diagnosis and improve clinical or outbreak management [12,13].

The main risk factors for acquiring LD are smoking, older age, chronic cardiovascular or respiratory disease, diabetes, alcohol misuse, cancer (especially profound monocytopenia as seen in hairy cell leukaemia), and immunosuppression [14-17]. No known risk factors identified in some cases (28% in a recently published series) [18].The chronic kidney disease (CKD) population is predisposed to adverse infectious events but it's not considered up to this moment a main risk factor or a bad prognostic to the Legionella infection [19,20].

Generically, the mortality rate of 8–12% is typical, but some studies have shown that this rate can change according to different populations [20]. Some advances regarding secondary complications due to these infections have been made including extracorporeal membrane oxygenation (ECMO). This is an extracorporeal circuit intended to oxygenate blood and remove carbon dioxide, ensuring a systemic perfusion of oxygenated blood as a rescue therapy in patients already ventilated under protective ventilation strategy [21]. Although this technique exists since 1971, the latest advances in technology have improved the risk-benefit profile [22]. It is available in Portugal since 2009.

The ECMO is indicated for acute respiratory failure associated with severe ARDS and pneumonia non-respondent to recruitment manoeuvres. According to data from 2013 Extracorporeal Life Support Organization (ELSO) conference, the number of patients undergoing ECMO for respiratory failure was 3761 with an ECMO survival rate of 64% and a survival rate of 55% at discharge [23-25]. The complications of this technique relates mainly to the risk of anticoagulation-induced bleeding. The failure of the oxygenator and thrombus formation are other common complications [26]. The association with other extracorporeal techniques is scarce in the literature.

Case Report

The authors present a 31 years old male patient resident in Vila Franca de Xira, smoker (4 pack units year), with stage 5 chronic kidney disease (CKD) of unknown etiology, admitted in a multi-purpose intensive Care Unit (ICU) with the diagnosis of hypoxic pneumonia to LP serogroup 1 (positive antigenuria). In the initial assessment, the patient underwent thorax computed axial tomography that highlighted a number of areas of consolidation and bilateral ground glass opacities translating a pneumonic process (Figure 1). The thoracic echography didn't highlight any signs of fluid overload. Antibiotherapy with levofloxacin and azithromycin was maintained, while conventional hemodialysis (cHD) was started due to important nitrogen product retention. In a few hours, the patient became refractory to conventional invasive ventilation and was chosen for ECMO with maintenance of

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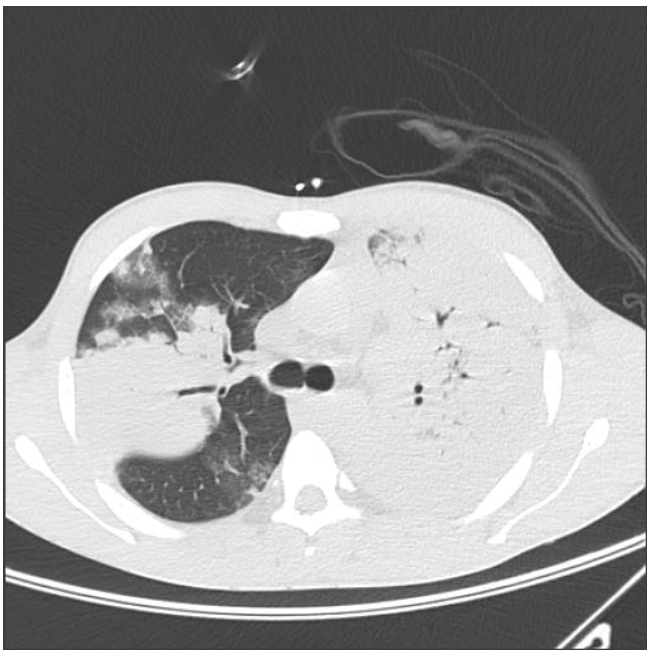

Figure 1: Anexo. Thorax CT cutting image showing severe pulmonary condensation on the left lung and moderate affection of the right lung, with no evidence of pulmonary congestion.

protective ventilation. The patient was maintained in conventional dialysis. On the 4th day of ECMO some objective signals of the water overcharge were verified. It was necessary to switch cHD to Sustained Low-Efficiency Dialysis (SLED) thus maintaining two techniques of extracorporeal circulation simultaneously for 7 hours a day. The use of vasopressor wasn't necessary. A gradual clinical improvement was registered, which led to the suspension of the ECMO technique at day 7. At day 8 he was extubated and was also able to tolerate cHD.

Discussion

Although many people are exposed to *Legionella spp.*, very few develop Legionnaires' disease and in many cases no known risk factor is identified. This suggests that there is still much to discover in LD. The identification of high mortality risk groups could increase practitioner awareness and contribute to its reduction. Specifically, prospective LD studies, comparing different severity of illness scores, should be performed in this field [18]. The severity of the disease is often determined by the patient's immunocompetency as well as the timeliness of appropriate antibiotic treatment. Patients admitted in the ICU for severe *Legionella* pneumonia have a mortality rate of 33% [19,27].

Dominguez et al. [20] in a study developed to determine the characteristics and factors associated with the case fatality rate (CFR) of LD outbreak in Catalonia, Spain, showed that mortality might be higher in people who were elderly, had cancer, corticosteroid treatment and smoke. Dialysis, immunosuppressive disease and delay in diagnosis or treatment of their disease were not associated with the CFR. CKD patients not dependent on dialysis have not been addressed. El-Ebiary et al. [19] in a univariate analysis study developed to investigate the ICU mortality and prognosis factors in LD showed that cardiac disease, diabetes mellitus, creatinine > 1.8 mg/dl, septic shock, chest X-ray extension, mechanical ventilation, hyponatremia < 136 mEq/L, PACO2/FIO2 < 130, and blood urea levels > 30 mg/dl were factors related to poor outcome. Chronic renal failure was evaluated and was not suggested to be a prognostic factor influencing the outcome.

Renal involvement is a well-described complication of this disease and when identified is considered a poor prognostic factor. Another issue is if chronic kidney disease independently may have a predisposition to infection by the agent as well as the outcome of the disease. It is a subject that has been little explored in the literature. Other bibliographic sources report that chronic disease and immunosuppressive diseases may represent risk factors [28,29]. CKD can be included in one or other classification but has not been highlighted.

It is important to realize that infectious diseases are the second most common cause of death in end-stage renal disease (ESRD) patients. Patients with CKD are immunocompromised and present impaired cell-mediated and humoral immunity. CKD is considered an immunocompromised state, given that T-cell, B-cell, and monocyte/macrophage function are all diminished [8]. T-cell activation and proliferation are depressed, lymphokine production and antibody-dependent cell-mediated cytotoxicity are reduced, and there is increased suppressor cell activity, among other abnormalities. In addition to a decreased immune response, patients with CKD also have a greater predisposition to infections by other ways: they have a deficient mucocutaneous barrier and poor mucociliary and alveolar macrophage clearance. Pulmonary infections decisively contribute to morbidity and mortality in immunocompromised patients [30].

Studies speculate that ECMO is most successful if started when the patients are in the early stages of a precipitous decline, reducing the damage from ventilator-induced lung injury [31]. Based on this principle we started early ECMO.

Conclusions

The authors report a serious manifestation of infection in a young man with soft tobacco use. Although we are just describing a case study, some important questions arise, namely if CKD can be an independent risk factor and worse prognosis for Legionella infection. LD can be more aggressive in this group of patients, may justifying a particular attention and earlier start of ECMO. The combination of extracorporeal techniques is also an issue which deserves a particular attention considering the increased risk of complications. Being CKD a fast emerging major public health problem in the 21st century, it is essential to be aware of the risks that this group infected with an important community-acquired pneumonia agent.

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