**RESEARCH PAPER**

# Legionnaires' Disease Complicated by Haemolysis, Disseminated Intravascular Coagulation, and Acute Respiratory Distress Syndrome: An Unusual and Severe Presentation

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**ABSTRACT**
Legionnaires' disease is a severe form of atypical pneumonia caused by Legionella pneumophila, often associated with significant morbidity and mortality. While pulmonary involvement is well recognized, extrapulmonary manifestations such as haemolysis and disseminated intravascular coagulation are rare and poorly documented. We report a case of a 38-year-old female with no prior comorbidities who presented with high-grade fever, productive cough, breathlessness, and altered mental status. Investigations confirmed Legionella pneumophila infection. The patient rapidly progressed to severe acute respiratory distress syndrome requiring mechanical ventilation. During the intensive care course, she developed intravascular haemolysis and overt disseminated intravascular coagulation, evidenced by characteristic laboratory abnormalities. Despite targeted antimicrobial therapy and aggressive supportive management, the clinical course was complicated by progressive multiorgan dysfunction. This case highlights a rare and severe presentation of Legionnaires' disease with concurrent haemolysis, DIC, and ARDS. Early recognition of such atypical manifestations and prompt multidisciplinary management are crucial to improve outcomes.

**Keywords:** Legionnaires' disease, haemolysis, disseminated intravascular coagulation, acute respiratory distress syndrome

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## INTRODUCTION

Legionnaires' disease is a severe and potentially life-threatening form of atypical pneumonia caused predominantly by *Legionella pneumophila*, a Gram-negative intracellular bacterium commonly found in aquatic environments and man-made water systems [1,2]. Since its first identification following the 1976 outbreak in Philadelphia, the incidence of Legionnaires' disease has steadily increased worldwide, attributed to improved diagnostic techniques, aging populations, and a rise in immunocompromised individuals [1,3]. Although it accounts for a relatively small proportion of community-acquired pneumonia (CAP), Legionnaires' disease is disproportionately associated with severe clinical presentations requiring intensive care unit (ICU) admission and carries a high mortality rate ranging from 4% to 40% in critically ill patients [1,4].

The pathogenesis of Legionella infection involves inhalation of contaminated aerosols, followed by intracellular replication within alveolar macrophages, leading to a robust inflammatory response and extensive pulmonary injury [2,5]. This exaggerated immune response contributes to diffuse alveolar damage, which in severe cases may progress to acute respiratory distress syndrome (ARDS), a complication associated with significant morbidity and prolonged ICU stay [4,6]. Studies have demonstrated that Legionella pneumonia is among the leading infectious causes of severe CAP necessitating mechanical ventilation and advanced supportive care [1].

In addition to pulmonary involvement, Legionnaires' disease is increasingly recognized as a multisystem disorder with extrapulmonary manifestations affecting renal, hepatic, neurological, and hematological systems [5,7]. Rare but clinically significant complications include

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rhabdomyolysis, acute kidney injury, and electrolyte disturbances, reflecting the systemic inflammatory and toxic effects of the organism [7]. Hematological abnormalities, although less commonly described, may include hemolysis and coagulopathy, which can further complicate the clinical course and worsen prognosis.

Disseminated intravascular coagulation (DIC) is an uncommon but severe complication associated with overwhelming infection and sepsis, characterized by widespread activation of the coagulation cascade, leading to both thrombosis and bleeding tendencies [8]. In the context of Legionella infection, DIC likely results from a combination of endotoxin-mediated endothelial injury and cytokine-driven systemic inflammation [8,9]. Similarly, hemolysis in infectious diseases may arise due to direct microbial effects, immune-mediated destruction of red blood cells, or microangiopathic processes, further contributing to anemia and organ dysfunction.

The coexistence of Legionnaires' disease with hemolysis, DIC, and ARDS represents an exceptionally rare and severe clinical presentation, reflecting a fulminant systemic inflammatory response with multi-organ involvement. Such cases pose significant diagnostic and therapeutic challenges, often requiring early recognition, aggressive supportive management, and targeted antimicrobial therapy to improve outcomes [1,6,9]. Despite advances in diagnostic modalities such as urinary antigen testing and molecular techniques, delayed diagnosis remains a concern due to the nonspecific clinical presentation and overlap with other causes of severe pneumonia [1,3].

Given the rarity and clinical severity of this constellation of complications, reporting such cases is crucial to enhance understanding of the disease spectrum, guide early recognition, and optimize management strategies. This case highlights an unusual and life-threatening presentation of Legionnaires' disease complicated by hemolysis, disseminated intravascular coagulation, and acute respiratory distress syndrome.

**Case Report**

Legionnaires' disease is typically characterized by severe atypical pneumonia; however, its presentation with concomitant hematological and coagulation abnormalities is exceedingly rare. The following case illustrates an unusual and fulminant clinical course of *Legionella pneumophila* infection complicated by intravascular haemolysis, disseminated intravascular coagulation, and acute respiratory distress syndrome, highlighting the potential for multisystem involvement and rapid clinical deterioration.

**Patient Information and Clinical Presentation**

A 38-year-old female with no known comorbidities presented with a short history of high-grade fever, productive cough, progressively worsening breathlessness, and altered mental status. There was no history of recent hospitalization, travel, blood transfusion, or exposure to environmental or occupational toxins.

On admission, the patient was febrile, tachycardic, hypotensive, and hypoxemic, requiring supplemental oxygen. Respiratory examination revealed bilateral diffuse crackles on auscultation.

**Initial Investigations**

Laboratory investigations demonstrated leukocytosis with markedly elevated inflammatory markers. Significant biochemical abnormalities included hyponatremia (serum sodium: 124 mEq/L) and acute kidney injury (serum creatinine: 2.1 mg/dL).

Chest radiography showed bilateral scattered alveolar opacities, suggestive of diffuse pulmonary involvement (Image 1).

**Diagnosis and Clinical Course**

Microbiological evaluation of sputum identified *Legionella pneumophila*, confirming the diagnosis of Legionnaires' disease. Blood cultures remained sterile.

The patient was started on appropriate antimicrobial therapy with intravenous levofloxacin along with supportive management. Despite early targeted treatment, her respiratory status deteriorated rapidly, fulfilling the Berlin criteria for severe acute respiratory distress syndrome (ARDS), necessitating invasive mechanical ventilation. Diagnostic bronchoscopy was performed to exclude alternative diagnoses such as miliary tuberculosis or coexisting infections.

**Hematological and Coagulation Complications**

During the intensive care stay, a progressive decline in haemoglobin levels was observed. Further laboratory evaluation revealed elevated lactate dehydrogenase (1200 U/L), indirect hyperbilirubinemia (2.82 mg/dL), reduced serum haptoglobin, and the presence of fragmented red blood cells on peripheral smear, consistent with intravascular haemolysis.

Simultaneously, the patient developed thrombocytopenia (platelet count: 86,000/mm$^3$), significant prolongation of coagulation parameters (INR: 5.51), elevated D-dimer levels (1850 ng/mL), and hypofibrinogenemia (110 mg/dL), fulfilling the diagnostic criteria for overt disseminated intravascular coagulation (DIC).

**Management and Outcome**

The patient was managed in the intensive care unit with lung-protective ventilation strategies, vasopressor support for hemodynamic instability, renal replacement therapy as required, and blood component transfusions for correction of coagulopathy.

Despite aggressive and comprehensive supportive care, the clinical course was marked by progressive multiorgan dysfunction, reflecting the severity of the disease process.

**DISCUSSION**

Legionnaires' disease is well recognized as a cause of severe atypical pneumonia; however, its presentation with concurrent haemolysis and disseminated intravascular coagulation (DIC) remains exceedingly rare and poorly

described in literature. The present case highlights a fulminant systemic manifestation of *Legionella pneumophila* infection, characterized by rapid progression to acute respiratory distress syndrome (ARDS) accompanied by significant hematological derangements. Such atypical presentations often pose diagnostic challenges and may contribute to delayed recognition and adverse outcomes.

The progression to severe ARDS in this patient reflects the intense inflammatory response induced by *Legionella* infection. Previous studies have demonstrated that *Legionella pneumophila* can trigger a robust cytokine-mediated immune response, leading to diffuse alveolar damage, increased vascular permeability, and hypoxemic respiratory failure requiring mechanical ventilation [11]. The Berlin criteria-defined ARDS in this case underscores the aggressive pulmonary involvement that may occur even in previously healthy individuals, emphasizing the need for early suspicion and prompt supportive care.

Extrapulmonary manifestations of Legionnaires' disease, although increasingly recognized, remain underreported. Hematological complications such as haemolysis are particularly rare. The intravascular haemolysis observed in this patient, evidenced by elevated lactate dehydrogenase, indirect hyperbilirubinemia, reduced haptoglobin, and schistocytes on peripheral smear, suggests a microangiopathic process likely triggered by systemic inflammation and endothelial injury [12]. Similar observations have been reported in severe infections where inflammatory mediators and oxidative stress contribute to red blood cell destruction.

The development of disseminated intravascular coagulation further complicates the clinical course and is indicative of severe systemic involvement. Sepsis-induced coagulopathy is characterized by widespread activation of coagulation pathways, consumption of clotting factors, and secondary fibrinolysis, leading to both thrombotic and hemorrhagic complications [13]. In the present case, thrombocytopenia, elevated D-dimer levels, prolonged INR, and hypofibrinogenemia fulfilled the diagnostic criteria for overt DIC, reflecting advanced disease severity. Endothelial dysfunction and cytokine storm associated with severe infections such as Legionella are key contributors to this pathological process.

The coexistence of haemolysis and DIC suggests a shared underlying mechanism involving endothelial injury, microvascular thrombosis, and dysregulated immune response. Such a combination is rarely described in Legionnaires' disease and indicates a severe form of systemic inflammatory response syndrome (SIRS) with multiorgan involvement [14]. Early identification of these complications is crucial, as they are associated with increased morbidity and mortality.

Despite timely initiation of appropriate antimicrobial therapy with levofloxacin, the patient experienced rapid clinical deterioration, highlighting that antibiotic therapy alone may not prevent progression in severe cases. This underscores the importance of aggressive supportive management, including lung-protective ventilation, hemodynamic stabilization, renal support, and correction of coagulopathy [15]. Furthermore, this case reinforces the need for clinicians to maintain a high index of suspicion for atypical and severe manifestations of Legionnaires' disease, particularly in patients presenting with unexplained hematological abnormalities.

## CONCLUSION

This case illustrates an unusual and severe presentation of Legionnaires' disease complicated by intravascular haemolysis, disseminated intravascular coagulation, and acute respiratory distress syndrome. The concurrence of these life-threatening complications highlights the potential for extensive multisystem involvement in *Legionella pneumophila* infection. Early recognition, prompt initiation of targeted antimicrobial therapy, and aggressive supportive care are essential to improve clinical outcomes. Reporting such rare presentations is vital to enhance clinical awareness and guide timely diagnosis and management in critically ill patients.

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