

Invasive *Salmonella enterica* serovar *Enteritidis* Causing a Respiratory Infection: A Rare Presentation

Salmonella enterica serovar *Enteritidis* Invasiva Causando uma Infecção Respiratória: Uma Rara Apresentação

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Abstract:

Salmonella enterica serovar *Enteritidis* is a well-recognized enteric pathogen, yet its involvement in pulmonary infections, particularly with isolation from pleural fluid, remains rare. This case illustrates an uncommon presentation of invasive salmonellosis as community-acquired pneumonia with bilateral pleural effusion and bacteraemia.

We report a case of an eighty-six-year-old male admitted with prostration. On evaluation, he was afebrile and showed partial respiratory insufficiency. Chest radiography revealed bilateral pleural effusion. Analysis of pleural fluid was compatible with exudative effusion, and cultures yielded *Salmonella enterica*, which was also isolated from blood cultures. There was no history of recent gastrointestinal symptoms or epidemiological risk factors.

This case highlights a rare but clinically significant manifestation of invasive salmonellosis. Invasive salmonellosis may present with an atypical extraintestinal involvement, such as a pneumonia with a pleural effusion. Early recognition and targeted antibiotic therapy are key to improving individual and general outcomes in a vulnerable population.

Keywords: Respiratory Tract Infections; *Salmonella enterica*; *Salmonella* Infections.

Resumo:

Salmonella enterica serovar *Enteritidis* é um agente entérico amplamente reconhecido, mas o seu envolvimento em infeções pulmonares, particularmente com isolamento do líquido pleural, permanece raro. Este caso ilustra uma apresentação incomum de salmonelose invasiva, manifestando-se como pneumonia adquirida na comunidade com derrame pleural bilateral e bacteriemia.

Relata-se o caso de um homem de oitenta e seis anos admitido por prostração. À avaliação inicial, encontrava-se apirético, com insuficiência respiratória parcial. A radiografia torácica revelou derrame pleural bilateral. A análise do líquido

pleural foi compatível com exsudado, tendo as culturas identificado *Salmonella enterica*, também isolada em hemoculturas. O doente não apresentava antecedentes de sintomas gastrointestinais recentes nem fatores epidemiológicos de risco.

Este caso evidencia uma manifestação rara, mas clinicamente relevante da salmonelose invasiva. A forma invasiva pode apresentar envolvimento extraintestinal atípico, como pneumonia com derrame pleural. O reconhecimento precoce e uma antibioterapia dirigida são essenciais para melhorar os resultados individuais e de saúde pública nesta população vulnerável.

Palavras-chave: Infecções Respiratórias; Infecções por *Salmonella*; *Salmonella enterica*.

Learning Points

1. Clinicians should maintain a high index of suspicion for atypical pathogens like *Salmonella* in patients with pneumonia and pleural effusion, especially in immunocompromised patients or those with underlying structural lung disease.
2. Although rare, pulmonary involvement in *Salmonella* infections is associated with a bad prognosis and a high mortality rate.
3. Pleural effusion is a frequent feature among reported pulmonary *Salmonella* cases.
4. Given the potential public health implications, prompt notification and reporting to national surveillance systems are essential to ensure appropriate epidemiological investigation and outbreak detection.

Introduction

Salmonella enterica is a gram-negative, intracellular, non-spore-forming, facultative anaerobic bacilli, belonging to the *Enterobacteriaceae* family. It is commonly associated with self-limited gastroenteritis, characterized by diarrhoea, abdominal cramps, nausea, vomiting and fever.^{1,2} *S. enterica* successfully colonizes humans, animals and plants, and is a leading cause of morbidity and mortality in people worldwide, emerging as an invasive infection in industrialised countries, and posing a

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considerable threat to public health, worsened by the emergence of antimicrobial drug resistance.³⁻⁵

Invasive forms of salmonellosis can occur in up to 8% of the patients with non-typhoidal *Salmonella* infections, particularly affecting vulnerable populations such as the elderly, children and individuals with specific predisposing conditions. These include patients with impaired cellular immunity, notably those living with HIV infection or undergoing treatment with systemic corticosteroids, as well as individuals with haematological conditions associated with haemolysis, such as sickle cell disease, other haemoglobinopathies, or malaria.⁶ These cases may lead to bacteraemia and extraintestinal dissemination, including endovascular arteritis, endocarditis, septic arthritis, osteomyelitis, urinary tract infection, and splenic abscess.^{1,7} Although development of a chronic carrier state is rare, occurring in less than 1% of the patients, these invasive complications underscore the importance of early recognition and appropriate management in high-risk groups.⁸

Pulmonary manifestations are rare, with few cases reported in the literature, and the isolation of *Salmonella* in pleural effusions is exceedingly uncommon.¹ Many factors may contribute to the development of a pulmonary infection, such as lung cancer, radiotherapy and prolonged administration of corticosteroids.⁹ Antimicrobial therapy is required for a successful resolution of the infection.³

We aim to report a rare case of an invasive *Salmonella enterica* serovar *Enteritidis* (non-typhi) infection, presenting as a community-acquired pneumonia complicated with pleural effusion and bacteraemia in an elderly male patient with multiple comorbidities. This case underlines the importance of considering *Salmonella* as a potential pathogen in atypical respiratory infections, especially in vulnerable populations.

Case Report

An 86-year-old male patient was admitted to the Emergency Department with a sudden onset of prostration (Glasgow Coma Scale 13), pallor, profuse diaphoresis and lower limb weakness beginning the previous day. The patient had no gastrointestinal symptoms such as diarrhoea or vomiting. His relevant medical history included hypertension, dyslipidemia, obesity, chronic kidney disease, major depressive disorder, Parkinsonism and heart failure with reduced ejection fraction (35%-40%) of ischemic aetiology. Chronic medication included bisoprolol, amiodarone, rivastigmine, levodopa/carbidopa, acetylsalicylic acid, diclofenac, rosuvastatin/ezetimibe and clonazepam.

Upon examination, the patient appeared prostrated and uncooperative. He was afebrile (36.4°C), with a blood pressure of 117/55 mmHg, heart rate of 68 bpm, and oxygen saturation of 91%-92% while receiving oxygen at 2 L/min via face mask. Auscultation revealed diminished breath sounds and bilateral crackles. The abdomen was soft, non-tender and depressible, and there were no signs of peripheral oedema.

Arterial blood gases showed a hypoxemic respiratory failure (PaO₂ 48.9 mmHg, SatO₂ 85.9%) and mild respiratory alkalosis (pH 7.532). Blood tests revealed leucocytosis (12.7 x 10⁹/L) with neutrophilia, C-reactive protein of 14.16 mg/dL, creatinine 1.34 mg/dL and an elevated NT-proBNP (> 35,000 pg/mL). Blood cultures were obtained.

Chest radiography demonstrated an enhanced cardiac index, with a fine appearance of bilateral pleural effusion, more pronounced on the left, with left basal hypotransparency. Empirical antibiotic therapy with amoxicillin/clavulanate (1.2 g every 8 hours) and azithromycin (500 mg once daily) was initiated upon admission, based on the working diagnosis of community-acquired pneumonia.

Upon transfer to our ward on the second day of hospitalization, the patient exhibited clinical deterioration, evidenced by oxygen desaturation to 86%, elevated inflammatory markers and progression of a left-sided pleural effusion on chest radiography (Fig. 1). Empirical antibiotic therapy was escalated to piperacillin-tazobactam (4.5 g every 8 hours), and ultrasound-guided thoracentesis yielded 1,400 mL of serofibrinous pleural fluid.

Following thoracentesis, early the next day, inflammatory markers took a downward trend (C-reactive protein: 21.76 to 9.06 mg/dL). Pleural fluid analysis revealed 4.1 g/dL of total proteins, LDH 284 U/L and glucose 133 mg/dL – suggesting exudate effusion. It also revealed a turbid appearance with 736 nucleated cells/μL, of which 727 were leukocytes, showing a 72% predominance of mononuclear cells. Biochemical analysis showed a pH of 7.318 and a glucose level of 100 mg/dL. This overall profile, despite confirming an inflammatory process, did not meet the typical criteria for empyema, suggesting non-purulent pleural involvement. Cytological examination excluded the presence of epithelial malignancy.

Later in that day, patient's clinical condition further deteriorated, with progressive respiratory failure in the setting of a presumed aspiration event and an underlying pulmonary infection. Despite appropriate therapeutic interventions, the condition remained refractory to treatment and culminated in the patient's death.

The day after the patient died, blood cultures and pleural fluid yielded *Salmonella enterica* serovar *Enteritidis* (non-typhi). The delay in microbiological identification was related to the occurrence of part of the incubation and processing period over the weekend. Antimicrobial susceptibility testing (AST) presented sensitivity to beta-lactams, including amoxicillin/clavulanate, third-generation cephalosporins such as ceftazidime and carbapenems, while showing resistance to fluoroquinolones and aminoglycosides.

No gastrointestinal source was identified, and the case was reported to public health authorities, although, after discussion with the family, no epidemiological context, recent travels or exposure could be established.

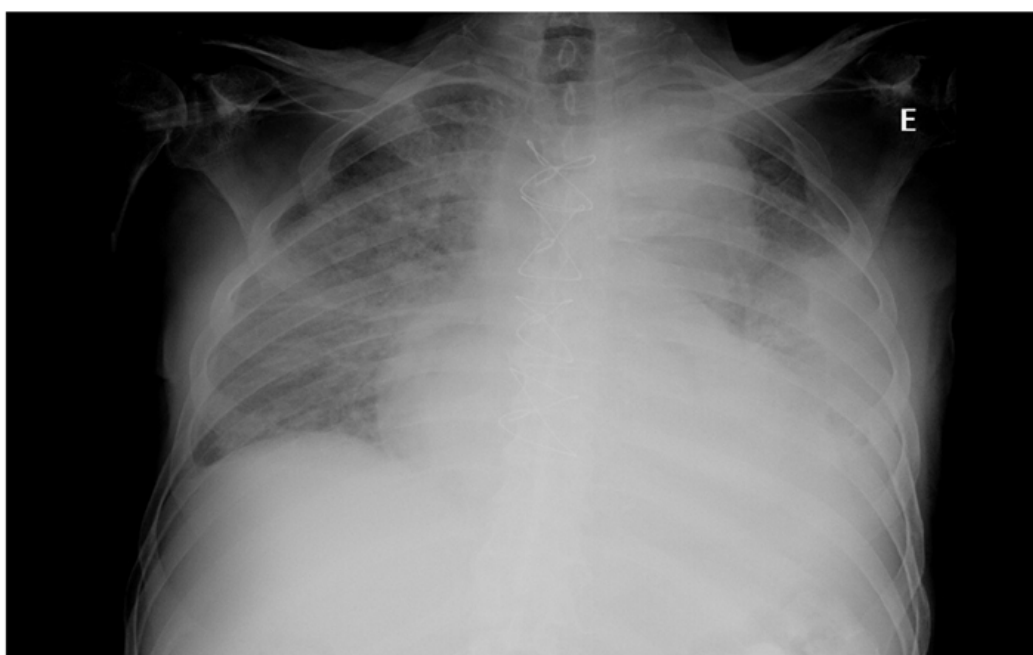


Figure 1: Chest radiography showing evidence of left-sided pleural effusion.

Discussion

Salmonella enterica serovar *Enteritidis* is a well-known cause of gastroenteritis with systemic dissemination. Pulmonary salmonellosis is usually associated with risk factors such as immunosuppression, malignancy, or structural lung disease, linking them to a high mortality rate among elderly individuals.⁹ In our case, despite an advanced age and comorbidities including chronic cardiovascular and neurological disease, there was no history of immunosuppression or exposure to typical sources of *Salmonella non-typhi*, and no gastrointestinal complaints. The absence of a clear epidemiological context, coupled with an unapparent respiratory presentation, posed a significant diagnostic challenge.

Initial management was aligned with standard protocols for community-acquired pneumonia, treating it with empiric coverage. However, clinical deterioration, persistently high inflammation markers and imaging findings highlighted a potential for an underlying invasive or disseminated infectious process. This approach was consistent with the PSI/PORT score, indicating a 27.0%-29.2% mortality risk, and a moderate mortality risk category according to the CURB-65 score.

The decision for collecting blood cultures was made to anticipate the investigation, due to his clinical deterioration and initial reserved prognosis. Blood cultures are not routinely recommended in complicated cases of community-acquired pneumonia, which may potentially delay the identification of atypical pathogens or extrapulmonary sources of infection when the clinical course deviates from the expected.

Although the delay in blood culture results did not influence the clinical outcome in this case, as the isolated strain was susceptible to the empirical antibiotic regimen, it highlights an

important limitation in the management of severe infections. Delays related to laboratory processing may postpone pathogen identification and antimicrobial susceptibility results, which, in other clinical scenarios, could result in inappropriate empirical therapy with significant prognostic implications. In this context, the implementation of rapid antimicrobial susceptibility testing (RAST) directly from positive blood cultures has emerged as a valuable tool in the management of severe infections.¹⁰ By significantly reducing the time to availability of susceptibility results, RAST has the potential to shorten the time to targeted antimicrobial therapy. In severe clinical presentations, such as the one described, earlier microbiological confirmation may support timely therapeutic decisions and provide greater diagnostic confidence during critical phases of patient management.

The isolation of *Salmonella enterica* serovar *Enteritidis* in both blood and pleural fluid cultures confirmed an invasive salmonellosis with direct pleuropulmonary involvement. Given the moderate cellularity and relatively benign biochemical profile of the pleural fluid, the findings were not compatible with empyema, supporting the notion that pleural involvement by *Salmonella* may present with non-purulent, subacute features.

The absence of atypical enteric manifestations and the lack of an identifiable source of infection reinforce the diagnostic challenge posed by such atypical presentations. While aspiration was initially considered, the chronology of events and culture data do not support this mechanism. Instead, a transient, asymptomatic bacteraemia with pulmonary seeding remains the most plausible hypothesis. This underscores the need for clinicians to maintain a high index of suspicion for atypical pathogen agents such as *Salmonella*, even when classical risk factors are absent.

Pulmonary manifestations of *Salmonella* remain rare and sparsely reported in medical literature. Many of the cases report pleural effusions associated with the pneumonia, which, by themselves, are associated with a worse prognosis, often indicating a severe or complicated infectious process.^{1,7}

When caused by *Salmonella*, the presence of a pleural effusion increases the risk of mortality even more, further underscoring the complexity of this rare presentation. In the review, we did not find any previously reported case in Portugal. Most of the cases involve patients with an underlying immunosuppression, although few were described in immunocompetent individuals, like our patient.^{2,5,11} Notably, many of the immunocompromised patients presented with pre-existing pulmonary abnormalities, which may have served as a foundation for such a severe infection.^{8,9}

This case involving an elderly patient with bilateral community-acquired pneumonia, where *Salmonella enterica* serovar *Enteritidis* was isolated both from blood cultures and pleural fluid, adds valuable clinical evidence due to this unusual presentation. From a public health perspective, such cases, although rare, may indicate an underrecognized transmission route or reservoir, and highlight the importance of thorough epidemiological investigation and reporting to national surveillance systems. ■

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CAJ, FF – Manuscript writing and revision.

MRC, MQ, LC – Manuscript review.

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