

Case Report

An Unusual Cause of Lung Abscess

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ABBREVIATIONS USED IN THIS ARTICLE

NTS = Non-typhoid *Salmonella*

TB = Tuberculosis

CBNAAT = Cartridge-based nucleic acid amplification test

MALDI-TOF = Matrix assisted laser desorption/ionization-time of flight mass spectrometry

HIV = Human immunodeficiency virus

Abstract

A 75-year-old male, with multiple co-morbidities including chronic obstructive pulmonary disease, type II diabetes mellitus and bronchogenic carcinoma, presented with lung abscess, and was detected to have *Salmonella entericaserovar* Anatum, non-typhoid *Salmonella* (NTS) infection. Treatment with appropriate antibiotics and source control by image-guided drainage showed rapid clinical improvement. *To the best of our knowledge*, this is the first case report of lung abscess caused by *Salmonella enterica* species serovar Anatum.

Introduction

Salmonella is a common enteric pathogen. Extra-pulmonary infections have been documented including bacteremia and localised infections. Pleuro-pulmonary complications due to non-typhoidal *Salmonella* (NTS) is rare. Risk factors for the development of the disease includes preceding gut infection, extremes of age, malignancy, diabetes, frequent use of oral steroids and proton pump inhibitors. We present an unusual case of salmonellosis, caused by *Salmonella entericaserovar* Anatum which improved with source control and treatment with appropriate antibiotics.

Case Report

A 75-year-old male, who quit smoking 10 years back, presented to our outpatient clinic with complaints of fever with rigor and chills and cough with purulent expectoration for two weeks. He had no associated headache, vomiting or urinary symptoms. He had a brief period of diarrhoea two weeks preceding the illness, which resolved spontaneously. There was a history of loss of appetite without any significant weight loss. He resided indoors mostly and there was no exposure to farming or significant history of travel. He had no past history of tuberculosis (TB) and close contact with TB patients. The comorbid illnesses included diabetes mellitus, hypertension, dyslipidaemia and coronary artery disease for which he had

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undergone angioplasty. He was also on treatment for chronic obstructive pulmonary disease with inhaled medications comprising of fluticasone propionate (inhaled corticosteroid), salmeterol (long-acting beta-2 agonist) and tiotropium (antimuscarinic agent) for the past five years. In 2016, he was diagnosed with adenocarcinoma lung. Mutation studies were negative for epidermal growth factor, anaplastic lymphoma kinase/oncogene or c-ros oncogene 1. The patient was given chemotherapy with carboplatin and pemetrexed, last cycle of chemotherapy was three months prior to the current presentation. The patient had a baseline breathlessness of Grade 2 on modified Medical Research Council scale; which worsened to grade 4, preceding hospitalisation.

Physical examination revealed a temperature of 101°F, heart rate of 106/min, regular in rhythm and blood pressure was 60/100 mm/Hg. He was tachypnoeic with a respiratory rate of 30 per minute, and oxygen saturation of 88% at room air. He did not have clubbing or peripheral enlarged lymph nodes. Rest of the examination was unremarkable. Auscultation of the chest revealed bilateral polyphonic rhonchi and coarse crepitations in the right infra-clavicular and mammary areas. Examination of other systems was unremarkable. Laboratory investigations revealed total leucocyte count of 8400/mm³ (polymorphs 86.7%, monocytes 6.6%, lymphocytes 6.5%, eosinophils 0.1%), haemoglobin 11 g/dL, C-reactive protein of 249 mg/L (normal 0 to 5 mg/L). HbA1c of 6.5%, serum creatinine 0.9 mg/dL, serum sodium 136 mEq/L and serum potassium 4.0 mEq/L. Chest radiograph (postero-anterior view) showed a cavity in the right upper and the mid zones with fluid, suggestive of lung abscess (Figure 1).

He was initiated on intravenous antibiotic (piperacillin-tazobactam) along with other measures like nebulisation with bronchodilators. Glycaemic status was controlled with rapid-acting insulin. Sputum smear for acid-fast bacilli and CBNAAT (cartridge-based nucleic acid amplification test) blood culture were done. Sputum culture grew Gram-negative bacilli which was later identified as *Salmonella* spp using MacConkey agar culture medium. There was colourless and transparent growth which did not alter the appearance of the medium (Figure 2). MALDI-TOF (Matrix assisted laser desorption/ionisation-time of flight mass spectrometry), done using a Microflex LT™, bench top mass spectrometer (Bruker Daltonics, Bremen, Germany) for serotype identification identified as *Salmonella entericaserovar* Anatum (Non-typhoid salmonella). It had a score value of 2.37 indicating high probability of accurate species



Figure 1. Chest radiograph (postero-anterior view) showing a cavity with an air-fluid level.



Figure 2. MacConkey Agar culture plates showing colourless transparent growth of *Salmonella*.

identification. On culture sensitivity, *Salmonella* was sensitive to ampicillin, ciprofloxacin, ceftriaxone, cotrimoxazole and chloramphenicol. Blood culture did not reveal any growth. Treatment now started with ceftriaxone and azithromycin and postural drainage of lung abscess was done. He continued to be febrile, and hence, for better source-control, underwent computed tomography guided aspiration of lung abscess and 200mL of thick pus was aspirated. Aspirate was sent for bacterial culture which again revealed it to be *Salmonella entericaserovar* Anatum.

As fever persisted and a residual collection in the abscess cavity, drainage of pus with pig-tail catheter was done. Post drainage, he remained afebrile and gradually improved and later the pig-tail drain was removed. He was discharged with an advice to continue antibiotic therapy with intravenous ceftriaxone and

oral cotrimoxazole. On follow-up, after four weeks of treatment, symptoms were resolved completely and chest radiograph showed a significant reduction in the size of abscess cavity with no fluid (Figure 3).



Figure 3. Post-treatment chest radiograph (postero-anterior view) showing significant reduction in the size of the abscess cavity and no fluid.

Discussion

Salmonella are gram-negative, facultative anaerobic bacilli, belonging to the family of *Enterobacteriaceae* and commonly cause gastroenteritis. The genus *Salmonella* is divided into two species, *Salmonella enterica* and *Salmonella bongori*. Further, this can be classified antigenically into one of more than 2500 serotypes (serovars), which are also helpful in outbreak situations to find the source. Most of the human pathogenic *Salmonella* serovars belong to the enteric species and *Salmonella entericaserovar* Anatum is one of them, belongs to NTS. The main colonisation of *Salmonella serovars* is the intestinal tract of humans and farm animals. Like many other infectious diseases, the course and outcome of the infection depends on various factors including the dose of inoculation and the immune status of the host.² *Salmonella* gastroenteritis could result in bacteremia and rarely focal metastatic infection, like abscess.³ Lung infection with NTS is a rare entity. Although it is known to be pathogenic in animals, infections in humans are uncommon and mostly have been reported in the paediatric age group or in immunocompromised adults. Mortality rates are high for empyema due to NTS.¹

Pulmonary infections may occur by direct extension from adjacent organs, aspiration of gastric secretions, haematogenous spread from gastrointestinal tract or seeding from reticulo-endothelial cells to pleural space.¹ Presentation is similar to any other bacterial pneumonia

and preceding diarrhoea may be a rare diagnostic clue which may not be present in most of the cases. Culture of the lung abscess specimen or pleural fluid (in case of empyema) is a confirmatory test, although concurrent blood culture and stool culture growth for *Salmonella* spp can also be considered.

In a case series published by Cohen *et al*⁴, the authors studied extra-intestinal manifestations of *Salmonella*. There were 36 cases of pleuro-pulmonary infections of which, five had lung abscess. In their study, the most common isolated serotypes were *S. typhimurium*, *S. typhi* and *S. choleraesuis*.⁴ There was a recent case report of *Salmonella* pneumonia from Bahrain⁵ with encysted empyema in an immunocompromised patient of Hodgkin's lymphoma and on chemotherapy. Few case reports of *Salmonella* pulmonary infections in patients with lung cancer were reported as early as 1980.⁶ Samonis *et al*⁷ reported a case of *Salmonella pneumonia* in a patient with small cell lung carcinoma who died seven days after the onset of the infection. Similarly, there have been case reports on *Salmonella* lung infections in patients with diabetes mellitus.⁸ *Salmonella* is suppressed by gastric acidity. Consequently, surgery or medications attenuating the gastric acidity predispose to this infection.⁹

Ridha *et al* in 1996 described a patient with acquired immunodeficiency syndrome who developed lung abscess due to NTS. The risk factors described by the authors were human immunodeficiency virus (HIV) or underlying malignancy.¹⁰ Interleukins 12 and 23 play a key role in immunity against *Salmonella* infections in humans. Therefore, patients with HIV and therapeutic immunosuppression are at increased risk of invasive disease.¹¹

Most cases with *Salmonella* empyema or lung abscess require source control with repeated drainage procedures as in our case. A review of the literature revealed that pulmonary infection with *Salmonella* is very rare. There are several documented risk factors which are known to predispose to development of this infection in the lungs. These include advanced age, diabetes, patients on proton pump inhibitors, underlying malignancy, frequent use of corticosteroids and immunocompromised conditions. Our patient had most of the above-mentioned risk factors. Perhaps the diarrhoeal disease which he had two weeks prior to admission in our hospital, could have been the harbinger of *Salmonella* infection.

It is important to have a high index of suspicion of *Salmonella* as a cause of lung abscess in the presence of specific risk factors, although it is a very rare condition. Despite an extensive literature search, we could not come across any other previously reported case of lung

abscess caused by *Salmonella entericaserovar* Anatum. To the best of our knowledge, this could perhaps be the first reported case of lung abscess caused by this particular organism.

In conclusion, NTS although rare, can cause pleuro-pulmonary complications. Their clinical course is usually grave, might require repeated drainage procedures for source control and is associated with high mortality. This should be considered as possible aetiological agents in patients with specific risk factors, like underlying malignancy and long-term use of anti-reflux medications.

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