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Case report

PLEUROPULMONARY SALMONELLA INFECTION – A CASE REPORT

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Abstract: **Introduction:** Invasive nontyphoidal salmonellosis occurs in 5–10% of all nontyphoidal *Salmonella* infections, with an increasing trend, even in non-endemic areas. Extraintestinal manifestations may include inflammation or abscess formation in various organs, such as the lungs, meninges, kidneys, testes, muscles, and gallbladder.

Case report: We present the case of a 65-year-old female patient admitted for treatment due to fatigue, dyspnea, and weight loss. She did not report diarrhea or fever, and no epidemiological factors suggested a gastrointestinal infection. Her medical history included hypertension and long-term heavy cigarette smoking. A chest X-ray, followed by a CT scan, revealed a pleural effusion, and *Salmonella enteritidis* was isolated from the pleural fluid. Stool, blood, and urine cultures were negative. Further diagnostics revealed dilated bile ducts, mild thickening of the gallbladder wall, and chronic gastritis. Laboratory findings indicated an elevated erythrocyte sedimentation rate, leukocytosis with neutropenia, and increased levels of C-reactive protein and lactate dehydrogenase. The patient was treated with ceftriaxone. The clinical course was complicated by an ischemic cerebrovascular accident, but the overall outcome was favorable.

Conclusion: Pulmonary salmonellosis is rare but can occur in the absence of the typical gastrointestinal symptoms associated with *Salmonella* infection. Early diagnosis is crucial for successful treatment. In this context, prompt microbiological sampling and the initiation of broad-spectrum antibiotics are essential.

Keywords*:* Salmonella, pleural empyema, negative stool cultures, negative blood cultures.

INTRODUCTION

Salmonellosis is one of the leading gastrointestinal infections worldwide, with over 90 million cases and more than 155,000 deaths annually (1). These infections are classified into three main types: typhoidal, nontyphoidal invasive, and nontyphoidal noninvasive. Typhoidal forms are the most severe and are most commonly observed in endemic regions. Nontyphoidal invasive salmonellosis accounts for 5–10% of all *Salmonella* infections and remains a significant challenge in diagnosis and treatment (2). Nontyphoidal noninvasive salmonellosis is the mildest clinical form.

The most common clinical manifestations include fever and signs of enteritis, such as diarrhea accompanied by abdominal pain. The bacteria can spread from the intestines through the bloodstream or lymphatic system, causing inflammatory changes in various organs, including the meninges, bones, skeletal muscles, heart, lungs, kidneys, and testes. In affected organs, empyemas or abscess-like formations may develop (3, 4). *Salmonella* has also been isolated from cultures of patients with skin lesions, external auditory canal infections, or infections at the tip of a dialysis catheter (5).

The most common risk factors for *Salmonella* infection include residing in endemic areas such as sub-Saharan Africa, the Middle East, and Southeast Asia (6). Additional risk factors include male gender, advanced age, comorbidities, and the use of immunosuppressive medications (7).

CASE REPORT

A 65-year-old woman was admitted to General Hospital Užice in August 2024 due to fatigue and difficulty breathing. The fatigue had persisted for two months, and dyspnea had worsened over the past few days. During this period, she had lost 5–6 kg of body weight. She also reported nausea but no vomiting, fever, or diarrhea. Her medical history included hypertension and long-term heavy smoking.

A previous abdominal ultrasound revealed only one abnormal finding: the presence of free fluid in the Douglas pouch. A computed tomography (CT) scan of the abdomen showed a heterogeneous liver structure, a gallbladder wall thickness of 4 mm, dilation of the hepatic duct and common bile duct up to 12 mm, and suspected early dilation of the intrahepatic bile ducts in the left liver lobe. Numerous lymph nodes, measuring up to 8 mm, were observed in the hepatogastric and hepatoduodenal ligaments, as well as para-aortically and paracavally. Free fluid was also noted perihepatically and in the pelvic cavity. An esophagogastroduodenoscopy revealed chronic gastritis.

Magnetic resonance cholangiopancreatography (MRCP) showed mildly dilated intrahepatic bile ducts and dilated extrahepatic bile ducts extending to the major papilla. The common hepatic duct measured 8 mm, and the common bile duct measured 9 mm, with smooth contours up to the intrapancreatic section, where there was luminal narrowing and wall thickening of up to 4 mm.

Upon admission, the patient was afebrile, cachectic, and dyspneic. Peripheral oxygen saturation (SpO_2) on room air was 83%. On auscultation, breath sounds were absent in the right lower lung field. The heart rate was irregular. The abdomen was non-tender and non-distended, with no palpable hepatosplenomegaly.

The electrocardiogram showed atrial fibrillation with absolute ventricular arrhythmia, an average ventricular rate of 70–80 beats per minute, and micro R waves up to V3, indicating systolic overload of the left ventricle.

A chest X-ray revealed lung parenchymal opacity on the right side, suggestive of a pleural effusion (Figure 1).

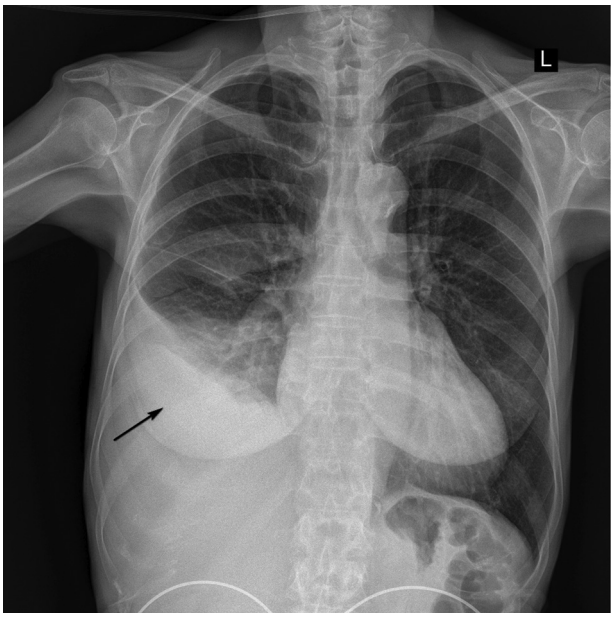

Figure 1. Chest X-ray
(*Source: image is from the author's archive)*

Figure 2. Computed tomography of the chest
(*Source: image is from the author's archive)*

A CT scan of the chest revealed early emphysematous changes of the centrilobular type bilaterally and an atypical pleural effusion on the right, measuring up to 50 mm in thickness. The effusion extended to the lung apex and interlobarly in the cranial part of the costal margin, with axial dimensions of 72 × 43 mm and caudal dimensions of 26 × 9 mm. There was associated compressive atelectasis and ground-glass opacities in the adjacent lung parenchyma (Figure 2).

Laboratory findings showed an elevated erythrocyte sedimentation rate (ESR), leukocytosis with neutrophilia, and increased levels of lactate dehydrogenase and C-reactive protein (Table 1). A pleural punc-

Table 1. *Laboratory analyses at the patient's admission*

Parameters (normal range)	Measured value
Erythrocite sedimentatiton rate (< 20 mm/hr)	98
Red blood cells (4-5.9 x 1012/L)	3.5
White blood cells (4–10 x 109/L)	13.9
Neutrophil count (1.9–8.0 x 109/L)	9.6
Platelet count (150.0–450.0 x 109/L)	263
Fibrinogen (2.0–4.0 g/L)	4.5
Blood sugar (4.1–5.9 mmol/L)	5.5
Blood urea nitrogen (2.8–7.2 mmol/L)	7.2
Serum creatinine (59.0–104. Umol/L)	34
Alanine aminotransferase (<45 U/L)	97
Aspartate aminotransferase (15.0-60.0 U/L)	48
Alkaline phosphatase (30–120 U/L)	64
Serum amylase (30–118 U/L)	54
Urine amylase (21–447 U/L)	142
Sodium (132–146 mmol/L)	136
Potassium (3.5–5.5 mmol/L)	4.1
Lactate dehydrogenase (208.0–378.0 U/L)	547
Creatne kinaze (32.0–294.0 U/L)	69
Creatine kinaza-MB (< 24 U/L)	9
C-reactive protein (< 5 mg/L)	104

ture evacuated 1400 mL of purulent fluid, and SpO_2on room air improved to 96%.

Salmonella enteritidis was identified in the puncture culture using the Vitek® 2 Advanced Expert System (bioMérieux). Antibiotic susceptibility testing, performed using the disk diffusion method, showed sensitivity to *Amoxicillin, Ceftriaxone, Ciprofloxacin*, and *Trimethoprim-sulfamethoxazole*. No isolates were found in the urine culture or repeated stool cultures.

Treatment included oxygen support, antibiotics (*Ceftriaxone*), cardiotonics, calcium channel blockers, diuretics, and antithrombotic therapy (acetylsalicylic acid).

On the fifth day of hospitalization, the patient developed right-sided weakness and difficulty speaking. A CT scan of the brain revealed a large area of hypodensity in the middle and, to a lesser extent, in the upper right frontal gyrus, consistent with an older ischemic lesion. In the upper left frontal gyrus, one relatively larger and one smaller area posterior to it appeared as more recent ischemic lesions.

Further neurological monitoring was conducted, followed by physical therapy.

The hospitalization lasted 12 days. The patient was discharged without respiratory or gastrointestinal complaints, with normal auscultatory findings and chest X-ray. The neurological examination revealed mild sensory dysphasia and moderate right-sided hemiparesis.

DISCUSSION

Pulmonary infections caused by gram-negative bacteria in community settings are rare (8). Extraintestinal salmonellosis is also uncommon and typically occurs in individuals with immunodeficiencies (9).

We present a case of a patient who acquired the infection in a community setting. She did not belong to the typical high-risk group—elderly men on immunosuppressants—and primarily presented with respiratory symptoms. Similar cases have been reported by other authors (10, 11).

Our patient had experienced fatigue but attributed it to the effects of smoking. The most common symptoms of non-typhoidal Salmonella infection are diarrhea and abdominal pain (12). However, in our case, as well as in other reported cases, these symptoms were absent (10, 11). Pulmonary Salmonella infection was also described by Kaur et al., who diagnosed a bronchogenic Salmonella cyst in their patient (13).

While investigating the source of the infection, it was suspected that Salmonella may have entered the bronchi through inhaled marijuana vapors. Our patient was a long-time smoker but denied marijuana use, although she occasionally rolled cigarettes with cut tobacco. Based on Kaur et al.'s reasoning, we cannot definitively exclude this route of pathogen entry.

As with previous reports, blood cultures in our case were sterile. The patient denied experiencing fever during the two months of her symptoms. Before hospitalization, she had been prescribed amoxicillin by a gastroenterologist, which she took for seven days. The Salmonella enteritidis strain isolated from the pleural puncture was sensitive to amoxicillin. It is possible that the antibiotic therapy partially affected the pathogen and limited early dissemination but was insufficient to fully eradicate the infection.

The clinical course and outcome of the infection depend on the serotype of the pathogen and the immune status of the host (14). Different Salmonella serotypes produce specific toxins that exert varying effects on organs (15). The first line of defense against enteropathogenic Salmonella is the intestinal immune system, which is activated by bacterial toxins (16). Macrophages in the intestinal mucosa are activated through receptors for the Salmonella flagellin antigen (17). In response, Salmonella polarizes macrophages, enabling immune evasion and long-term persistence in the intestines (18). Among various mechanisms of dissemination, Salmonella exploits host cell migration, primarily through dendritic cells (1). A key virulence factor of these bacteria is the type III secretion system, which initiates apoptosis in infected macrophages (19). Through this system, Salmonella modulates programmed cell death, a crucial host defense mechanism (20).

The complexity of these immune evasion strategies may explain the increasing prevalence of invasive non-typhoidal Salmonella infections (2), which have been associated with higher mortality rates and an increased need for intensive care (21). Immediately after the pleural puncture, we initiated *Ceftriaxone* treatment without anticipating the presence of gram-negative bacteria in the pleural culture. Since Salmonella enteritidis was found to be sensitive to *Ceftriaxone* and the patient's clinical condition improved, we continued this therapy. Other authors have also reported successful treatment of Salmonella-related pulmonary infections with *Ceftriaxone* (22). As in our case, antibiotic therapy was often preceded by surgical intervention to drain empyemas or abscesses whenever feasible (4, 22).

Recent studies have highlighted rising antibiotic resistance in Salmonella strains. However, in our case, the pathogen remained susceptible to multiple antibiotics, and the patient's symptoms resolved rapidly. Laboratory findings were consistent with a bacterial

infection, including elevated erythrocyte sedimentation rate (ESR), leukocytosis with neutrophilia, and increased levels of C-reactive protein and lactate dehydrogenase. Similar laboratory patterns have been reported by other authors (5).

The clinical course of our patient was unexpectedly complicated by an ischemic stroke. A CT scan revealed older ischemic changes, but the patient had no history of prior neurological symptoms. Long-standing hypertension may have contributed to vascular changes that weakened her immune defenses and increased susceptibility to infection.

Despite the cerebrovascular event, the patient's overall clinical course was favorable. However, the exact source of the Salmonella infection remains uncertain. Given the initial gastric symptoms and imaging findings of biliary tract abnormalities, we considered the biliary tract a potential source of infection, as described in previous literature (23, 24). A bile culture would have been necessary to confirm this, but the patient declined a repeat endoscopic retrograde cholangiopancreatography.

In conclusion, this case represents a rare presentation of invasive non-typhoidal Salmonella infection. Early suspicion of Salmonella infection is crucial for accurate diagnosis and treatment, especially in the absence of typical enteric symptoms.

Abbreviations

CT - computed tomography

MRCP - Magnetic resonance cholangiopancreatography

SpO_2 - Peripheral oxygen saturation

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Conflict of Interest: The authors declare no conflicts of interest related to this article.

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Sažetak

PLEUROPULMONALNA INFEKCIJA SALMONELOM - PRIKAZ SLUČAJA

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Uvod: Invazivna netifoidna salmoneloza je prisutna kod 5-10% svih netifoidnih salmoneloza, sa tendencom rasta, čak i u neendemskim područjima. Ekstraintestinalni klinički oblici mogu biti upale ili apscesi u raznim organima, kao što su pluća, moždanice, bubrezi, testisi, mišici, žučna kesa.

Prikaz slučaja: Analizirali smo slučaj pacijentkinje starosti 65 godina primljene na lečenje zbog malaksalosti, otežanog disanja i gubitka u telesnoj težini. Nije imala dijareju, niti febrilnost. Nije bilo epidemioloških podataka za crevnu infekciju. Prethodna medicinska dokumentacija je ukazala na arterijsku hipertenziju i dugogodišnje intenzivno pušenje cigareta. Na radiografskom snimku, a zatim i skeneru grudnog koša viđen je pleuralni izliv, a u punktatu je izolovana Salmonella enteritidis. Koprokulture, hemokulture i urinokultura su bile negativne. Dijagnostikovano je proširenje žučnih puteva i lako zadebljanje žučne kese, kao i hronični gastritis. U laboratorijskim nalazima je imala ubrzanu sedimentaciju eritrocita, leukocitozu sa neutropenijom, povišene vrednosti c-reaktivnog proteina i laktat dehidrogenaze. Lečena je ceftriaksonom. Klinički tok se komplikovao ishemičnim cerebrovaskularnim insultom, ali je ishod lečenja bio povoljan.

Zaključak: Plućni oblik salmoneloze nije čest, ali je moguć bez prethodnih simptoma uobičajenih za crevnu salmoneloznu infekciju. Za uspešno izlečenje je važno rano postavljanje dijagnoze. U tom smislu je potrebno što ranije uzimanje uzorka za mikrobiološku dijagnostiku i uvođenje antibiotika širokog spektra dejstva.

Ključne reči: Salmonella, pleuralni empijem, negativne koprokulture, negativna hemokultura.

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