

Polyneuritis and Rare Sequelae of Leptospirosis Contracted While on an Urban Clean-Up Mission in Detroit : A Case Report of Weil's Disease and Literature Review

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Abstract

Leptospirosis is a common zoonosis, an infectious disease that infects both humans and animals, which is caused by spirochete bacteria from genus *Leptospira*. Approximately 30% of children in urban Detroit and 16% of adults in Baltimore demonstrated serologic evidence of previous leptospirosis infections. The Detroit study showed correlation between degree of rat infestation and seropositivity rates. This finding suggests rats are major vectors for human leptospirosis in mainland United States. The leptospires from infected animals survive best in fresh water, damp alkaline soil, vegetation, and mud with temperatures higher than 22 °C. Although leptospirosis is a well documented clinical condition, the sequelae of polyneuritis has not yet been reported to our knowledge. The following case is an example of such an occurrence. A 49-year-old Caucasian female presented to the emergency department with flu-like symptoms after volunteering in an urban Detroit neighborhood clean-up project. She admitted to picking up wood from stagnant water without wearing personal protective equipment. The primary differential diagnosis being Weil's disease from leptospirosis and was proven positive with serologic testing via the Center for Disease Control. A computed tomography (CT) abdomen and pelvis demonstrated lymphadenopathy throughout the abdomen and near the spinal column. She was treated with ceftriaxone and doxycycline for 12 days but developed chronic neuralgia and polyneuritis. Leptospires are known to cause vasculitis. This patient developed polyneuritis either from direct invasion of the nerves from leptospires or compromised blood supply to the nerves. In addition to antibiotics, patients with severe cases of leptospirosis also require supportive therapy and careful management of renal, hepatic, hematologic, and central nervous system complications. If renal failure ensues, early initiation of hemodialysis or peritoneal dialysis may reduce mortality. Rapid identification of symptoms and a high clinical suspicion are paramount because early intervention can save their life.

Keywords: Leptospirosis; Polyneuritis; Neuralgia; Weil's disease

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Introduction

Leptospirosis is a common zoonosis infectious disease that infects both humans and animals, which is caused by spirochete bacteria from genus *Leptospira*. Leptospires are thin, spiral-shaped Gram-negative aerobic organisms (Fig. 1). They have hooked ends and paired axial flagella allowing them to burrow into tissues. They can be isolated on artificial media, which makes them unique among spirochetes. Its life cycle starts with hematogenous spread of leptospires to the proximal renal tubules where they colonize and shed via urine into the environment. Rats, dogs, and ungulates, among others, that can become chronic, asymptomatic carriers. Humans, however, shed leptospires for a limited time and are accidental hosts. Leptospires are transmitted when mucous membranes, lungs via inhalation or abraded skin is exposed to body fluids of an acutely infected animal and by soil or fresh water contaminated with the urine of a chronic carrier. Seventy percent of leptospirosis cases occur from occupational and recreational exposures. Urban workers and residents in economically deprived areas may contract the disease through exposure to rat urine [1]. Most cases of leptospirosis start with nonspecific signs, like fever, headache, nausea, vomiting. The disease course of leptospirosis falls into two phases: acute phase of illness lasting 5 - 7 days, followed by a 1 - 3 day period of improvement in which the fever and symptoms subside. Leptospirosis can either regress to a relatively asymptomatic illness or progress to a more severe illness.

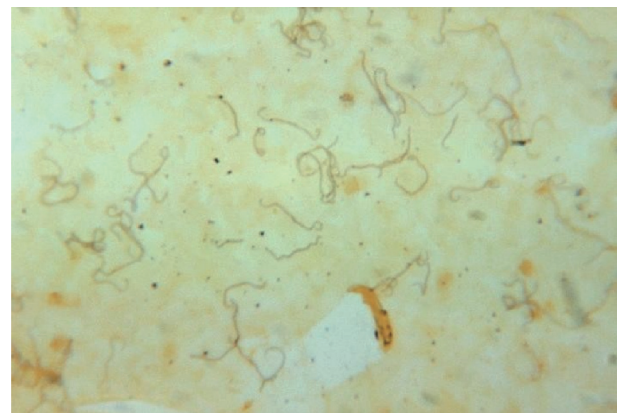


Figure 1. Silver stain of leptospires in fatal human leptospirosis.

Weil's disease, also known as icteric leptospirosis, occurs in approximately 10% of cases, and has a fatality rate of 5-10%. Patients with this presentation can have fever, jaundice, renal failure, and hemorrhage. The pulmonary system, cardiac system, and central nervous systems are also frequently involved.

Culture times for *Leptospira* are long so treatment is begun empirically in patients with a plausible exposure history and compatible symptoms. Serologic identification of leptospires, microscopic agglutination testing (MAT), is available only at reference laboratories. Antibiotic therapy in the treatment of mild leptospirosis is not necessary because the disease is self-limited, and most cases resolve without medical attention. Oral antibiotics shorten the course of illness and urinary excretion of leptospires. Doxycycline is a good first-choice oral antibiotic. For more severe presentations, intravenous penicillin G and third-generation cephalosporins (cefotaxime and ceftriaxone) have shown effectiveness. Severe cases of leptospirosis also require supportive care for renal, hepatic, hematologic, and central nervous system complications. Early initiation of hemodialysis may be needed along with cardiac inotropic medications, eye drops and diuretics. Vasculitis of capillaries, exhibited by endothelial edema, necrosis, and lymphocytic infiltration appears to be the most common presentation. It appears that capillary vasculitis is found in all affected organ systems. The resulting loss of red blood cells and fluid through enlarged junctions and fenestrae, which cause secondary tissue injury, probably accounts for many of the clinical findings [1-54].

Although leptospirosis is a well documented clinical condition, the sequelae of peripheral polyneuritis has not yet been reported to our knowledge. The following case is an example of such an occurrence.

Case Report

A 49-year-old Caucasian female presented to the emergency department with flu-like symptoms after recently volunteering in an urban Detroit neighborhood clean-up project. She admitted to picking up wood from stagnant water without wearing personal protective equipment. She was alert, oriented and able to follow commands on admission. Within hours, she rapidly developed hepatitis, rhabdomyolysis, thrombocytopenia, anemia, acute renal failure requiring hemodialysis, acute respiratory failure requiring mechanical ventilation, and ultimately, acute respiratory distress syndrome. All initial infectious disease testing was negative. The patient's history of cleaning up wood from stagnant garbage-filled water was clue to perform zoonotic analyses, with the primary differential diagnosis being Weil's disease from Leptospirosis. Serologic testing was sent to the Center for Disease Control in Atlanta, which tested positive. She was treated with ceftriaxone and doxycycline for 12 days. Her overall status improved, she was extubated and transferred out of the intensive care unit (ICU). A CT abdomen and pelvis demonstrated lymphadenopathy near the lumbar and sacrum regions of the spinal cord and peripheral nerves. She continued to follow up in the outpatient setting and complained of shock-like pain and neuralgia bilaterally in her

lower extremities. The rhabdomyolysis resolved, but her pain remained despite completion of antibiotic treatment which is most likely caused from direct invasion of leptospires into the nerves or compromised blood flow to the nerves. She remains a clinic patient and her pain is controlled with oral medications.

Discussion

The clinical condition presented above likely was polyneuritis caused by leptospires due to the chronological association seropositivity of leptospirosis, CT evidence of lymphadenopathy near peripheral nerves and spinal cord, persistent neuralgia and polyneuritis symptoms post discharge in the outpatient setting, and lack of an alternative explanation. One could argue that her nerve-type pain was caused from spinal stenosis in the cervical vertebrae, which was seen on subsequent magnetic resonance imaging (MRI) scans. However, the patient stated that the pain and shock-like sensations in her lower extremities were new, and started happening immediately after she got leptospirosis. Additionally, cervical spinal stenosis is a chronic, insidious condition and would create neuralgia in both upper and lower extremities. The patient's pain started from areas seen in the CT where lymphadenopathy was prominent, which were located mainly in the lumbar and sacral regions. Additionally, Leptospirosis is known to cause vasculitis which can cause poor blood flow to the nerves and subsequent damage. This was a plausible theory instead of direct invasion from the leptospires directly into the nerves. However, leptospires may remain in immunologically privileged sites despite being cleared from the blood for months. The only true way to determine the etiology of the patient's neuralgia would be to biopsy the peripheral nerves, which was not done in this case to date. The patient also suffered from rhabdomyolysis from leptospire invasion which caused pain initially. However, the creatinine kinase level normalized while in the ICU. Plus, the "shock-like" pain the patient complained of after discharge in the clinic is more typical of neuralgia. Regardless of the nerve destruction mechanism, the pain and discomfort felt by the patient is ongoing and knowing the etiology would unlikely change the treatment regimen.

Several recent publications suggested that leptospirosis can lead to meningeal symptoms in 50% of patients. For instance, cranial nerve palsies, encephalitis, peripheral facial palsy and changes in consciousness are less common [2]. Meningitis can last for weeks. Additionally uveitis, iridocyclitis and chorioretinitis can develop and may persist for years. Leptospirosis has also been noted by researchers to be an infective systemic vasculitis [3]. For example, focal necrosis, inflammatory infiltration, and hemorrhage have been documented within the adrenal gland. The main pathologic factor in skin is caused mostly by epithelial vascular insult. Skeletal muscle involvement is secondary to edema, myofibril vacuolization, and vessel damage [1-45]. Although the systemic immune response may eliminate leptospires from the body, a large inflammatory reaction can develop which can produce secondary end-organ injury [1]. Leptospirosis is most prevalent in Hawaii, which

consistently reports the highest annual occurrence rate. However, 30% of children in urban Detroit [4] and 16% of adults in Baltimore [5] demonstrated serologic evidence of past infection. The Detroit study also showed correlation between rat infestation levels and seropositivity rates. This finding suggests rats are major vectors for human leptospirosis in the United States. Leptospire from infected animal urine survive best in damp alkaline soil, freshwater, vegetation, and mud with temperatures higher than 22 °C [16].

The woman in this case presented with acute infection, septicemia, and multiorgan failure, followed by rapid immune clearance. She now is stricken with sequelae of polyneuritis and chronic pain. Leptospirosis symptoms are vague and resemble many common viral illnesses. She was started on empiric antibiotic therapy, but she was found to be seropositive for leptospirosis days after her admission and after many immunologic tests. Nonetheless, the turning point for this patient occurred after gaining knowledge from her history of exposure to rat urine during an urban Detroit clean-up project. A high index of suspicion of a zoonotic infection helped save her life. Furthermore, it is essential clinicians are aware that leptospirosis can occur in urban areas, perhaps near a large academic hospital, and be mindful that it often mimics common viral illnesses. There have been no reported cases yet about someone having peripheral neuralgia and polyneuritis from leptospirosis. A peripheral nerve biopsy would help distinguish if this woman had nerve pain from a direct spirochete invasion or vasculitis impeding blood flow to the nerve. But it would not necessarily change her symptomatic treatment, which at this time consists of oral pain medications. It is paramount to educate patients to avoid contact with environments [55] potentially contaminated with animal urine, especially rodent-infested areas and wear protective clothing and shoes. For severe leptospirosis, intravenous penicillin G is considered the drug of choice. But doxycycline and ceftriaxone was used in this case, based on susceptibilities. Supportive care with mechanical ventilation and hemodialysis may also be necessary.

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None to declare.

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Conflict of Interest

No conflict of interest.

Informed Consent

Verbal consent was obtained from the patient.

Author Contributions

Nichole Zuccarini, lead author of article and physician who worked with patient in clinic; Samaa Lutfi, editor of article; Thomas Piskorowski, attending physician and advisor to clinical case.

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