

Disseminated Lyme Disease Presenting as Urinary Retention and Acute Renal Failure

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Abstract

Lyme disease may affect the central and peripheral nervous system. Neuroborreliosis typically causes meningoencephalitis, meningoradiculitis, and cranial neuritis. However, neuroborreliosis may rarely affect the autonomic nervous system. There are case reports of neuroborreliosis causing intestinal pseudo-obstruction and acute urinary retention from detrusor dysfunction in adults with Lyme positive serology. To our knowledge, urinary retention from Lyme disease has not been previously reported in the pediatric population. We present a case of a 13-year-old male with autism admitted to our pediatric intensive care unit, PICU, with acute renal failure, ARF, secondary to obstructive uropathy in the setting of urinary retention who was ultimately diagnosed with and treated for Lyme disease.

Keywords Lyme disease; Disseminated Lyme Disease; Urinary Retention; Acute Renal Failure

Introduction

Lyme disease is the most common tick-borne infection in the United States. Lyme disease is a tick-borne infection caused by the spirochete *Borrelia burgdorferi* that can cause disseminated disease via the central nervous system (CNS), cardiovascular system, and cause various manifestations including arthritis, encephalomyelitis, neuropathies, and carditis [1]. Lyme disease is endemic in the United States, with a steadily increasing number of confirmed cases over the last 25 years. It is the sixth most commonly reported infectious disease in the country. Nearly 400 confirmed cases occur in the state of Delaware alone in 2017 [2]. We report here a case of Lyme disease presenting with urinary retention, obstructive uropathy, and acute renal failure.

Case Report

A 13-year-old non-verbal male with profound intellectual disability, expressive and receptive language delay, and autism presented to our emergency room in Delaware with acute abdominal distention, abdominal pain and decreased urine output. Two days prior to presentation he was discharged from the general pediatric service after a four-day hospitalization where he was evaluated for diffuse weakness, left side greater than right. During the first admission, magnetic resonance imaging, MRI, of his brain (Figure 1) revealed abnormal signal intensity in the medial right thalamus, without contrast enhancement. An MRI of his cervical, thoracic, and lumbar spine were normal. Although a lumbar puncture was performed, viral and bacterial cultures and autoimmune antibodies were not sent on his cerebrospinal fluid. Oligoclonal bands were negative. Neurology evaluated him and felt his diagnosis was most consistent with an acute encephalopathy from unspecified viral encephalitis, post infectious encephalitis, or a demyelinating disease. He was discharged home after demonstrating clinical improvement in weakness without any specific therapy.

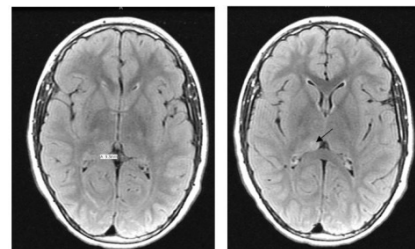


Figure 1: Initial MRI of brain demonstrating focal area of abnormal signal intensity in the medial right thalamus, without contrast enhancement, which may represent demyelinating lesion or evidence of viral infection. Arrow demonstrates location of the lesion. No other areas of abnormal signal intensity.

Since his previous admission, the patient's mom reported improvement in weakness but a change in his bowel and urination habits. Although the patient was incontinent and diapered at baseline, his parents noted small amounts of urine in his diaper frequently, rather than large voids occurring at longer intervals. In addition, he had no bowel movements for a week prior to presentation. On the day of this admission parents reported worsening abdominal pain and no urine output for sixteen hours.

On initial exam in the emergency room, ER, the patient was unable to lay down and was crying in pain. At that time, vital signs were unremarkable aside from tachycardia to 111 beats per minute. Physical exam findings were remarkable for a distended, tender, and rigid abdomen. An abdominal x-ray (Figure 2) revealed findings of a small bowel obstruction. General surgery was consulted. A cat scan, CT, of the abdomen revealed massive ascites pushing on the small bowel likely mimicking a bowel obstruction (Figure 3). Laboratory results were significant for a leukocytosis of 22.5 K/UL with neutrophil predominance of 69.3%, hyponatremia to 126 mmol/L, hyperkalemia

to 6.2 mmol/L, hypochloremia to 90 mmol/L, anion gap metabolic acidosis with bicarbonate of 12 mmol/L, hyperphosphatemia to 9.1 mmol/L, blood urea nitrogen (BUN) of 117 mg/dL, and creatinine of 7.2 mg/dL. Hepatic function tests and coagulation studies were normal. His electrocardiogram did not show peaked T waves. Emergency management for hyperkalemia was initiated in the emergency department upon admission to the PICU he was hypotensive requiring norepinephrine infusion. Piperacillin-Tazobactam was initiated empirically due to diagnosis of septic shock. A urinary catheter was placed which drained over 2 liters of urine. His urinalysis was remarkable for leukocyte esterase, blood, and protein. Microscopic evaluation was significant for >50 white blood cells/HPF and 25-50 red blood cells/HPF. A urine culture was not obtained prior to antibiotics. The patient was intubated in order to facilitate placement of an emergent dialysis catheter in the right internal jugular vein. Continuous renal replacement therapy, CRRT, was initiated. The following morning an ultrasound of the abdomen revealed an estimated 3 liters of loculated ascites. Interventional radiology, IR, placed a peritoneal drain with immediate drainage of 500 mL of straw-colored fluid. Peritoneal fluid examination had a white blood cell count of 8675/MM3 with 91% neutrophils and negative bacterial culture. Infectious disease consultants diagnosed sterile peritonitis and without a urine culture prior to antibiotics, they recommended narrowing antibiotics to cefazolin for treatment of urinary tract infection.



Figure 2: Abdominal x-ray on presentation concerning for small bowel obstruction. Black arrows point to small bowel distention and areas of dilated loops of bowel. Orange arrows demonstrating air-fluid levels.



Figure 3: CT scan of abdomen with black arrows demonstrating massive ascites and orange arrows demonstrating shift of small bowel into upper abdomen.

The PICU team and pediatric nephrology suspected our patient had an obstructive uropathy secondary to acute neurogenic bladder leading to a rupture in the urinary system resulting in a large urinoma, ascites and ARF. While the etiology for his acute neurogenic bladder was initially unclear, the medical team proposed a link to the unspecified neurologic process that began a week prior prompting his first hospital admission. The diagnosis of a bladder rupture with subsequent seal was supported by a second abdominal CT and a cystogram. His second abdominal CT (Figure 4) revealed irregularity and thickening of the dorsal wall of the bladder, not seen on prior MRI of the lumbar spine, raising the possibility of bladder injury from perforation. A cystogram revealed bladder abnormalities suspicious for perforation without extravasation of contrast to confirm perforation.

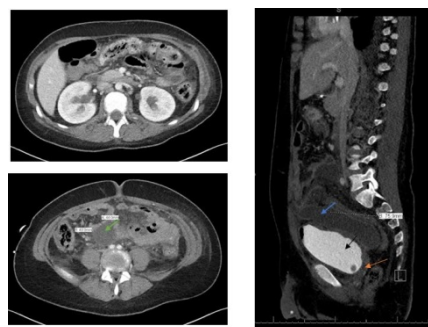


Figure 4: Repeat CT scan of abdomen with black arrow demonstrating no contrast extravasation from the bladder to suggest active bladder rupture. Orange arrow depicting irregularity and thickening of the dorsal wall of the bladder raising the possibility of bladder injury or edema, possible prior episode of bladder perforation or focal cystitis. Green arrow depicting one of several residual fluid collections in the mesentery with possible loculation. Blue arrow depicting persistent pelvic ascites with peritoneal enhancement concerning for peritonitis.

On hospital day 2, the patient's shock resolved, his electrolytes normalized with continued production of urine and CRRT was discontinued. Although his foley catheter was removed, intermittent bladder catheterization was needed due to continued evidence of neurogenic bladder. On the fourth day of hospitalization, the patient was found unresponsive with seizure like activity. Electroencephalography revealed semi-rhythmic delta slowing and excessive spindles but no epileptiform features. Levetiracetam was started. Repeat MRI (Figure 5) of the brain demonstrated a stable focal area of abnormal signal intensity in the medial right thalamus without contrast enhancement. Repeat MRI of the cervical, thoracic, and lumbar spine was unremarkable except for diffuse hypointensity of the bone marrow, with unclear significance. On hospital day 10, antibiotic therapy was changed from Cefazolin to Ceftriaxone due to fevers.

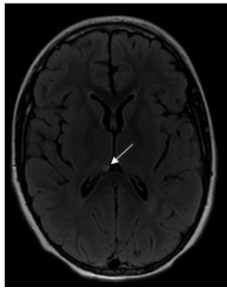


Figure 5: Repeat MRI brain with white arrow demonstrating stable focal area of the abnormal signal intensity in the medial right thalamus without contrast enhancement.

Further infectious, neurologic, hematologic and autoimmune evaluation was performed throughout his hospital stay to assist with diagnosis. A lumbar puncture was not obtained. C-reactive protein and erythrocyte sedimentation rate were consistently elevated and continued to rise thru discharge. Antinuclear antibody was negative. Leukocytosis and thrombocytosis present on admission resolved at time of discharge. Hypercoagulable workup including antithrombin III, methylenetetrahydrofolate reductase, factor V leiden were all normal. Lyme immunoglobulin M (IgM) antibody was equivocal, and Lyme immunoglobulin G (IgG) was positive via enzyme-linked immunosorbent assay (ELISA). Upon further history taking, the patient was found to live in a rural area and had multiple ticks removed by his mother over the last few months. Mom denied any skin lesions. Western blot test revealed IgG positive immunoblot with nine IgG bands and IgM immunoblot positive with two positive bands. Final diagnosis of disseminated Lyme disease was made with decision to continue intravenous Ceftriaxone for a total of twenty-one days.

The patient was unable to void spontaneously throughout most of his hospital stay and required intermittent catheterization. He was started on Tamsulosin. Prior to discharge and after 12 days of IV Ceftriaxone this patient was able to void spontaneously. A peripherally inserted central catheter, PICC, line was placed and he was discharged home to complete a 21-day course of IV antibiotics therapy. Urodynamic studies were unable to be completed due to the patient's intellectual disability and baseline incontinence.

Discussion

Although there is case reports of autonomic dysfunction including urinary retention attributed to Lyme disease in adults, this is the first reported case of acute urinary retention in a child due to suspected neuroborreliosis. It is known that Lyme disease may affect the central and peripheral nervous system [1,2]. Neuroborreliosis is usually associated with the triad of meningoencephalitis, meningoradiculitis, and cranial neuritis, however patients may present clinically with some or all of these elements [3]. Neuroborreliosis may rarely affect the autonomic nervous system.

Lyme disease is a clinical diagnosis with the presence of erythema migrans, however in its absence, serologic testing is needed to make the diagnosis. Instances of disseminated Lyme disease are more difficult to diagnose and require careful history taking of exposure to tick bites as well as typical signs and symptoms of Lyme borreliosis [1]. Serologic testing is based on the positive identification of spirochetal

antigens on a high sensitivity ELISA test with confirmatory testing for a highly specific Western blot assay [1]. To distinguish intrathecal antibody production from spillage into the cerebral spinal fluid (CSF), both CSF and serum testing should be performed. A ratio of 1.3 of CSF to serum antibody production is considered consistent with Lyme disease in the appropriate clinical context [4]. Demonstration of intrathecal production of anti-Borrelia burgdorferi antibodies provides the strongest evidence of true infection, but correction for peripheral blood immune reactivity to B. burgdorferi that crosses the blood brain barrier is essential to establishing a diagnosis [5].

B burgdorferi penetrates the blood-brain barrier easily and early in infection in a mechanism that is not well defined. This penetration triggers local production of CXCL13, a B-cell-attracting chemokine, leading to migration of B cells into the CNS where they multiply and develop antibodies targeting B burgdorferi [6]. Other studies have suggested systemic or local production of various cytokines may play a pathophysiologic role, although this is not well understood. Interferon γ and tumor necrosis factor α production may be increased during infection with potential downstream biochemical effects. Immune activation likely plays a significant role in amplifying the clinical impact of the small number of spirochetes that persist in the nervous system [6].

Voiding dysfunction and micturition disorders may occur as an early or later sign in Lyme disease [7]. Micturition disorders in Lyme disease may occur by direct invasion of the spirochete into the urinary bladder or via penetration of the spirochetes into the central nervous system causing demyelinating lesions of the spinal cord. The first report of Lyme disease presenting with urologic complications was in 1990 by Chancellor, MB et al in an adult patient that presented with paralysis and urinary retention [8]. Chancellor MB, et al later described 7 patients with neuroborreliosis that had detrusor hyperreflexia in 5 patients and detrusor areflexia in 2 patients [7]. In these patients, urological symptoms were slow to resolve.

Similarly, a case report by Kim et al., described an adult patient with rapidly progressive bilateral ptosis, dysphagia, spastic Para paresis, and voiding difficulty in whom Lyme disease was diagnosed. A urodynamic study demonstrated detrusor areflexia and bulb cavernous reflex tests showed delayed latency, indicating demyelination at the S2-S4 levels [9]. Neurologic symptoms caused by Lyme disease typically are relieved with appropriate antibiotic therapy, however in these reports; there was either slow recovery or no recovery of normal bladder function.

Treatment of Lyme Neuroborreliosis is with Doxycycline or a Beta-lactam for 14-28 days. A recent systematic review by Dersch et al., showed no statistically significant difference between beta-lactam antibiotics and doxycycline regarding neurological symptoms after treatment. No statistically significant difference was found between penicillin G and ceftriaxone regarding neurological symptoms after treatment [10-12] csf. This is similar to older studies that found Penicillin G to be of equal efficacy compared to Ceftriaxone in treatment of neuroborreliosis [13].

This case study should prompt pediatricians and pediatric subspecialists to consider and test for Lyme disease when a child living in an endemic area presents with acute voiding dysfunction or urinary retention of otherwise unexplained etiology. The early diagnosis and proper treatment of Lyme disease can potentially reverse autonomic dysfunction associated with neuroborreliosis.

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