Case Report: Infectious Diseases in Pilgrims Visiting the Holy Land

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Abstract. Every year Christian pilgrims from around the world visit the holy sites located around the Sea of Galilee. Some become ill during their stay with infectious diseases that were acquired in their country of origin, and are hospitalized at Poriya Medical Center. They pose a diagnostic challenge due to language barriers, the rarity of these infections in Israel, and the fact that diagnostic tests are not readily available. All patient records from 2015 of Holy Land tourists hospitalized at Poriya Medical Center were screened for the diagnosis of imported zoonotic diseases that are not commonly diagnosed in Israel. Three patients who were on a Holy Land tour were hospitalized during 2015 with laboratory-confirmed diagnostically challenging zoonotic infectious diseases: a 91-year-old priest from Ethiopia diagnosed with relapsing fever due to *Borrelia recurrentis*, an 85-year-old retired mountaineer from New Hampshire diagnosed with human granulocytic anaplasmosis, and a 57-year-old farmer from central Brazil diagnosed with leptospirosis. These case reports emphasize the importance of considering imported zoonotic infectious diseases and obtaining appropriate diagnostic tests when treating Holy Land travelers to Israel.

INTRODUCTION

Every year Christian pilgrims from around the world come to visit the Holy Land. Due to wider access of international flights, people from all corners of the globe and from all walks of life arrive in Israel for a Holy Land pilgrimage. As part of their tour they visit sites located around the Sea of Galilee. During their stay in this area some become ill with infectious diseases that were acquired in their country of origin, and are hospitalized at Poriya Medical Center. They pose a diagnostic challenge due to language and cultural barriers, the rarity of these infections in Israel, and the fact that diagnostic tests for such infections are not readily available. We present three cases from the past year with diagnostically challenging zoonotic infectious diseases.

CASE REPORTS

Case 1. A 91-year-old priest, residing in a monolithic rock-cut church in Lalibela, a town located in northern Ethiopia, arrived in Israel with a group of pilgrims. Five days after his arrival, he was brought to the emergency room (ER) due to abdominal pain, vomiting, fever, and chills of 3 days' duration. He had no known prior illnesses, and had not eaten anything since his symptoms began. He had also been complaining of severe weakness and chills. On arrival at the ER, the patient was obtunded, his blood pressure was 78/45 mmHg, pulse 117 beats per minute, and temperature 36.7°C. On physical examination, he was found to be in a stuporous state and right upper quadrant abdominal tenderness was noted. Blood examinations demonstrated a white blood cell (WBC) count of 9,970/μL with 83% neutrophils and 0.6% eosinophils, hemoglobin 13 g/dL, and platelets 20,000/μL. Blood glucose level was 100 mg/dL, creatinine 2.7 mg/dL, blood urea nitrogen (BUN) 89 mg/dL, sodium 142 mEq/L, potassium 3.9 mEq/L,

alanine aminotransferase (ALT) 134 U/L, aminotransferase (AST) 491 U/L, alkaline phosphatase (AP) 361 U/L, bilirubin 4.1 mg/dL with 3.8 mg/dL direct bilirubin, and lactate dehydrogenase (LDH) 2,196 U/L. Blood coagulation tests showed an increased international normalized ratio (INR) of 1.66 and a normal partial thromboplastin time of 29 seconds (normal range 25–35). An electrocardiogram (ECG) demonstrated sinus tachycardia with left bundle branch block. There was no prior ECG for comparison of findings. An abdominal sonogram demonstrated gallbladder wall thickening with sludge. A brain computed tomography (CT) scan did not demonstrate any pathologic findings. A chest CT scan demonstrated a right middle lobe infiltrate with bilateral pleural effusion.

The patient was diagnosed with severe sepsis and disseminated intravascular coagulation due to acute cholecystitis, and was admitted to the surgical department where fluids, glucose, cefuroxime, and metronidazole were administered. The next morning a peripheral blood smear demonstrated multiple spirochetes per high-power field. Treatment with intravenous doxycycline 100 mg twice daily was administered, with a slow clinical recovery, during which he developed rapid atrial fibrillation and pulmonary edema necessitating mechanical ventilation. After being in a comatose state for a few days, the patient's neurologic state steadily improved until returning to baseline condition. A repeat blood smear was negative for spirochetes. The patient was discharged after 15 days in good clinical condition.

A blood sample was sent for polymerase chain reaction (PCR) assay to the Central Laboratories of Ministry of Health that identified the *Borrelia flagellin* B (*flaB*) gene 750 BP,¹ using a genus-specific set of primers (BOR1 and BOR2). The result came back positive for relapsing fever *Borrelia*. Because acquisition of infection was suspected to occur in Ethiopia where *Borrelia persica* infection has not been reported, a repeat test for the detection of *Borrelia* species was performed by real-time PCR assay targeting a 346-base-pair fragment of the *flaB* gene.² The real-time PCR was positive and the product was sequenced and compared with other sequences deposited in

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GenBank® using the BLAST algorithm (<http://blast.ncbi.nlm.nih.gov/Blast.cgi>). *Borrelia* DNA from this patient was identical to *Borrelia recurrentis* (GenBank CP000993.1).

Case 2. An 85-year-old man residing on a large forested estate in New Hampshire, United States, was visiting Israel on a guided tour of the Holy Land sites. He was a retired mountaineer, diagnosed with sleep apnea and benign prostatic hypertrophy, and had been ill with Lyme disease a few years previous. On the day of his arrival in Israel, a week before seeking medical attention, a high fever accompanied by weakness, generalized myalgias, vomiting, and diarrhea appeared. Two weeks before his current illness he noticed a tick bite on his right thigh. On arrival at Poriya Medical Center, he had a temperature of 39.9°C, pulse 87 beats per minute, and blood pressure was 112/60 mmHg. Physical examination revealed abdominal tenderness, a systolic 2/6 murmur at the left sternal border, and no rash. Blood count was notable for severe thrombocytopenia with 17,000 platelets/ μ L and leukopenia 1,240 WBC/ μ L. Hemoglobin was 14.5 g/dL. Blood glucose level was 107 mg/dL, creatinine 1.6 mg/dL, BUN 37 mg/dL, sodium 137 mEq/L, potassium 4 mEq/L, AST 291 U/L, ALT 119 U/L, AP 112 U/L, bilirubin 0.9 mg/dL, and LDH 2,739 U/L. Mild proteinuria and hematuria were noted in a urine sample. A pulmonary infiltrate was noted in the right lower lobe on chest X-ray. An abdominal ultrasound demonstrated an enlarged prostate with no other findings. A peripheral blood smear demonstrated intraneutrophilic morulae.

Diagnosis of human granulocytic anaplasmosis (HGA) was suspected and oral doxycycline 100 mg treatment was administered with rapid resolution of symptoms and laboratory abnormalities. A PCR test sent to the microbiology laboratory of a tertiary care hospital came back positive for HGA.

Case 3. A 57-year-old farmer from central Brazil who owned a ranch with pigs and cattle, developed fever, arthralgias, myalgias, headache, and vomiting beginning 1 day before his visit to Israel on a Holy Land tour. On arrival at the ER, he was in good clinical condition and his vital signs were normal: oral temperature was 36.7°C, pulse 89 beats per minute, and blood pressure was 120/78 mmHg. Physical examination was notable only for mild conjunctival suffusion, with no nuchal rigidity, no organomegaly, and no rash. Blood count was normal: hemoglobin 15.1 g/dL, platelets 291,000/ μ L, and WBC 8,980/ μ L. Biochemistry examinations revealed a blood glucose level of 112 mg/dL, creatinine 1.1 mg/dL, BUN 23 mg/dL, sodium 139 mEq/L, potassium 4.8 mEq/L, AST 74 U/L, ALT 118 U/L, AP 185 U/L, bilirubin 0.6 mg/dL, and LDH 691 U/L. Erythrocyte sedimentation rate was 70 mm/hour. ECG demonstrated sinus rhythm with complete right bundle branch block. A urinary dipstick demonstrated hematuria. A chest X-ray did not demonstrate any abnormalities. An abdominal ultrasound demonstrated mild hydronephrosis of right kidney.

Assuming a disease of viral etiology, symptomatic treatment alone was administered. His symptoms resolved without specific therapy and he was discharged within 3 days. After his discharge, a serologic sample sent to the central parasitology laboratory for antibodies to *Leptospira* came back positive (> 200 IU) by microscopic agglutination test method.

DISCUSSION

All three cases represent diseases acquired in the country of origin of pilgrims visiting Israel on Holy Land tours. Many of

these tours start their sightseeing routes in northern Israel, around the Sea of Galilee, thus symptoms may appear during their visit in the vicinity of our medical center.

Relapsing fever, caused by spirochetes of the *Borrelia* genus, is an arthropod-borne infection that occurs in two major forms: tick-borne and louse-borne relapsing fever (LBRF), caused by *B. recurrentis*.³ It is principally a disease seen in the developing world; it is spread from person to person by the body louse and can result in epidemics.^{4,5} Infection with *B. recurrentis* is endemic in various regions in North Africa.⁶ A cross-sectional study performed in Dahr City, Ethiopia, in 2014 that screened blood samples from 407 inhabitants found that the overall prevalence of LBRF in high-risk populations was 2.5% and the rate of positivity was highest in yekolotemaries, followed by street children.⁷ During the past few years due to massive immigration of refugees from Africa, cases of LBRF among refugees who had recently arrived in Europe have been reported.^{8–10}

The mean incubation time of LBRF is 7 days (range: 4–18). The hallmark of LBRF is two or more episodes of high fever, headaches, and myalgias. Physical examination findings include mental status changes, petechiae, hepatosplenomegaly, abdominal tenderness, jaundice, abnormal lung function, and neurologic deficits.^{4,11} Laboratory tests usually demonstrate normal to mildly increased leukocyte counts, anemia, thrombocytopenia, increased liver enzyme levels, and prolonged coagulation parameters. Mortality in untreated patients may be substantial (up to 70%).⁵ A peripheral blood smear demonstrates spirochetes with a sensitivity of 70%.¹² PCR amplification has been developed for identification of most *Borrelia* species.¹³ First-line treatment consists of tetracyclines.¹⁴ In Israel, only two cases of *B. recurrentis* were reported¹⁵ in 1985 of new immigrants from Ethiopia, diagnosed by blood smear alone. At that time findings were not confirmed by molecular tools.

Anaplasmosis is a tick-borne disease caused by the bacterium *Anaplasma phagocytophilum*.¹⁶ HGA has been described in the United States and Europe with a more than 3-fold increase in incidence from 2000 to 2008 in the United States (from 351 to 1,053 cases).¹⁷ Regional estimates of HGA vary significantly by locale, with the states with the highest incidence located in northeastern U.S. regions.¹⁸ Anaplasmosis is transmitted to humans by tick bites primarily from the black-legged tick (*Ixodes scapularis*) and the western black-legged tick (*I. pacificus*). Deer and the white-footed mouse are the principal animal hosts for HGA.^{16,19} Of the four distinct phases in the tick life-cycle (egg, larvae, nymph, and adult), nymph and adult ticks are most frequently associated with transmission of anaplasmosis to humans.¹⁸ Typical symptoms occur within 1–2 weeks after a tick bite and include fever, headache, chills, and myalgias.²⁰ Severe disease has been reported in patients with factors leading to impaired immunity, such as advanced age, immunosuppressive agents, chronic illnesses, and malignancy.²¹ Lymphopenia tends to occur in the early stages of infection, followed by lymphocytosis with atypical lymphocytes. In contrast, the initial neutrophil count in patients with HGA is inversely related to the duration of symptoms before treatment is begun. Thrombocytopenia and elevated plasma levels of aminotransferases, LDH, and AP occur in most patients.²²

Anaplasmosis is initially diagnosed based on symptoms and clinical presentation, and later confirmed by the use of laboratory tests such as a peripheral blood smear for detection of intraneutrophilic morulae, specific PCR assays, and serological tests. First-line treatment of adults and children of all ages is doxycycline.²³ A case of possible HGA in Israel diagnosed by serological tests was published in 1999; no cases have been reported since.²⁴ Even this single case most probably represents a cross-reaction between antibodies for HGA and human monocytic ehrlichiosis, as the reservoir for HGA infection does not exist in Israel.²⁵

Leptospirosis is a widespread and prevalent zoonotic disease with a higher incidence in tropical regions. *Leptospira* are spiral-shaped, motile aerobic spirochetes that include nine pathogenic species.²⁶ Infection results from entry through cuts or abraded skin, mucous membranes, or conjunctivae of bacteria present in animal urine, contaminated water and soil, or infected animal tissue. Risk factors for infection include occupational exposure such as farmers and ranchers, recreational activities, and household exposure to rodents or other animals.²⁷ The incubation period is 2–26 days (average 10 days). Clinical manifestations of leptospirosis range from mild and self-limited disease to severe disease with mortality.²⁸ Patients generally present with the abrupt onset of fever, rigors, myalgias, and headache. Conjunctival suffusion is usually noted on physical examination. Disease may be complicated by jaundice and renal failure (Weil's disease).²⁹ Leukopenia and thrombocytopenia, hyponatremia, renal failure, and elevated liver enzymes may be present. Urinalysis frequently shows proteinuria, pyuria, granular casts, and microscopic hematuria. Diagnosis may be made by serological tests, PCR, or culture of the bacteria.³⁰ Treatment consists of oral doxycycline or azithromycin in mild cases and doxycycline, penicillin, or cephalosporins for patients with severe disease. A review published in 2001 found 59 cases of serologically confirmed cases of leptospirosis in Israel with an estimated annual incidence of 0.05/100,000.³¹

All presented cases represent rare or nonexistent infectious diseases in Israel. Increased international travel and better and cheaper access to air flights have allowed pilgrims from every corner of the globe to come to Israel. An increase in imported infectious diseases is seen all around the world due to globalization processes. Diagnosis of these infections relies on delayed test results that are only performed in specialized central laboratories. Thus preemptive diagnosis and treatment rely on clinical and laboratory findings and necessitate a high index of suspicion. In the first case the routine PCR test was aimed to detect *B. persica* that is endemic in Israel,^{32,33} but because acquisition of infection was suspected to occur in Ethiopia, additional inquiry was done using sequencing that resulted in correct identification as *B. recurrentis*. In all cases the final diagnostic test results arrived after the patient had been discharged. Specific infection control measures should be implied in various cases of suspected imported infectious diseases.

In conclusion, when treating pilgrims visiting Israel with suspected infectious diseases, one must consider infections acquired in their country of origin, obtain appropriate diagnostic tests, and empiric treatment should be initiated awaiting test results.

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