Blood exposure to *Babesia microti* through sharps injury

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Background

Babesia microti is an intraerythrocytic protozoa that can be transmitted through blood transfusion and organ transplantation. Sharps injuries are common in healthcare and represent potential transmission events from bloodborne pathogens, such as *B. microti*. A sharps exposure to *B. microti* has never been reported, and no guidance exists for managing exposed healthcare workers.

A 65-year-old man with a complex cardiac history, including coronary artery disease with prior myocardial infarction and stenting, multivessel coronary artery bypass grafting, type 1 diabetes mellitus, and peripheral artery disease, presented in June 2023 with several weeks of intermittent fevers and fatigue. Initial laboratory testing was notable for identification of *Babesia* on thin smear (2.7% parasitemia) and amplification of *B. microti* Deoxyribonucleic acid (DNA) using polymerase chain reaction (PCR). He had no erythema migrans rash and results of *Borrelia burgdorferi* antibody testing were negative. He was started on atovaquone and azithromycin. Three days later, he was found to be in complete heart block requiring a central venous catheter for transvenous pacing that was placed by a physician house officer at the bedside. Following insertion, the physician sustained a sharps injury from a scalpel contaminated with blood while cutting excess suture material from the patient's skin that was contaminated with blood. The physician discarded the gloves and performed hand hygiene. He was seen that day at occupational health.

Testing was ordered for the source patient including a *Babesia* thin blood smear and *B. microti* PCR, as well as human immunodeficiency virus (HIV), hepatitis B, and hepatitis C studies. The *B. microti* PCR was positive, while all the other tests were negative. Serial *B. microti* PCR tests from the source patient were persistently positive with the final positive test noted on day 19 post injury. The patient expired due to cardiac complications three days later. The exposed physician remained symptom free and had negative thin blood smear, *B. microti* PCR, and *B. microti* immunofluorescence assay (IFA) antibody one and six months following exposure. This investigation occurred during the clinical management of the patient and the exposed healthcare worker, and as quality improvement was except from Yale University Institutional Board Review.

Discussion

Babesiosis is a worldwide emerging infection caused by intraerythrocytic protozoa transmitted most commonly through ticks but also from exposure to infected blood products through transfusion or organ transplantation.[1–3] The most common cause of babesiosis is *B. microti* with endemic areas in the northeastern and northern Midwestern United States and northeastern and southwestern China.[1,3] Disease severity ranges from asymptomatic infection in about a fifth of adults to severe disease requiring hospital admission. More than 1,000 patients a year, on average, were hospitalized for babesiosis in the United States from 2011 to 2016.[3,4] Complications include cardiac, neurologic, pulmonary, renal, and hepatic impairment, as well as severe anemia, Disseminated intravascular coagulation (DIC), and shock. Fatality rates vary from 1% in the general population to 20% in highly immunocompromised hosts.[1–4]

Needlestick and sharp injuries are well-known causes of bloodborne pathogen transmission to healthcare workers. Transmission risk varies substantially by pathogen type and blood quantity transmitted, ranging from 0.3% for HIV to 30% for hepatitis B in the United States.[5] *Babesia* are bloodborne pathogens that can be transmitted through red blood cell transfusion, platelet transfusion, and organ transplantation, with associated mortality rates as high as 20%.[2]

The risk of transmitting *Babesia* through a needlestick or sharps injury is unknown because no such exposure has ever been reported. While no *Babesia* was noted on blood smear of the patient on the day of injury, *B. microti* PCR was positive and has a higher diagnostic sensitivity.[1,3] Relying on *Babesia* smears to determine transmission risk is subject to human error and a review of at least 200–300 fields under oil immersion should be performed to increase sensitivity, but is not always carried out.[3] Positive PCR testing has been associated with persistent and relapsing infection during prolonged periods of negative blood smear but positive PCR results.[3,6] DNA is rapidly cleared from the bloodstream, so a positive PCR result indicates active infection.[7] As few as four *B. microti*-infected erythrocytes have been shown to infect immunodeficient NOD.Cg-Prkdcscid Il2rgtm1Wjl/SzJ (NSG) mice and as few as 30 have infected relatively immune intact DBA/2 J mice.[8] These numbers are below the detection limit of standard blood smear and at or below the detection level of real-time PCR.[9,10] Nonetheless, the negative PCR results and long asymptomatic period in this healthcare worker are strong evidence that *B. microti* transmission did not occur.

Although needlestick and sharps injuries in health care providers treating babesiosis patients have not been reported, there is a theoretical risk of *Babesia* transmission. The incubation period for babesiosis ranges between 1–4 weeks after tick bite and 1 week to 6 months after blood transfusion.[2] Although *B. microti* transmission was not demonstrated in this healthcare worker, we suggest that blood smear and PCR or nucleic acid testing (NAT) be offered to healthcare workers with blood exposure from a patient with *B. microti* infection. Nucleic acid testing quantitates ribosomal ribonucleic acid (RNA) and is used by the Red Cross to screen blood donations for *Babesia* with a detection level of as few as 1.4 *Babesia* parasites/mL.[11,12] We suggest testing at the time of exposure, anytime *Babesia* symptoms develop up to 6 months

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after exposure, and at 6 months post exposure. The bloodborne transmission potential of babesiosis should be taught to healthcare workers in endemic regions.

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