



Exchange transfusion for babesiosis when, how, and how long?

Pramod K. Guru, John C. O'Horo¹, Heidi D. Lehrke², Jeffrey L. Winters², John W. Wilson¹

Abstract

Babesiosis is a zoonotic disease transmitted by *Ixodes* ticks seen in the United States and parts of Europe. Because of the typically mild course of most infections, the disease is uncommonly seen in clinical practice. However, asplenic patients can develop a life-threatening infection. The first line of therapy for *Babesia* infections is antiparasitic medications; however, red blood cell (RBC) exchange transfusion has been described as an adjunct therapy. We describe a severe case of babesiosis in an asplenic patient and review the evidence, indications, and protocols for RBC exchange transfusion in this setting.

Keywords: Babesiosis, exchange transfusion, infection

Access this article online

Website: www.ijccm.org

DOI: 10.4103/0972-5229.194017

Quick Response Code:



Introduction

Babesiosis is an intraerythrocytic infection caused by the protozoan genus *Babesia*, with three different known species: *Babesia bovis*, *Babesia microti*, and *Babesia divergens*. The zoonotic life cycle is maintained by the tick vector *Ixodes scapularis*, and humans are an incidental host. The exact incidence of infection is not known, but the organism is endemic in Northeastern and upper Midwestern areas of the United States. Both the incidence and severity are higher in the elderly and asplenic patients.^[1] Case fatality rates among hospitalized patients vary, and up to 5%–9% have been reported in the literature.^[2] Severe cases can cause multi-organ dysfunction similar to malaria. In malaria, red blood cell (RBC) exchange transfusion has been historically used for severe cases, and because of this, babesiosis cases have been treated with this therapy. We describe a case of severe *Babesia* infection successfully treated with RBC exchange and discuss indications for using this intervention.

Case Report

A previously healthy 67-year-old man from Northern Wisconsin, USA, with a distant history of Hodgkin's disease and subsequent splenectomy admitted to a local hospital during the summer, complaining of the malaise of 2 weeks duration and a single episode of syncope. He reported several days of intermittent fevers with chills, nausea, and vomiting. He described episodes of tick bites on his back a month earlier, and was empirically treated with doxycycline for presumed differential diagnosis of anaplasmosis versus ehrlichiosis. Three days later, he returned to the emergency department with continuing symptoms. At that time, he was febrile to 39°C and tachycardiac with hypotension and tachypnea. Laboratory analysis showed acute renal failure (serum creatinine 2.3 mg/dl, baseline 0.9 mg/dl) and lactate of 3.6 mmol/dl. His peripheral blood smear showed features of *B. microti*, with a parasitemia of 28.5% [Figure 1a]. Blood testing by PCR was negative for *Anaplasma* spp.,

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

From:

Department of Critical Care Medicine, Mayo Clinic, Jacksonville, FL, ¹Department of Medicine, Division Infectious Disease, Mayo Clinic, ²Department of Laboratory Medicine and Pathology, Division of Transfusion Medicine, Mayo Clinic, Rochester, MN, USA

Correspondence:

Dr. Pramod Kumar Guru, Department of Critical Care Medicine, Mayo Clinic, Jacksonville, FL, USA.
E-mail: guru.pramod@mayo.edu

For reprints contact: reprints@medknow.com

How to cite this article: Guru PK, O'Horo JC, Lehrke HD, Winters JL, Wilson JW. Exchange transfusion for babesiosis when, how, and how long?. Indian J Crit Care Med 2016;20:674-6.

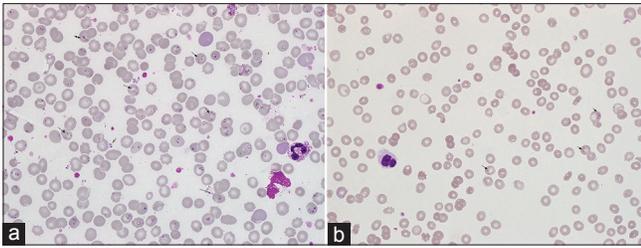


Figure 1: (a) Pre-red blood cell exchange peripheral blood smear revealing abundant (28.5%) intracellular and occasional extracellular parasitic ring forms of *Babesia microti* (Giemsa, $\times 600$). Variable morphology of *Babesia* trophozoites (solid arrows) in red blood cell, a classic tetrad resembling Maltese cross (double arrow) and extracellular ring trophozoites (hollow arrows). (b) Post-red blood cell exchange peripheral blood smear revealing occasional (3.1%) intracellular parasitic ring forms of *Babesia microti* (Giemsa, $\times 600$). Variable morphology of *Babesia* trophozoites (solid arrows) in red blood cell

Ehrlichia spp., and *Borrelia* spp. but positive for *B. microti*. He was given atovaquone and azithromycin before transfer. On arrival to the medical intensive care unit, respiratory status had decompensated, hypoxemia with SaO_2 below 90% requiring O_2 by nasal cannula, further and he had progressive anemia with evidence of hemolysis (hemoglobin 8.8 mg/dl, lactate dehydrogenase 1608 U/l and total bilirubin 8.5 mg/dl), worsening renal failure (serum creatinine 3.08 mg/dl), and emerging hepatic injury (aspartate aminotransferase 123 U/l, alanine transaminase 72 U/l, alkaline phosphatase 115 U/l, and total bilirubin 8.5 mg/dl). A diagnosis of fulminant babesiosis with impending respiratory failure was made. His pharmacologic treatment was changed to oral quinine and intravenous clindamycin. After a single emergent automated RBC exchange, the parasitemia decreased to 3.1% [Figure 1b]. The patient improved significantly within 24 hours of exchange transfusion and was discharged home on day 6 with oral atovaquone, doxycycline, and azithromycin. His blood smear was negative for *Babesia* 12 days after initial presentation, and he continued antimicrobial therapy for 30 days following his last negative smear. He continues to do well with negative blood smears.

Discussion

The current case describes an unusually good outcome for an asplenic patient with severe babesiosis, to which we believe automated RBC exchange transfusion predominantly contributed. The first descriptions of RBC exchange transfusion for severe babesiosis in an asplenic patient with 13% parasitemia occurred in 1981, but the report offered neither guidance as to when it should be considered nor protocol for its execution.^[3]

The specific application of RBC exchange transfusion remains ill-defined in the treatment of babesiosis.

The use and benefits are mainly extrapolated from the treatment of severe malaria. The similarities in the organisms' life cycle and erythrocytic invasion mechanism would seem to suggest that RBC exchange transfusion should provide benefit, however, even in malaria, there is only one nonpeer reviewed randomized trial supporting its use, and a recent analysis performed by the Centers for Disease Control and Prevention has suggested that it is not effective compared to medical management.^[4,5] However, the prevalence of babesiosis is much lower, making it more difficult to systematically study and typically is milder. The American Society for Apheresis (ASFA) in its most recently published guidelines has recommended RBC exchange in severely affected individuals as an ASFA category I indication with a recommendation grade of 1C.^[6] The use of RBC exchange in asymptomatic but high-risk patients (e.g., asplenic patients) has been categorized by ASFA as category II indication with a recommendation grade of 2C. The most recent Infectious Disease Society of America guidelines suggest that high-grade parasitemia, significant hemolysis, or end-organ disease in the liver, kidney, or lungs are indications for RBC exchange transfusion.^[7] Indications for RBC exchange transfusion that have been used in other reports include:^[8-10]

- Elderly patients, age >50
- Coma
- Disseminated intravascular coagulation
- Pregnancy
- Pediatric patients, age <12 months.

In patients with babesiosis or malaria, RBC exchange transfusion reduces the parasitemia load by directly removing the infected cells. Reducing parasitemia avoids further hemolysis, release of chemokines responsible for target organ damage such as renal failure, tissue hypoxemia, and further propagation of disseminated intravascular coagulation. Other mechanisms for successful exchange transfusion outcomes may include altering the rheologic properties of the blood. *Plasmodium falciparum* malaria alters the surface properties of RBC, making them less deformable and more adherent. This, in turn, affects perfusion and blood flow, and RBC exchange transfusion may, therefore, help improve blood flow and oxygen delivery by noninfected erythrocytes. It is not known whether the same alterations occur with babesiosis, but given the similarities in life cycle and common hemolysis, this may contribute. The ASFA guidelines on *Babesia* note that the primary benefits of RBC exchange transfusion seem to be the rapid therapeutic effectiveness of parasitemia load reduction; thus, in severe cases, the benefits of the procedure usually outweigh any associated risk.^[6]

The guidelines recommend that a one red cell volume exchange transfusion be performed which replaces all but 10%–15% of the patient's original RBCs. Treatment with RBC exchange transfusion is indicated until the patient's parasite burden is less than 5%.^[6]

Conclusion

Babesiosis can cause life-threatening infection in elderly asplenic patients. Early institution of exchange transfusion in cases of babesiosis with high-grade parasitemia can rapidly reduce the parasitemia load and along with appropriate antimicrobial therapy, may significantly increase the likelihood of successful treatment outcomes. More studies are needed to further confirm the benefit of RBC exchange transfusion compared to medical management alone in this patient population and also to further clarify a threshold of parasitemia load that warrants consideration for exchange transfusion.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Powell VI, Grima K. Exchange transfusion for malaria and *Babesia* infection. *Transfus Med Rev* 2002;16:239-50.
2. Hatcher JC, Greenberg PD, Antique J, Jimenez-Lucho VE. Severe babesiosis in Long Island: Review of 34 cases and their complications. *Clin Infect Dis* 2001;32:1117-25.
3. Cahill KM, Benach JL, Reich LM, Bilmes E, Zins JH, Siegel FP, *et al.* Red cell exchange: Treatment of babesiosis in a splenectomized patient. *Transfusion* 1981;21:193-8.
4. Miller KD, Greenberg AE, Campbell CC. Treatment of severe malaria in the United States with a continuous infusion of quinine gluconate and exchange transfusion. *N Engl J Med* 1989;321:65-70.
5. Tan KR, Wiegand RE, Arguin PM. Exchange transfusion for severe malaria: Evidence base and literature review. *Clin Infect Dis* 2013;57:923-8.
6. Schwartz J, Winters JL, Padmanabhan A, Balogun RA, Delaney M, Linenberger ML, *et al.* Guidelines on the use of therapeutic apheresis in clinical practice-evidence-based approach from the writing committee of the American Society for Apheresis: The sixth special issue. *J Clin Apher* 2013;28:145-284.
7. Wormser GP, Dattwyler RJ, Shapiro ED, Halperin JJ, Steere AC, Klemperer MS, *et al.* The clinical assessment, treatment, and prevention of lyme disease, human granulocytic anaplasmosis, and babesiosis: Clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis* 2006;43:1089-134.
8. Spaete J, Patrozou E, Rich JD, Sweeney JD. Red cell exchange transfusion for babesiosis in Rhode Island. *J Clin Apher* 2009;24:97-105.
9. Jacoby GA, Hunt JV, Kosinski KS, Demirjian ZN, Huggins C, Etkind P, *et al.* Treatment of transfusion-transmitted babesiosis by exchange transfusion. *N Engl J Med* 1980;303:1098-100.
10. Vannier E, Krause PJ. Human babesiosis. *N Engl J Med* 2012;366:2397-407.