

# Gestational Lyme Disease Bibliography

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*Transmission of Lyme disease by tick is well known. However, some studies have provided evidence of gestational transmission and others have suggested transmission through lactation. In addition, transmission by intimate human contact has been hypothesized. Given the implications, for the fetus and infants, it is essential that more research be done in this area, so that the mother can be treated efficaciously.*



Bale, J. F., Jr. and J. R. Murph (1992). "Congenital infections and the nervous system." Pediatr Clin North Am **39**(4): 669-90.

*Borrelia burgdorferi* can potentially infect the fetus and cause adverse fetal outcomes.

Gardner, T. (1995). Lyme disease. Infectious diseases of the fetus and newborn infant. J. S. Remington and J. O. Klein. Philadelphia, Saunders. **Chap. 11**: 447-528.  
"A total of 46 cases of adverse outcomes of these 161 cases of gestational Lyme borreliosis were found, including miscarriage, stillbirth, perinatal death, congenital anomalies, systemic illness, early-onset fulminant or mild sepsis and later-onset chronic progressive infection....Thirty-seven percent of the total number of adverse outcomes were miscarriages or fetal deaths, 11 percent were neonatal deaths and 48 percent were either fetal or neonatal deaths." The effect of antibiotic therapy was dramatic in these patients: with antibiotics, 85% of neonates were normal, while 15% had an adverse outcome. In striking contrast, without antibiotics, only 33% were normal, while 67% had an adverse outcome.

MacDonald, A. B. (1986). "Human fetal borreliosis, toxemia of pregnancy, and fetal death." Zentralbl Bakteriol Mikrobiol Hyg [A] **263**(1-2): 189-200.

MacDonald, A. B. (1989). "Gestational Lyme borreliosis. Implications for the fetus." Rheum Dis Clin North Am **15**(4): 657-77.

Great diversity of clinical expression of signs and symptoms of gestational Lyme borreliosis parallels the diversity of prenatal syphilis. It is documented that transplacental transmission of the spirochete from mother to fetus is possible. Further research is necessary to investigate possible teratogenic effects that might occur if the spirochete reaches the fetus during the period of organogenesis. Autopsy and clinical studies have associated gestational Lyme borreliosis with various medical problems including fetal death, hydrocephalus, cardiovascular anomalies, neonatal respiratory distress, hyperbilirubinemia, intrauterine growth retardation, cortical

blindness, sudden infant death syndrome, and maternal toxemia of pregnancy. It is my expectation that the spectrum of gestational Lyme borreliosis will expand into many of the clinical domains of prenatal syphilis.

MacDonald, A. B., J. L. Benach, et al. (1987). "Stillbirth following maternal Lyme disease." N Y State J Med **87**(11): 615-6.

Markowitz, L. E., A. C. Steere, et al. (1986). "Lyme disease during pregnancy." Jama **255**(24): 3394-6.  
Because the etiologic agent of Lyme disease is a spirochete, there has been concern about the effect of maternal Lyme disease on pregnancy outcome. We reviewed cases of Lyme disease in pregnant women who were identified before knowledge of the pregnancy outcomes. Nineteen cases were identified with onset between 1976 and 1984. Eight of the women were affected during the first trimester, seven during the second trimester, and two during the third trimester; in two, the trimester of onset was unknown. Thirteen received appropriate antibiotic therapy for Lyme disease. Of the 19 pregnancies, five had adverse outcomes, including syndactyly, cortical blindness, intra-uterine fetal death, prematurity, and rash in the newborn. Adverse outcomes occurred in cases with infection during each of the trimesters. Although B burgdorferi could not be implicated directly in any of the adverse outcomes, the frequency of such outcomes warrants further surveillance and studies of pregnant women with Lyme disease.

Schlesinger, P. A., P. H. Duray, et al. (1985). "Maternal-fetal transmission of the Lyme disease spirochete, *Borrelia burgdorferi*." Ann Intern Med **103**(1): 67-8.

Weber, K., H. J. Bratzke, et al. (1988). "*Borrelia burgdorferi* in a newborn despite oral penicillin for Lyme borreliosis during pregnancy." Pediatr Infect Dis J **7**(4): 286-9.

Brzostek, T. (2004). "[Human granulocytic ehrlichiosis co-incident with Lyme borreliosis in pregnant woman—a case study]." *Przegl Epidemiol* **58**(2): 289-94.

Thrombocytopenia, fever and fatigue were observed in a 25 year-old woman in her 29<sup>th</sup> week of pregnancy in a Lyme endemic area. In the last 7 weeks erythema migrans was present. The woman was not treated by that time. The infant presented thrombocytopenia in the first few weeks of life. 3 months after delivery erythema migrans disseminata was observed, by that time Lyme borreliosis and HGE were serologically confirmed. It was not confirmed that the infection was transferred to the infant, but it is possible that thrombocytopenia was caused by the infection with *A. phagocytophila*.

Goldenberg, R. L. and C. Thompson (2003). "The infectious origins of stillbirth." *Am J Obstet Gynecol* **189**(3): 861-73. In areas where syphilis is very prevalent, up to half of all stillbirths may be caused by this infection alone. Malaria may be an important cause of stillbirth in women infected for the first time in pregnancy. *Toxoplasma gondii*, ... and Lyme disease have all been implicated as etiologic for stillbirth.

Gustafson, J. M., E. C. Burgess, et al. (1993). "Intrauterine transmission of *Borrelia burgdorferi* in dogs." *Am J Vet Res* **54**(6): 882-90.

10 female Beagles were inoculated intradermally with ...*B. burgdorferi*. Of 10 spirochete-inoculated (SI) females, 8 became infected with *B. burgdorferi* as evidenced by spirochete culture results and/or PCR-detected *B. burgdorferi* DNA in the tissues of females or their pups. Of the 10 SI females, 8 delivered litters (3 to 7 pups) that had at least 1 neonatal or 6-week-old pup with *B. burgdorferi* DNA-positive tissues (by PCR), and spirochetes were cultured from tissues from pups of 2 litters.

### Lactation

Schmidt, B. L., E. Aberer, et al. (1995). "Detection of *Borrelia burgdorferi* DNA by polymerase chain reaction in the urine and breast milk of patients with Lyme borreliosis." *Diagn Microbiol Infect Dis* **21**(3): 121-8. In addition to urine, breast milk from two lactating women with erythema migrans was tested and also found reactive.

Altaie, S. S., S. Mookherjee, et al. (1996). Abstract # I-17 Transmission of *Borrelia burgdorferi* from experimentally infected mating pairs to offspring in a murine model. FDA Science Forum. Transmission via breast milk demonstrated in murine model.

Maraspin, V., J. Cimperman, et al. (1999). "Erythema migrans in pregnancy." *Wien Klin Wochenschr* **111**(22-23): 933-40. From 1990 through to 1997, 105 pregnant women with typical EM were investigated at the Lyme Borreliosis Outpatients' Clinic of the Department of Infectious Diseases at the University Medical Centre in Ljubljana, Slovenia. All patients were treated for 14 days except three (2.9%) in whom the treatment with ceftriaxone was discontinued because of mild side effects. Ninety-three (88.6%) out of 105 patients had normal pregnancies; the infants were delivered at term, were clinically healthy, and subsequently had a normal psychomotor development. In the remaining 12 (11.4%) patients an adverse outcome was observed. Two (1.9%) pregnancies ended with an abortion (one missed abortion at 9 weeks, one spontaneous abortion at 10 weeks), and six (5.7%) with preterm birth. One of the preterm babies had cardiac abnormalities and two died shortly after birth. Four (3.8%) babies born at term were found to have congenital anomalies; one had syndactyly at birth and three had urologic abnormalities which were registered at the age of 5, 7, and 10 months, respectively. A causal association with borrelial infection was not proven in any infant. For at least some unfavourable outcomes a plausible explanation not associated with Lyme borreliosis was found.

Harvey, W. T. and P. Salvato (2003), "Lyme disease: ancient engine of an unrecognized borreliosis pandemic?," *Medical Hypotheses* **60**(5), 742–759.

No serious or credible epidemiological studies have attempted to identify the true rate of human congenital [Bb] transfer. The only method we have of estimating congenital human [Bb] transfer is by other intra-human illnesses. Transfer rates of Cytomegalovirus, Toxoplasmosis and *Treponema pallidum* range from 14% to 68%.

### Transplacental Babesia infection in dogs

"This is the first confirmed report of transplacental *Babesia* infection in any animal species."

A *Babesia gibsoni* infected bitch was mated with an uninfected dog in order to determine whether this parasite could be vertically transmitted. The bitch delivered a litter of four live and one stillborn pup. The four pups died from congenital babesiosis between 14 and 39 days post-birth. *Babesia gibsoni* DNA was detected in tissue from all five pups. These results show that vertical transmission occurred by the uterine route and not via the transmammary route. This is the first confirmed report of transplacental *Babesia* infection in any animal species.

Fukumoto S., Fatal experimental transplacental *Babesia gibsoni* infections in dogs, *Int J Parasitol*. 2005 Jun 23