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Transplacental Transmission of *Borrelia burgdorferi* In a Murine Model

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Congenital *B. burgdorferi* infections have been reported in the literature in three neonates whose mothers had Lyme borreliosis during the first trimester of pregnancy. In an effort to facilitate studying Lyme borreliosis during pregnancy a murine model was developed. Splenectomized mating pairs, 6-8 week-old C3H/HeJ mice, were divided into groups A-D. Group A: infected females, uninfected males; group B: infected males, uninfected females: group C: infected males and females; and group D (control): uninfected males and females. The infectious dose was 10^6-10^7 *B. burgdorferi* (strains 297, W18, and Son-1) in 250 ul SKB II media administered subcutaneously. The control group receivedsterile SKB II. The studies were performed in two phases. In phase one the males were infected and immediately mated. The day of coital plugging was established as day 1 of pregnancy. The pregnant mice were then infected during early- [day 6-7 post copulation (PC)], middle-(day 9-10 PC) and late- (day 12-13 PC) gestation periods. Period mice were sacrificed 6 days post infection. Fetuses and their placentas were harvested and cultured for nine weeks in SKB II. No *B. burgdorferi* was detected by culture, thus, PCR was performed on the cultures for detection of *B. burgdorferi* DNA. There were no appreciable differences observed in transmission rates among the three *B. burgdorferi* strains, therefore, the data were pooled. No *B. burgdorferi* was detected in samples from group B. In groups A and C combined, during early-gestation *B. burgdorferi* was detected in 4/30 (13%) fetuses and 3/30 (10%) placentas. During middle-gestation *B. burgdorferi* was detected in 3/57 (5%) fetuses and 4/57 (7%) placentas. No *B. burgdorferi* was detected in fetuses or placenta during late-gestation period.

In phase two studies mating pairs were assigned to groups A-D and were infected immediately prior to mating. The pregnancies were allowed to go to term and the pups were sacrificed at 1, 7, 14, and 21 days of age. The milk content of the stomach, sections from ear, skin, heart, liver, spleen, brain, bladder, and kidney of all pups were cultured for *B. burgdorferi*. Milk was not cultured from sacrificed 21 day-old weanlings. Transmission to offspring was indicated when *B. burgdorferi* was isolated from any tissue. Of 25 infected females, 2 (8%) transmitted *B. burgdorferi* to their pups on day one via their milk. No transmission was detected via milk on days 7 or 14. Among 49 infected females from groups A and C, 5 (10.2%) transmitted *B. burgdoferi* to their pups either in utero or intrapartum. Two of the transmissions were detected on day 1, two on day 7, and one on day 14. From the 132 pups at risk for close contact infection in group B, 9 pups were infected resulting in a close contact transmission rate of 6.8%. This transmission model suggests that *B. burgdorferi* can be transmitted in utero. Increasing the inoculum size and/or changing the route of inoculation to intrauterine or intra-amniotic may enhance infection rates. This model has the potential to be used to study intervention strategies for gestational Lyme disease.

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