# **Borrelia Infections**

*Borrelia* are spirochaetes, causing two main human disease groups:

1. **Lyme disease (Lyme borreliosis)**
2. **Relapsing fevers** (louse-borne, tick-borne, *B. miyamotoi*)

## **I. Lyme Disease (Lyme Borreliosis)**

### **Epidemiology**

* **Most common tick-borne disease in Northern Hemisphere.**
* **Causative organisms**:
  + US → *Borrelia burgdorferi sensu stricto*.
  + Europe/Asia → *B. garinii*, *B. afzelii*, *B. burgdorferi s.s.* (i.e the entirity, the sensu lato complex).
* **Vector: Ixodes**
  + *Ixodes scapularis* - US NE/Midwest
  + *I. pacificus* - Pacific US
  + *I. ricinus* - Europe
  + *I. persulcatus* - Asia.
* **Reservoirs**: Rodents and birds.
* **UK incidence**: ~2–3,000 confirmed cases/year; highest in South England and Scottish Highlands.

### **Clinical Features**

* **Stage 1 (Early Localised)**:
  + *Erythema migrans* (diagnostic expanding rash, >5 cm).
  + Local lymphadenopathy, flu-like illness.
  + Rare: *Borrelial lymphocytoma* (Europe).
* **Stage 2 (Early Disseminated)**:
  + Multiple EM lesions.
  + Neuro: lymphocytic meningitis, cranial nerve palsy (esp. facial), radiculitis.
  + Cardiac: AV block, myocarditis.
* **Stage 3 (Late/Persistent)**:
  + Arthritis (mono/oligo, esp. knee; common in US).[*B. burgdorferi]*
  + Acrodermatitis chronica atrophicans (Europe). [*B. afzelii]*
  + Chronic neuroborreliosis (polyneuropathy, encephalopathy). [*B. garinii]*

### **Diagnosis**

* **Clinical**: Erythema migrans is diagnostic
* **Serology**: 2-tier (ELISA → Western blot). Negative early; cross-reactions possible.
* **PCR**: Useful for CSF, synovial fluid, skin biopsies (variable sensitivity).
* **Culture**: Rare, BSK medium.

### **Treatment**

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| **Clinical Presentation** | **Adults & ≥12y** | **Children 9–12y** | **Children <9y** | **Pregnancy** |
| **Erythema migrans,**  **non-focal systemic symptoms, cranial nerve**  **peripheral neuroborreliosis** | * **Doxycycline 100 mg bd × 21d** * Amoxicillin 1 g tds × 21d * Azithromycin 500 mg od × 17d | Doxycycline 5 mg/kg day 1, then 2.5 mg/kg  IV Ceftriaxone 80 mg/kg od | Avoid doxycycline  Amoxicillin 30 mg/kg tds  IV Ceftriaxone 80 mg/kg od | Avoid doxycycline |
| **Central nervous system** | * **IV Ceftriaxone 4 g × 21d** * **D**oxycycline 200 mg bd × 21d |
| **Arthritis**  **Acrodermatitis chronica atrophicans** | * **Doxycycline 100 mg bd × 28d** * **Amoxicillin 1 g tds × 28d** * **IV Ceftr**iaxone 2 g × 28d |
| **Lyme carditis – stable** | * **Doxycycline 100 mg bd × 21d** * IV Ceftriaxone 2 g × 21d |
| **Lyme carditis – unstable** | * **IV Ceftriaxone 2 g × 21d** |

**Special notes:**

* Children: doxycycline allowed from 9y if severe (off-label but NICE-endorsed).
* Azithromycin: reserve if others unsuitable; avoid in carditis.
* Pregnancy: avoid doxycycline/azithromycin → use amoxicillin or ceftriaxone.
* Jarisch–Herxheimer reaction may occur after antibiotics.

## **II. Relapsing Fevers (LBRF, TBRF, B. miyamotoi)**

### **Epidemiology**

* **Louse-borne RF (LBRF):** *B. recurrentis*, transmitted by *Pediculus humanus corporis*.
  + Human-only host.
  + Historically epidemic; now Horn of Africa, refugee/homeless settings in Europe.
* **Tick-borne RF (TBRF):** Many species (*B. hermsii, B. duttonii, B. turicatae* etc.).
  + Soft ticks (*Ornithodoros* spp.) → feed rapidly at night, unnoticed.
  + Africa, Asia, Americas, southern Europe.
* ***Borrelia miyamotoi*:**
  + *Ixodes* hard ticks (same as Lyme).
  + Found in Europe, Russia, Japan, US.
  + Maintained in rodent reservoirs.

### **Clinical Features**

* Incubation 7–12 d.
* Sudden high fever, chills, sweats, headache, myalgia, GI upset.
* Rash sometimes.
* **Relapsing fever episodes:** 2–7 d febrile illness alternating with afebrile periods (days–weeks).
* Relapses due to antigenic variation.
* **LBRF:**
  + Severe, often 1–5 relapses.
  + CFR up to 30–70% untreated.
  + Complications: hepatosplenomegaly, jaundice, nephritis, myocarditis, neuropathy, meningitis.
* **TBRF:**
  + Milder, more relapses (up to 10–11).
  + CFR <10% (higher in pregnancy/children).
  + Neuro/myocardial involvement more common than Lyme.
* ***B. miyamotoi*:** Febrile illness ± relapses (~10%), sometimes neuro/cognitive involvement. Mild leucopenia, ↑transaminases.

### **Diagnosis**

* **Blood films during fever:** Large spirochaetes visible on Giemsa/Field stains. Sensitivity 70% LBRF, lower TBRF.
* **Buffy coat, dark-field/phase-contrast** can aid detection.
* **PCR**: sensitive, species identification.
* **Culture**: experimental, not routine.
* **Serology**: limited, cross-reactive, not standardised.

### **Treatment**

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| **Condition** | **Treatment** |
| **LBRF** *B. recurrentis* | **Single-dose doxycycline 100 mg**  (alt. IM procaine penicillin, erythromycin). |
| **TBRF** | **Doxycycline 100 mg bd × 5–10 d**  (alt erythromycin). |
| **CNS involvement** | **IV Ceftriaxone 2 g od × 10–14 d**  (alt. IV penicillin G 3 MU q4h). |
| ***B. miyamotoi*** | Doxycycline 100 mg bd × 10–14 d. |
| **Jarisch–Herxheimer reaction** | Occurs in 30–100% (esp. LBRF). Supportive management essential. |

# **Exam Pearls**

* **EM rash = treat empirically** (do not wait for serology).
* *B. garinii* → neuroborreliosis; *B. afzelii* → acrodermatitis; *B. burgdorferi* s.s. → arthritis.
* **Jarisch–Herxheimer reaction**: must mention in relapsing fever answers.
* LBRF = human-specific, higher mortality. TBRF = zoonotic, more relapses, lower mortality.
* *B. miyamotoi* transmitted by *Ixodes* ticks but clinically resembles relapsing fever.
* Post-treatment Lyme symptoms do **not** indicate active infection → prolonged antibiotics not recommended.