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Molecular diagnosis of *Borrelia* infection

Borrelia is a genus of spirochete bacteria and the causative agent of the vector-borne lyme disease. Depending on the bacterial species, infection is transmitted via bites from ticks of the *Ixodus* genus or lice. Of the 52 known species of *Borrelia*, 12 are known to cause Lyme disease or borreliosis and are transmitted by ticks. The major *Borrelia* species causing Lyme disease are *Borrelia burgdorferi*, *Borrelia afzelii*, and *Borrelia garinii*. In North America, *B. burgdorferi* sensu stricto and *B. mayonii* species cause Lyme, whereas in Europe and Asia *B. afzelii* and *B. garinii,* also referred to as *B. burgdorferi* sensu lato, can also cause lyme disease. The sheep tick, *I. ricinius,* is the primary vector of the disease in Europe.

It is estimated that there are 2000-3000 new cases of Lyme disease in England and Wales each year with around 15% cases contracted abroad. Cases are more commonly diagnosed in the summer season relative to tick numbers.

Infection with *B. burgdorferi,* (including *B. garinii* and *B. afzelii*), can manifest itself in a range of dermatological, neurological, cardiac, and musculoskeletal disorders. Early infection with *Borrelia* can present as a classical ‘bulls eye’ rash (erythema migrans). Subsequently the infection can disseminate to the skin, central nervous system (CNS) and heart. *Borrelia burgdorferi* is known to invade the CNS and be neurotropic, leaving the cerebrospinal fluid (CSF) to adhere to glial cells or other brain tissue[1]. Once in the CNS, *B. burgdorferi*, may remain latent, only to re-activate and cause illness months later. Chronic, disseminated infection is associated with high morbidity and may cause impairment of motor or sensory functions and cognitive problems. Early diagnosis and treatment is effective in preventing long lasting irreversible symptoms.

The early serodiagnosis of Lyme disease is difficult because the antibody response in the first weeks of infection is absent or barely detectable[2].

Furthermore, there is little diagnostic value in antibody assays in distinguishing between active and inactive infection because antibody persists after therapy. *Borrelia burgdorferi* can be recovered from CSF, skin and blood by culture, however culture is not a gold standard for *Borrelia* due to its lack of sensitivity[3]. The spirochaetes grow slowly and cultures need to be monitored for up to 12 weeks, with results confirmed by microscopy, PCR or staining by specific monoclonal antibodies[3].

Molecular amplification has the advantage of being a highly sensitive and rapid technique. In blood, the bacteraemia is transient and high detection rates can be expected only during a short period of the primary infection[4]. A high correlation has been found between the detection of *B. burgdorferi* by PCR and the presence of erythema migrans [5,6]. In 2010 the European Federation of Neurological Sciences published guidelines stating that although PCR on CSF samples has a low sensitivity, it may be useful for the identification of very early Lyme neuroborreliosis where there are no detectable antibodies or in patients with immunodeficiency[3].

EDTA whole blood, CSF and tissue samples are validated sample types for *Borrelia* genus DNA detection. Other samples may be tested and reported along with an appropriate caveat. We have previously extracted and detected *Borrelia burgdorferi* DNA from tick specimens.

Micropathology Ltd uses nested PCR targeting the *Borrelia* flagellin gene for qualitative detection of *Borrelia* spp. *Borrelia* species including, but not limited to, *B. burgdorferi, B. afzelii, B. garinii, B. lonestari,* and *B. andersonii* are detected with this assay. The assay is included in annual external quality assurance schemes.

References

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