

日本におけるライム病関連ボレリアの 鞭毛蛋白遺伝子塩基配列比較による系統解析

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A Phylogenetic Analysis of *Borrelia burgdorferi* sensu lato Isolates Associated with Lyme Disease in Japan by Flagellin Gene Sequence Determination

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ABSTRACT We determined nearly complete flagellin gene sequences for *Borrelia burgdorferi* sensu lato isolates (11 isolates obtained from *Ixodes persulcatus* ticks and patients in Hokkaido, Japan, and 1 European isolate) representing six different restriction fragment length polymorphism (RFLP) ribotype groups following cloning of the PCR-amplified genes. These sequences were aligned with those of representatives of the three *Borrelia* species associated with Lyme disease, and a phylogenetic tree was constructed by the Clustal method. On the Lyme disease borrelia portion of the tree, the species were clearly delineated into three different phylogenetic groups, in complete agreement with the division of *B. burgdorferi* sensu lato into three species. A phylogenetic analysis revealed that the representatives of RFLP ribotype groups IV, V and VI clustered tightly with each other and belonged on the same branch as *Borrelia garinii*. We used the criteria that are currently used to delineate bacterial species and determined the levels of DNA relatedness for these *Borrelia* isolates. For the RFLP ribotype group IV, V and VI isolates, the levels of DNA relatedness ranged from 79 to 88%, and the levels of DNA relatedness to the reference strain of *B. garinii* ranged from 70 to 80%. The levels of DNA relatedness of the RFLP ribotype IV, V and VI isolates to the representatives of other species associated with Lyme disease ranged from 53 to 66%. All of these

findings indicate that the RFLP ribotype group IV, V and VI isolates should be included in the species *B. garinii*.

抄録 ライム病関連ボレリアの鞭毛蛋白遺伝子の塩基配列を決定し系統解析を行った。鞭毛蛋白遺伝子に基づく系統樹は3つのクラスターに分岐し、既存の3種のライム病ボレリアの分類と一致したことから、鞭毛蛋白遺伝子の系統解析がライム病ボレリアの種の分類に有用であることが示された。また、RFLP ribotype 解析の group IV～VI に属する分離株はこの系統解析において group II の *Borrelia garinii* のクラスターに分類されたが、group II の分離株とは別のサブクラスターを形成し *B. garinii* との DNA 相同性が 70～80% と低いことから、group IV～VI の分離株は *B. garinii* のサブグループであることが明らかになった。