Case Report: Erythema caused by a Local Skin Infection with

Arthrobacter mysorens

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**ABSTRACT**

A case of an erythema resembling Lyme-Disease like Erythema migrans but with atypical symptoms like persistent pruritus is reported. The patient had no history of a recent tick-bite but displayed a positive serology for an advanced stage of Lyme-Borreliosis, which stood in contrast to the tentative diagnosis of Erythema migrans as a symptom of early Lyme-Disease. *Arthrobacter mysorens*, a soil bacterium, was isolated from the affected skin and from soil collected in the area where the patient possibly acquired the infection. The identity of both isolates was accomplished by molecular finger printing methods. *Arthrobacter mysorens* was proved to be the causative agent for the erythema by direct isolation from the affected skin and a positive serology, thus supporting the atypical appearance of the erythema compared to Erythema migrans caused by *Borrelia* Infection. Infections with *Arthrobacter mysorens* might be underreported and microbiologic diagnostic techniques should be applied in cases of patients with unclear erythemas, resembling Erythema migrans, without a history of tick-bites.
Background. Skin erythemas of unknown origin are a frequent reason for consulting the general practitioner or the dermatologist. Among many clinicians, laminary spreading erythemas are often leading to the tentative diagnosis of a tick-bite associated Erythema migrans (EM), a symptom of early localized infection with *Borrelia burgdorferi (sensu lato)* (1, 2). As the development of an immunologic response to this infection usually takes 4 to 6 weeks and the incubation period for Erythema migrans is typically 7 to 14 days, early Lyme-Borreliosis often presents itself with a negative serology (3, 4). In addition tick bites are not always described or remembered by the patient. Thus the diagnosis is mostly based on the clinical symptoms. In its typical appearance, EM is a homogenous spreading, indolent, erythematous, oval shaped lesion with a bright red border and a central clearing. Minimal pruritus might be present in an early stage. EM develops at the site of the tick bite and therefore can be located on any part of the body. Mild systemic symptoms like low-grade fever and chills might be present. EM in the United States is often associated with more prominent signs of inflammation, compared to Europe (1-4). This case report illustrates that erythemas caused by other pathogens might resemble this clinical picture, thus a possibility of a wrong tentative diagnosis exists which might complicate and prolong the illness.

Case presentation. In June early Summer, a nine-year old boy spent four hours in a forest to build a special forest track to ride his mountain bike. He returned home with a dirty shirt in particular at the right side of the chest, very close to the right acromastium (Fig. 1). A small erythema with an average diameter of one centimetre and a clear-cut red edge above the right acromastium was apparent on the next day. His mother suspected a potential insect or tick bite, although no tick could be found. The then conducted Lyme disease-specific ELISA was negative for IgM antibodies but positive for IgG. An immunoblot (Recomblot Borrelia, Mikrogen,
Germany) with the patient’s serum revealed a *B. burgdorferi sensu lato*-specific, IgG antibody responses to p100, p41, BmpA, OspC (weakly positive), p41, and p18 but no IgM-specific antibody response was detected. This finding was consistent with a \textit{Borrelia} infection in an advanced stage (> 6 months after infection) or a residual of an earlier infection, as a symptom-free patient may also have a similar \textit{Borrelia} antibody reaction if she/he was infected e.g. one year before testing. Clinical findings in this stage typically are those of advanced neuroborreliosis (progressive encephalomyelitis etc.), Acrodermatitis chronica atrophicans or a Lyme-arthritis. Since the patient didn’t display any symptoms corresponding to these clinical syndromes, a residual, asymptomatic infection was suspected and no specific treatment initiated. Nonetheless, with the absence of IgM-antibodies, these serologic findings argue against a \textit{Borrelia} infection as the cause for the patients’ symptoms, as erythema migrans caused by \textit{Borrelia burgdorferi s. l.} represents a very early stage of infection (2, 8, 9). To exclude a possible re-infection, a control serology was performed 4 weeks later in a sample pair examination with the previous sample, which showed no significant changes compared to the first serologic examination. Within one week the small erythema spread laminarily, exhibiting a red edge with a paler faded centre, symptoms which resemble an EM caused by \textit{B. burgdorferi} (Fig. 1) as an early symptom of Lyme Disease (1, 4). In distinction to a typical EM with its regular, oval form the shape of the erythema was nearly rectangular and displayed “protuberances” at the edge (Fig. 1). Thus the clinical picture together with the serological findings stands in contrast to EM in early Lyme disease (2, 3). Since the boy complained about a persistent pruritus, which is atypical in EM (where minimal pruritus is only occasionally described in an early stage), a dermal mycosis was suspected, leading to a prescription of a topical antimycotic drug solution with the active component Econazol (Janssen Cilag GmbH, Neuss, Germany) by the family physician. The treatment proved to be ineffective since the erythema continued its
centrifugal spread and started to cover the complete right chest, neck and shoulder.
The erythema still presented a clear erythematous edge and a faded centre (Fig. 1).
By now, the family consulted the Institute of Medical Microbiology (Giessen, Germany) and as part of a staged diagnostic approach, three swabs of the skin were taken at the same time, the first one from the starting point of the infection, the second one from the edge of the erythema and the third approximately 50 millimetres outside the visible edge. The swabs were examined for fungi and for bacteria by culture. The culture on sheep blood agar plates from swab one and two revealed many yellow-pigmented small colonies at room temperature after 48 hours of incubation. After 72 to 96 hours the colonies showed a frayed edge indicating motile bacteria (Fig. 2). These colonies could not be demonstrated in the culture of the third swab from the outside of the erythema. Additionally, few *Staphylococcus epidermidis*, as members of the indigenous skin flora, could be found in all three swab samples. No fungal culture was obtained even after prolonged incubation of 4 weeks which argues against the presence of dermatophytes. The yellow-pigmented colonies did not grow at 37°C in the presence or absence of CO₂. The partial sequencing of the 16S rRNA gene and data base analysis using the BLAST algorithm (NCBI) and the SepsiTTest™ BLAST (www.sepsitest-blast.de) identified the isolate as *Arthrobacter mysorens* (GeneBank accession number HM751094). Biochemical assays using API-systems (BioMerieux, Nuertingen, Germany) demonstrated only the genus *Arthrobacter* but not the species. Antibiotic susceptibility testing via Agar diffusion method and E-Test, classified the isolate to be susceptible against amoxicillin, doxycyclin, cefuroxim, ceftriaxon, and cefotaxim (MIC’s<0.064 mg/ml). The patient was thereafter successfully treated with oral amoxicillin for one week (3 x 1 g per day). The skin erythema was no longer detectable within two days and new swab cultures were negative for *Arthrobacter mysorens*. To further determine the role of *A. mysorens* an immunoblot analysis using a whole cell extract of *A. mysorens* was
performed. It showed a specific immune response in the patient serum to a ∼53-kDa and a ∼32-kDa protein, respectively (Fig. 2D) which demonstrates that the immune system responded to *A. mysorens*. A control *Borrelia* serology after 6 months demonstrated a loss of the OspC and p18 bands and a weakened intensity of the BmpA band in the IgG-immunoblot, thus indicating a diminishing immune response and supporting the thesis of a residual from an earlier infection. The genus *Arthrobacter* includes a heterogenous group of aerobic, gram-positive, catalase-positive, non-fermentative coryneform bacteria that are widely distributed in the environment where their main habitat is soil. Cells are able to resist desiccation and starvation (6). From a review of the literature only about 42 documented cases of *Arthrobacter* species isolated from clinical samples could be retrieved (5).

**Conclusions**

To our knowledge, this is the first documented case of a skin infection with *A. mysorens*, probably a new relevant human clinical isolate of this genus. In order to identify the possible source of the infection, we collected forest soil samples (n=50) from the area where the infection most likely occurred and could indeed isolate *A. mysorens* from one sample. Randomly amplified polymorphic DNA (RAPD) analysis using two different primers revealed clonal identity between the soil and the skin isolate (Fig. 2A) (11). Therefore, the local skin infection caused by this particular soil bacterium was likely to be caused by contamination with forest soil. The mobile pathogen (Fig. 2) seems to be capable of epidermal spread and could be detected only in the centre and at the edge of the erythema (Fig. 1). *Arthrobacter* species have been occasionally isolated from patients with immunodeficiencies (6). Furthermore, *Arthrobacter* species have been described as microbial allergens which can cause allergic reactions in furniture factory workers and in people occupationally exposed to
herbal dust (7, 10). The ability of *Arthrobacter* species to cause allergic reactions is a plausible explanation for the pruritus that the boy suffered from.

**Consent**

Because of the difficulties in culturing and identifying *Arthrobacter* isolates by conventional culture methods and biochemical assays, it is likely that infections with these coryneform bacteria are underreported, especially as the standard treatment regime for EM (Doxycyline, Amoxicillin, Cefuroxime axetil) would also treat *Arthrobacter* infections. Cultivation of these bacteria was possible by using incubation at room temperature, which is in general not performed or recommended for these types of samples. Therefore, we advise to use room temperature and prolonged incubation for the bacterial culture out of erythema skin samples and, in case of bacterial growth to employ molecular diagnostic techniques like 16S rRNA sequencing or MALDI-TOF MS for the identification of unusual bacterial isolates. This report shows the importance to clearly distinguish such an infection from the well-known Lyme disease since the erythema observed could be mistaken for erythema migrans after a tick bite indicating an early infection with *B. burgdorferi*.

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REFERENCES


**Figure Legends**

**Figure 1.** Erythema on patient’s chest. The black dot indicates the start point of the erythema, the arrow heads the periphery. *Arthrobacter mysorens* was isolated from the black dot area and from the red edge close to the arrow heads.

**Figure 2.** Analysis of *Arthrobacter mysorens* A) Randomly amplified polymorphic DNA (RAPD) analysis of the clinical isolate (lane 1) and the soil isolate (lane 2) using primer P1 [5’-GGTGCGGGAA-3’] and primer P5 [5’-AACGCACGCAAC-3’]. The analyses were done with the “Ready To Go RAPD analysis beads” test kit from Pharmacia (Fribourg, Germany). B) Yellow-pigmented *Arthrobacter mysorens* clinical isolate grown on sheep blood agar plates after 72 hours incubation at room temperature. C) Scanning electron microscopy of *Arthrobacter mysorens* clinical isolate. Magnification: 30,000x. D) Immunoblot analysis of the patients serum using a whole cell extract of *Arthrobacter mysorens* clinical isolate. Arrow heads indicate the two reacting proteins of ~53-kDa and ~32-kDa, respectively.