

CASE REPORT

Hospitalisation Due To Lyme Disease: Case Series In British Forces Germany

BC Baker, AM Croft, CR Winfield

ABSTRACT

Lyme disease is a tick-transmitted infection with disabling sequelae and important occupational health implications for a military workforce. It is likely that some military patients with typical clinical signs remain undiagnosed and untreated. Prompt treatment with an antibiotic is essential, besides targeted education on preventing infection through avoiding exposure to tick bites. We describe four British Forces Germany personnel (two serving military personnel, one adult civilian, one child) who during 2002-2003 required hospital inpatient treatment for Lyme disease. The epidemiology, pathogenesis, clinical features, diagnosis and treatment of the disease are discussed.

Key words: Lyme Disease, British Army, *Borrelia burgdorferi*, Occupational Health

Introduction

Lyme disease is a multi-system illness resulting from the bite of an Ixodes or hard-bodied tick (Figure 1) infected with spirochaetes of the genospecies *Borrelia burgdorferi* sensu lato (1). The disease takes its name from the town of Lyme in Connecticut, USA.

Lyme disease is rare in Britain, with a mean of about 50 new cases reported in England and Wales each year (2). In mainland Europe the infection is more common, with especially high endemicity in southern Scandinavia, the Netherlands, parts of Germany and in eastern European states such as Austria and Slovenia (3). Lyme disease is, therefore, a threat to British troops and their families stationed in continental Europe.

We describe four British Forces Germany personnel who required hospital inpatient treatment for Lyme disease.

Case One

History and initial findings

Admitted in September 2002 to Allgemeines Krankenhaus, Viersen. The patient was a 46-year old male non-commissioned British Army officer. He complained of recent-onset neuroradicular symptoms in the shoulder girdle, radiating

into both arms and into the neck, and of diffuse paraesthesiae. He felt generally unwell, weak and apathetic.

He gave a history of a tick bite some 5 to 6 weeks earlier, while off-duty, resulting in localised reddening which persisted for several weeks.

Physical examination showed localised reddening on the left upper arm. Auscultation of the heart and lungs was normal, and there was no focal neurological deficit, and no peripheral, sensory or motor



Fig1. Developmental stages of the Ixodes tick (EUCALB).

deficits.

Investigations

Serology and CSF testing were both positive for *B. burgdorferi* IgG and IgM. ECG showed normal sinus rhythm of 70 beats per minute, with left axis deviation but no significant repolarisation abnormalities, and no blocks.

Treatment and progress

A diagnosis was made of radiculoneuritis secondary to Lyme disease. The patient was treated with intravenous cefuroxime. His symptoms had improved by the fifth day of antibiotic treatment, and his rash had disappeared. Discharged after 11 days.

Case Two

History and initial findings

Admitted in October 2002 to Allgemeines Krankenhaus, Viersen. The patient was a 46-year old female British Army officer. She had no previous illnesses of note, and no prior hospitalisations. She gave a history of dysaesthesia in both arms, with pins and needles and paraesthesiae in both hands. She complained of concentration difficulties and visual disturbances, and felt ill, tired and exhausted.

There was no history of tick bite, but physical examination showed typical erythema migrans on the right side of the chest, in the mid-axillary line. She was admitted with clinically suspected Lyme disease.

Lt Col B C Baker
MB ChB MRCCP
DipSport&TI RAMC
Regional Clinical
Director, Paderborn,
Talbot Barracks,
BFPO 16

Lt Col A M Croft
MA MBBS MSc MIL
DMCC DTM&H
FFPHM RAMC
Director of Public
Health, Headquarters
British Forces Germany
Health Service,
BFPO 40

Brig C R Winfield MA
BCh DCH FRCP
L/RAMC
Director of Secondary
Healthcare, Secondary
Healthcare Admin
Centre, BFPO 39

Investigations

Serology and CSF testing were negative for *B. burgdorferi* IgG and IgM. Western blotting was negative. ECG showed normal sinus rhythm of 70 beats per minute, with no significant repolarisation abnormalities, and no blocks. Echocardiography showed a normal sized heart, for her age.

Treatment and progress

The patient's symptoms, together with the classic erythema migrans rash, pointed to a clinical diagnosis of Stage 2 Lyme disease. The patient was treated with intravenous ceftriaxone, later changed to oral doxycycline. Discharged after 8 days.

Case Three

History and initial findings

Two consecutive admissions, in February and March 2003, to Zentrum für Kinder- und Jugendmedizin, Krefeld. The patient was a 12-year old female, the daughter of a non-commissioned British Army officer. She was investigated and diagnosed during the first admission, and treated during the second.

The patient gave a 6-month history of pain in her right hip, knee and ankle joints, with a more recent monoparesis of her right leg. She also complained of blurred vision in her right eye. There was no history of tick bite.

Physical examination showed a drop-foot gait and reduced right gluteal muscular mass, with paresis of the right peroneal nerve. The patient was unable to lift her right foot, and had a dull feeling in the foot. The right plantar reflex could not be elicited.

Investigations

Normal values for full blood screen, liver enzymes, electrolytes, creatinine, urea. Polio antibodies were detected but the results were consistent with previous immunisation. Serology was positive for *B. burgdorferi* IgG on ELISA and Western blot, but negative for IgM. CSF testing was positive for *B. burgdorferi* IgG and IgM. Fundoscopy normal. MRI images of the cervical, thoracic and lumbar spines showed no evidence of an intraspinal or intracranial cause of the paresis.

Treatment and progress

On the first admission, a diagnosis of Lyme disease was made. During a second, two-week admission the patient was treated with intravenous cefotaxime, together with intensive physiotherapy. Outpatient physiotherapy in a rehabilitation unit was recommended.

Case Four

History and initial findings

Admitted in July 2003 to Allgemeines

Krankenhaus, Viersen. The patient was a 48-year old female UK-based civilian, resident in Germany. She had made a complete recovery from a left-sided stroke one year previously, and complained now of recent-onset left-sided facial paresis, with diffuse neuroradicular symptoms in her shoulder girdle area. She felt ill, weak and tired.

She gave a history of a tick bite some 6 to 8 weeks earlier.

Physical examination was normal except for a facial palsy on the left.

Investigations

Serology was negative for *B. burgdorferi* IgG but positive for IgM. CSF testing was positive for *B. burgdorferi* IgG and IgM.

Treatment and progress

The symptoms and laboratory findings pointed to Lyme disease. The patient was treated with intravenous ceftriaxone for 14 days, and this led to resolution of her neuroradicular symptoms, and complete remission of her facial paresis.

Discussion

Epidemiology of Lyme disease

Humans acquire Lyme disease by cutaneous inoculation of spirochaete-infected saliva, after being bitten by an infective vector tick. In Europe, the natural reservoir hosts of *B. burgdorferi* s.l. comprise nine small mammals (including several mice, the bank vole and shrews), seven medium-sized mammals (especially squirrels) and a number of birds (4).

The global distribution of Lyme disease closely matches the worldwide distribution of ticks of the *Ix. ricinus* complex, although the disease is often highly focal within endemic regions (5). High-risk areas are characterised by a combination of forest and forest-edge habitats that support the natural reservoir hosts, and humid, temperate microclimatic ground-level conditions that favour *Ixodes* spp. ticks in all stages of their development (6). In Europe, Lyme disease risk is associated with forestry work and with residence and leisure activities in rural areas, but not in those areas devoted to intensive agriculture (7).

In Germany, rates of tick infectivity range from 10% to 40% (8). One survey in south-east Bavaria found that 11% of blood donors harboured antibodies to *B. burgdorferi* s.l., indicating previous exposure to the bacterium (9). It is estimated that in highly endemic areas of Germany, every tenth tick bite could lead to infection with *B. burgdorferi* s.l. (8).

Human Lyme disease can affect all age groups of both sexes. Age-adjusted attack rates show a bimodal distribution, with the greatest risk of acquiring the disease being in children and middle-aged adults (10).

Table 1. Principal clinical manifestations of Lyme disease (adapted from Reference 10).

System	Stage 1 disease	Stage 2 disease	Stage 3 disease
(Constitutional)	Malaise, fatigue, headache, fever, arthralgias	Severe malaise and fatigue	Persistent fatigue
Skin	Erythema migrans	Secondary annular lesions	Acrodermatitis chronica atrophicans
Musculoskeletal	Myalgias / arthralgias	Migratory musculoskeletal pains	Intermittent oligoarthropathy, periostitis / joint subluxations below acrodermatitis lesions
CNS		Meningitis, cranial neuropathy, radiculoneuritis, subtle encephalopathy	Encephalomyelitis, polyneuropathy, chronic encephalopathy
CVS		AV node block	Carditis

Vaccines have been developed against North American strains of *B. burgdorferi*, and one randomised controlled trial found that, compared with placebo, three doses of a vaccine based on the Outer Surface Protein A reduces the incidence of Lyme disease in adults resident in endemic areas of North America (10). There is no good evidence regarding the effects of Lyme disease vaccines in Europe and Asia, and because of the diversity of *B. burgdorferi* species on these two continents, North American vaccines are likely to be ineffective (1).

Lyme disease is generally transmitted to humans during the summer months. Most human cases are diagnosed between July to November, and the usual peak incident month is August (12).

Pathogenesis

Lyme disease consists of an inflammatory process with non-specific histological changes; the most striking of these changes are in the joints, in both the acute and chronic stages of the disease (13). Stains of EM lesions reveal a perivascular mononuclear infiltrate and fibrin deposition in the dermis, without epidermal changes except at the site of the bite (14).

The causative agent of Lyme disease is extremely sparse in infected tissue and is difficult to identify, even in stained sections. Spirochaetes have been visualised in skin lesions, heart tissue and synovium, but not



Fig2. Erythema migrans, or EM (Centers for Disease Control).

in peripheral nerves, where it has been postulated that an autoimmune mechanism accounts for the inflammatory lesions (15).

Clinical features

The one sign that enables a reliable clinical diagnosis of early Lyme disease to be made is the characteristic bull's eye rash (Figure 2) known as erythema migrans, or EM. This develops between 3 and 30 days (typically 7 to 14 days) after an infected tick bite (14).

Following inoculation of *B. burgdorferi*, infection may spread by the cutaneous, lymphatic or haematogenous routes (14). The principal clinical manifestations of *B. burgdorferi* infection are summarised in Table 1.

Lyme disease sequelae occur in untreated people, some weeks or months following the primary inoculation with *B. burgdorferi* (17). These sequelae present with the following frequencies:

- Arthritis. Develops in 50% of untreated people (1). Typically this is an intermittent oligoarthropathy, usually involving one large, weight-bearing joint (most commonly, the knee) (13). For a military workforce, this has obvious occupational health implications.
- Meningitis or neuropathies. Develop in 15% of untreated people (1). In addition, a chronic encephalopathy can develop, with memory deficit, sleep disturbance, persistent fatigue and personality disorders (14).
- Carditis. Develops in 5-10% of untreated people (1).

Middle-aged and elderly sufferers from Lyme disease, if untreated, are especially prone to develop a painful radiculoneuritis, formerly known as "Bannwarth syndrome". This has an incubation period of 7 weeks in adults and 4 weeks in children. In adults, this disorder often presents as a triad, which includes radicular pain, peripheral pareses (most frequently a facial palsy) and a lymphocytosis in the cerebrospinal fluid (12). The pain syndrome is often intense, such that one-third of patients with the

syndrome may become depressed, agitated and anxious, and some patients with pain alone have been certified insane due to personality changes and misdiagnosis (18).

In our series two patients (Cases Two and Three) reported visual disturbances. This sequela of Lyme disease is not commonly mentioned in standard textbooks of infection, although it is well described in the specialist literature (19-21). Again, it has important occupational health implications.

Diagnosis

The diagnosis of Lyme disease is usually obvious if there is a history of recent tick bite in an endemic area (13).

In patients where the history is unclear, and especially where there appears to be extracutaneous involvement, serological testing should be carried out for antibodies to *B. burgdorferi* (22). IgM antibodies can be detected within about 2 weeks of infection, the peak usually occurring between the third and sixth week. By 6 weeks or more, the level of IgG is usually raised (13).

Serum antibodies often persist for months or years following treated and untreated Lyme disease, and serological reactivity cannot, therefore, be used as a marker of disease activity (14). On the other hand, seronegativity is not necessarily a bar to the diagnosis of Lyme disease, since due to the genetic heterogeneity of the *B. burgdorferi* species complex, serodiagnosis is not 100% sensitive (13). This diagnostic challenge is demonstrated in Case Two of our series.

Since serodiagnosis early in Lyme disease infection is particularly difficult, even the most sensitive tests may be negative. When serologic testing is indicated, the US Centres for Disease Control and Prevention recommend testing initially with a sensitive first test, either an enzyme-linked immunosorbent assay (ELISA) or an indirect fluorescent antibody (IFA) test, followed by testing with the more specific Western immunoblot test to corroborate equivocal or positive results obtained with the first test (23).

Treatment

Treatment with antibiotics is beneficial for

all stages of Lyme disease, but is most successful early in the course of the illness (24). Patients in whom the central nervous system is affected should be treated with intravenous antibiotics; oral antibiotics are usually sufficient for most other manifestations.

Table 2 shows the recommended treatment regimens for British Forces Germany. These recommendations, which are revised annually, are based on the best available research evidence (1).

Conclusions

Lyme disease presents with diverse clinical signs and symptoms, and with several variations in the course of the disease.

The outdoor lifestyle of British military personnel and their dependants exposes them to infective ticks and it is likely that some military patients with typical clinical signs remain undiagnosed and untreated. A high index of clinical suspicion, and prompt treatment with an antibiotic, is essential in these cases.

Targeted education on the primary prevention of Lyme disease (that is, through avoiding exposure to tick bites) is mandatory for military employers.

Acknowledgements

We thank Mr Michael Quarrell, of the Secondary Healthcare Admin Centre, Bielefeld, for his help in retrieving the discharge summaries of the four patients described in this paper.

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Table 2. Lyme disease – recommended treatment regimens for British Forces Germany.

Patient category	First line choice	Second line choice	Third line choice	Fourth line choice
Adult males and non-pregnant women	doxycycline 100 mg bd, for 10 days (20 days if recurrence)	tetracycline 200 mg qds, for 10–20 days		
Pregnant	amoxicillin 25 mg / kg / day in 3 divided doses, for 14–28 days	phenoxymethylpenicillin 50 mg / kg / day in 4 divided doses, for 14–28 days	cefuroxime acetyl 500 mg bd, for 10–30 days	erythromycin 250 mg qds, for 10–30 days
Children under 12 years	amoxicillin 25 mg / kg / day in 3 divided doses, for 14–28 days	phenoxymethylpenicillin 50 mg / kg / day in 4 divided doses, for 14–28 days	erythromycin 50 mg / kg / day in 4 divided doses, for 15–20 days	

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