BRIEF REPORT

Southern Tick-Associated Rash Illness (STARI) in the North: STARI Following a Tick Bite in Long Island, New York

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The most common clinical manifestation of Lyme disease is the characteristic rash, erythema migrans (EM). In the 1980s EM-like eruptions were reported in Missouri and other southeastern states. The EM-like eruptions, which were of unknown etiology, often followed the bite of the Lone Star tick (Amblyomma americanum) and the rash is called STARI (southern tick-associated rash illness). Although the Lone Star tick is found in the Lyme disease–endemic areas of New England and Mid-Atlantic regions of the United States, STARI has been reported only once from the Northeast and Mid-Atlantic regions. We report a child from Connecticut who visited Long Island, New York, and developed a rash that was thought to be EM. Because the patient failed to respond to antibiotics used to treat Lyme disease, an investigation ensued, and the diagnosis of STARI was established.

Following a tick bite that occurred on Long Island, New York, a child developed a skin lesion that appeared to be erythema migrans (EM), suggestive of early Lyme disease. Despite appropriate antibiotic therapy for Borrelia burgdorferi infection, the cause of Lyme disease, the skin lesion continued to enlarge, which prompted an evaluation to determine the etiology of the eruption.

CASE REPORT

On the evening of 10 May 2009, a mother removed a tick from the back of her 2-year-old girl. The family from West Hartford, Connecticut, had been vacationing for the last 3 days on Long Island (Amagansett), New York. The child’s mother was certain that the tick bite occurred while they were in New York because she had done a tick check before they left Connecticut. The family returned to Connecticut, and on 15 May the child’s mother identified a 1-cm circle of erythema at the site of the bite. The next day the circle had doubled in size, and the child was seen by her pediatrician. At this time the patient was afebrile and well. The only abnormality was an almost 2-cm annular skin lesion (Figure 1A). Because of the history of a tick bite in a highly Lyme disease endemic area, the child was begun on amoxicillin (250 mg 3 times a day for 20 days). Over the next 4 days the skin lesion continued to expand, and she was referred to the Infectious Diseases Clinic at Connecticut Children’s Medical Center (CCMC). Again she appeared well and had a normal physical examination, with the exception of a 5-cm circle of erythema with a central punctum (Figure 1B). She had not missed a dose of amoxicillin. The pharmacy was contacted and confirmed that she was indeed prescribed amoxicillin. We explained to the family that EM was a clinical diagnosis, and that we thought she did indeed have EM, but we could not explain the lack of response to amoxicillin. Over the next day the skin lesion continued to enlarge, and the family inquired about a skin biopsy to possibly establish a diagnosis. On day 6 of amoxicillin therapy (day 8 of rash) the child was again seen at CCMC. She was afebrile and well. The rash (Figure 1C) had enlarged to 8 cm of annular erythema.

METHODS AND RESULTS

A 4-mm punch biopsy was performed. The specimen was sent for standard bacterial culture, B. burgdorferi culture using BSK-H complete medium with sodium bicarbonate, B. burgdorferi polymerase chain reaction (PCR) as described elsewhere [1], and histology that included a Steiner silver stain. None of these testing modalities showed evidence of B. burgdorferi, although a positive culture for B. burgdorferi during amoxicillin therapy would be highly unlikely. Histologic examination showed a superficial and deep dermal perivascular lymphocytic infiltrate.
without plasma cells (Figure 2) and without spirochetes using silver stain. Plasma cells are frequently present histologically in skin biopsies of EM. In addition, a complete blood count was normal, and anti-\textit{B. burgdorferi} antibodies were negative (negative enzyme-linked immunosorbent assay [ELISA] and negative immunoglobulin M [IgM] and IgG immunoblots for antibodies to \textit{B. burgdorferi}).

On day 7 of amoxicillin therapy the skin lesion was larger; then, over the next few days, it faded, and the patient remained well. The child finished the 20-day course of amoxicillin. The family had saved the macerated tick that they removed and asked that we test it for \textit{B. burgdorferi}. The tick was photographed (Figure 3) and was then pulverized and tested by PCR [1] for \textit{B. burgdorferi}. The tick was PCR negative. Later, the photograph was sent to one of our authors (Telford SR) who identified it as an adult Lone Star tick (\textit{Amblyomma americanum}) based on the presence of abdominal festoons, posteriorly oriented anal groove, and the shape and size of the coxae (leg junctions with the body); the shape of the body and coxae excluded American dog ticks (\textit{Dermacentor variabilis}), the only other common human biting tick in New York besides the deer tick. The deer tick or black-legged tick (\textit{Ixodes scapularis}) is the vector of Lyme disease and has an anteriorly situated anal groove and no abdominal festoons. The Lone

\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure1.png}
\caption{The evolution of the Southern Tick-Associated Rash Illness rash: The Lone Star tick was removed on 10 May; the rash began on 15 May; (A) was taken on 5/16 when amoxicillin was started on day 2 of the rash; (B) was taken on 20 May on day 6 of the rash; and (C) was taken on 22 May on day 8 of the rash.}
\end{figure}

\begin{figure}[h]
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\includegraphics[width=0.8\textwidth]{figure2.png}
\caption{The skin histology of our patient’s STARI rash showing a superficial and deep dermal perivascular lymphocytic infiltrate without plasma cells, neutrophils or eosinophils.}
\end{figure}

\begin{figure}[h]
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\includegraphics[width=0.8\textwidth]{figure3.png}
\caption{The macerated Lone Star tick that was removed from the patient.}
\end{figure}
Start tick does not serve as vector for *B. burgdorferi* [2], but their bite may be associated with an EM-like skin lesion referred to as STARI (southern tick-associated rash illness) [3]. Thus, our patient was diagnosed to have STARI. A case definition of STARI is: a rash that looks like EM (the rash of Lyme disease) and follows a Lone Star tick bite. The rash usually occurs within 7 days of the Lone Star tick bite and expands to more than 8 cm. The STARI rash may be associated with fever, headache, myalgias, and/or arthralgias.

**DISCUSSION**

EM is defined as a skin lesion that begins as a red macule or papule that expands to a large annular area of erythema of at least 5 cm in size. Central clearing or central vesicles may be present [4, 5]. In endemic areas, the presence of EM is considered a reliable indicator of Lyme disease. EM in our experience resolves dramatically following the initiation of appropriate oral antibiotic therapy with amoxicillin, doxycycline, or cefuroxime axetil [6, 7]. Our patient initially fit the clinical definition of EM; however, because the lesion was still expanding after six days of treatment with amoxicillin, the diagnosis was reconsidered and STARI was later diagnosed.

In the early 1990s, investigators [8–11] reported on patients from Missouri and other states in the Southeast and South Central United States who had EM-like skin lesions for whom there was no microbiologic or serologic evidence for *B. burgdorferi* infection. Some of these patients recalled an antecedent tick bite with the Lone Star tick. The Lone Star tick is the most common cause of tick bites in the south-central United States [12]. Studies have shown that 1–3% of Lone Star ticks contain the spirochete *B. lonestari* (a relapsing fever-like Borrelia) [13, 14]. There has only been a single case report for which *B. lonestari* infection was identified by PCR in the skin biopsy of an EM-like skin lesion from a patient who was bitten by a Lone Star tick. The tick was also positive by PCR for *B. lonestari* [15]. Follow-up studies have been uniformly unsuccessful in demonstrating *B. lonestari* in other patients with STARI [16, 17]. Thus, the cause of STARI is unknown, but some clinicians believe that doxycycline is therapeutically helpful [8, 16, 17]. In our STARI case the rash enlarged during amoxicillin therapy which suggests amoxicillin is ineffective therapy for STARI.

A systematic comparison of patients with EM-like skin lesions due to STARI versus those due to *B. burgdorferi* infection has shown many clinical differences [18]. Patients with STARI were more likely to recall a tick bite at the skin site and less likely to have systemic symptoms or multiple skin lesions. STARI skin lesions tended to be smaller, more circular in appearance and more likely to have central clearing [9, 18]. Nevertheless, it is difficult, if not impossible to distinguish the EM-like skin lesion of STARI, from that of Lyme disease for any particular patient.

**Figure 4.** Photographs of an *Amblyomma americanum* (Lone Star tick) and an *Ixodes scapularis* (black-legged or deer tick). Bar = 350 microns.
potentially posing considerable diagnostic confusion in South Atlantic states, such as Maryland, where both diseases coexist [19]. Lone Star ticks coexist with deer ticks in many sites through much of the Middle Atlantic regions of the United States; sporadic Lone Star tick infestations extend as far north as Maine [20]. Indeed, a patient with an EM-like skin lesion following a Lone Star tick bite has been reported from New Jersey [21]. Intense infestations of Lone Star ticks have been present since the 1980s on western Long Island [22], where our 2-year-old child had likely acquired her tick. To our knowledge, our patient is the first documented case of STARI acquired in New York State.

The histologic findings in skin of STARI and EM eruptions are similar with both showing a superficial and deep perivascular lymphocytic infiltrate without neutrophils or eosinophils. Plasma cells, however, are usually absent in STARI but are frequently observed in *B. burgdorferi* infection. Thus the lack of plasma cells in our biopsy was a clue to the STARI diagnosis [9]. Silver stains for spirochetes are negative in STARI and rarely positive in EM due to *B. burgdorferi* infection. In is important to note that the histological findings characteristic of STARI and EM are nonspecific and occur in many non-STARI, non-EM eruptions. The most reliable method of distinguishing the skin lesion of STARI from that of *B. burgdorferi* infection is by demonstrating that the patient was bitten at that site by a Lone Star rather than an *Ixodes* tick (Figure 4).

Evidence exists that unrecognized cases of STARI are occurring in Lyme disease endemic areas. In a recent systematic study [23] of patients with EM clinically diagnosed in Westchester County, New York, 3 (6.4%) of 47 cases were microbiologically or serologically negative for *B. burgdorferi* infection based on acute and convalescent *B. burgdorferi* serologic testing, PCR and culture of a skin biopsy specimen, and culture of a blood specimen. In a placebo-controlled Lyme disease vaccine trial [24] involving 31 sites in ten Lyme disease endemic states (including Maryland), EM was microbiologically or serologically confirmed to be due to *B. burgdorferi* infection for 142 cases (106 in the placebo group versus 36 in the vaccine group); EM, however, was not confirmed for 29 cases (15 in the placebo group versus 14 in the vaccine group). Since the Lyme disease vaccine was only effective for preventing confirmed cases of EM, it is possible that some or all of the unconfirmed cases were due to STARI. Thus, STARI may be more common in Lyme disease endemic areas in the Middle Atlantic and Northeastern regions of the United States than previously appreciated.

In summary, we present a child with an EM-like skin lesion from STARI that progressively enlarged while on an antibiotic that is effective therapy for Lyme disease. This case proves that STARI may occur in the northeastern United States and suggests that an atypical treatment response should serve as a diagnostic clue.

**Notes**

**Potential conflicts of interest.** S. T. has received institutional grant support from the NIH, is a board member for the Massachusetts Department of Agricultural Resources, and a consultant for Immunetics, Inc., Imugen, Inc., Meridian Diagnostics, and Fuller Laboratories. G. W. is a board member of the American Lyme Disease Foundation, and has received institutional grant support from NIH, Immunetics Inc., BioRad, Diasonin Inc., and MioMerieux.

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**References**


