RELAPSING fever is an uncommonly diagnosed disease in this country (12 cases reported in 1977). The few cases reported each year mainly occur in the western United States, and only recently has a case been documented that originated east of the Mississippi.\(^2\)

Two forms of relapsing fever are recognized, louse-borne (epidemic) and tick-borne (endemic). Both are caused by spirochetes of the genus _Borrelia_ and have similar symptoms. The louse-borne variety requires a human reservoir and is common in many other parts of the world. The only case of louse-borne relapsing fever reported in this century in the United States was in a recent Ethiopian immigrant,\(^3\) but tick-borne relapsing fever has many endemic foci in North America, largely because of the prevalence of animal reservoirs.

The following two cases appeared in a two-month period at the same hospital. Both fortuitously were diagnosed by the laboratory technicians, who noticed spirochetes on the complete blood cell count (CBC) smears.

**Report of Cases**

**Case 1.**—A 29-year-old previously healthy woman was eight weeks pregnant when her symptoms began. On the evening of Aug 25, 1978, she experienced generalized fatigue, fever, and headache. By the following morning, she had an oral temperature of 38.6 °C associated with rigors and chills, followed by a drenching sweat. She denied having taken antipyretics and noted that the fever recurred at regular four-hour intervals, reaching a high of 40.1 °C in the evening. She continued to have recurrent bouts of fever into the night and was seen in the emergency room the following morning with an oral temperature of 39.6 °C.

Physical examination disclosed no abnormalities except for fever and tachycardia. Laboratory tests showed a WBC count of 10.0 x 10^9/cu mm, with the following differential cell count: 65% polymorphonuclear leukocytes, 15% band forms, 13% lymphocytes, and 7% monocytes. The ESR was 56 mm/hr. Findings from the blood chemistry study using an automated 12-factor analysis system, urinalysis, and chest x-ray film were all normal.

At this time, the laboratory personnel informed the emergency department that spirochetes had been found on the Wright-stained blood smears (Fig 1). The patient was questioned further regarding her recent travel history. On Aug 18, approximately one week before the onset of symptoms, the patient had traveled to Lake Hume near King’s Canyon National Park in southern California. The patient’s family owns a resort cabin in this area, which they use periodically throughout the summer but which remains vacant during most of the winter. The patient spent two days there, sleeping in bedding that remains in the cabin during periods of disuse. There was no history of insect bites. The patient and her husband recalled seeing numerous mice, chipmunks, and squirrels in the area. They denied seeing rodents or ticks inside the cabin. Three other persons occupied the cabin at the same time, none of whom subsequently became ill.

After the diagnosis had been made, the patient was treated with oral tetracycline hydrochloride, 500 mg four times a day. After she received two doses, her fever defervesced, and she remained afebrile. Although she had vaginal bleeding on the second day of hospitalization, it spontaneously ceased after 24 hours. She gradually regained her strength and was discharged in satisfactory condition on the sixth day of hospitalization.

Concerned about the possible developmental effects of both the infection and the tetracycline, the patient elected to undergo a therapeutic abortion soon after her recovery.

**Case 2.**—A 31-year-old woman noticed aching in the muscles of her arms and legs on the evening of Oct 12, 1978. By the next morning, she had fever and chills and noticed numbness and tingling in both hands. By noon, she had an oral temperature of 38.8 °C and was having rigors and chills, lasting about 45 minutes, followed by a drenching sweat. Cycles of fever and chills followed by sweats recurred about three times a day for the next four days and then spontaneously subsided. The patient recalled having had severe headaches, nausea, and vomiting periodically throughout the febrile stage. On the fourth day of the fever, an erythematous macular rash appeared on her face and spread rapidly to her trunk and extremities. She described the lesions as being 1 to 2 cm and slightly pruritic and having irregular borders.

Five days after the onset of symptoms, the fever had subsided, but the patient still was experiencing paresthesias in her hands. Her physician told her she most likely had a postviral neuropathy, and no treatment was instituted. The following morning, she felt improved and resumed her normal activities.

Eleven days after the first episode, the patient awoke with general malaise and nausea. By that night, she had a temperature of 39.5 °C, myalgias, and a severe generalized headache. She was admitted to the hospital with a presumptive diagnosis of meningitis, but a neurologist believed that no CNS inflammation was present. Laboratory test results were normal, except for the WBC count of 10.5 x 10^9/cu mm, with 57% polymorphonuclear leukocytes, 20% band forms, 14% lymphocytes, and 9% monocytes. The ESR was 36 mm/hr. On the evening of admission, laboratory personnel reported finding spirochetes on a blood smear, and the diagnosis of _Borrelia_ was established (Fig 2).

The patient was treated with penicillin G potassium, 5 million units intramuscularly every six hours. She was afebrile the next day and remained so throughout her hospitalization. After two days, penicillin treatment was changed to tetracycline hydrochloride, 500 mg orally every six hours. The patient was discharged on the fourth day of hospitalization in satisfactory condition.

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The patient was interviewed retrospectively regarding her activities preceding the onset of symptoms. During the period of Oct 6 through Oct 8, the patient and her family vacationed at a small resort in the San Bernardino National Forest in southern California. They spent two evenings in a small rustic cabin shared by five other persons, none of whom subsequently became ill. After her return home, the patient noticed two insect bite marks, one on the hand and one on the foot. Both marks were gone by the time of onset of symptoms. Both the patient and her husband reported seeing numerous rodents in the area surrounding the cabin.

Comment

The principal vectors of endemic relapsing fever are ticks of the genus *Ornithodoros*. In nature these insects feed on common rodents, including mice, rats, chipmunks, and squirrels. They live primarily in rodent burrows and nests and are carried to man by their natural hosts in rodent-infested cabins or shacks. The *Ornithodoros* ticks are nocturnal feeders that engorge themselves repeatedly with a blood meal (five to 20 minutes) and then drop off their hosts. For this reason, there is seldom a history or evidence of tick bite by the time of onset of symptoms. The ticks are capable of transmitting the spirochetes to their offspring and of remaining infectious for years.

Southern and Sanford* in their review article compared the variations of signs, symptoms, and laboratory findings in a large number of patients with this disease. After approximately one week of incubation, there is a characteristic, abrupt onset of high fever accompanied by vague constitutional symptoms. The febrile periods, of varying length, are terminated in crisis, heralded by chills and drenching sweats. An afebrile interlude follows, after which there is a relapse of symptoms. The disease usually is self-limited; however, as many as 13 relapses have occurred in the same patient.*

Diagnosis of this disease is confirmed by the presence of spirochetes in the peripheral blood. *Borrelia* is the only pathogenic spirochete that stains with the aniline dyes used in preparing the CBC smear, and its presence is pathognomonic of the disease. Positive smears are not uniformly present, and the clinical history is important in making a presumptive diagnosis.

The drug of choice for relapsing fever is tetracycline, although erythromycin recently has been shown to be effective. A single, oral, 500-mg dose of tetracycline hydrochloride usually will clear the blood of spirochetes; however, a five- to ten-day course of 500 mg every six hours is recommended to prevent relapse. Other drugs with antiborrelial activity include penicillin and chloramphenicol, but they are less effective than tetracycline.

The vague, nonspecific features of this treatable disease frequently cause it to be misdiagnosed as a viral illness. While it is usually self-limited, its course can be shortened by appropriate antibiotic therapy and the morbidity of the disease proportionately reduced.

Prevention should be aimed at limiting man's exposure to *Ornithodoros* ticks and by vector control. This can be accomplished by rodent-proofing and periodic fumigation of rustic dwellings.

Because relapsing fever is not a reportable disease in many states, and probably goes undiagnosed in many instances, it is reasonable to assume that the national statistics are falsely low in estimating its prevalence. Clinicians need to familiarize themselves with this entity and to consider it in the differential diagnosis of fever of unknown origin. The combined efforts of clinicians, laboratory personnel, and epidemiologists are required to confront the problem of relapsing fever in the United States.

Rodney Morris, MS, and Cindy Roberts, MT, prepared and photographed the slides.

References