

Rat-bite fever in children

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ABSTRACT

Rat-bite fever (RBF), a multisystem zoonosis, in children. RBF is caused by Gram-negative organisms: *Streptobacillus moniliformis* or, less commonly, *Spirillum minus*. The affected school-aged girls with a history of rat exposure who presented with a multisystem illness consisting of fever, petechial and purpuric rashes, arthralgia, and polyarthritides. Those affected persons were subjected and responded to antibiotic treatment.

KEY WORDS: Antibiotics, Rat bite fever, *Streptobacillus moniliformis*

INTRODUCTION

Rat-bite fever (RBF) is an acute illness characterized by fever, rash, and polyarthritides. It can be caused by either of two Gram-negative organisms as follows: *Streptobacillus moniliformis* or *Spirillum minus*. Most cases of RBF resolve spontaneously within 2 weeks; however, 13% of untreated cases are fatal.^[1] Another form of the disease, *S. moniliformis* bacteremia (or Haverhill fever), is caused as a result of ingesting food or water potentially contaminated with rat feces. There have been two large outbreaks worldwide.^[2,3] RBF is rare in the US and is not a reportable disease. There are no data concerning the specific incidence of RBF.^[4-7]

CASE REPORT

A previously healthy 8-year-old girl presented to the emergency department (ED) with a 6-day history of fever of 40°C. She also had an erythematous rash on her hands and feet, which had spread to her arms, legs, and face. She was evaluated in the ED for severe abdominal pain, which then resolved spontaneously. Coxsackievirus was diagnosed, and analgesic therapy was prescribed 3 days before admission. 1 day before admission, she developed pain in both legs with swelling of the right knee. She subsequently refused to bear weight on that leg. The following day, she was referred to the ED for evaluation of fever and petechiae. On examination, her temperature was

38.6°C, heart rate was 125 beats/min, and blood pressure was 94/61 mmHg. She was alert and non-toxic. A petechial rash was noted on her hands and feet, a palpable maculopapular rash on the extensor surfaces of the upper and lower extremities, and three pustular lesions, some with purpuric necrotic centers, on her fingers and toes. Both wrists were swollen and painful on movement. The right knee was swollen and painful but without warmth or erythema. Pea-sized cervical and posterior auricular nodes were noted. No other findings were noted on physical examination. Her past medical history was unremarkable. She had no history of travel or contact with stray animals. Family pets included a cat, a guinea pig, and two young rats. An older pet rat had recently died from an unknown illness. There was no history of a tick bite.

Examination of her blood revealed a white blood cell count of $10 \times 10^9/L$ (80% segs, 15% lymphocytes, and 4% monocytes), a hematocrit level of 33%, a platelet count of $120 \times 10^9/L$, an erythrocyte sedimentation rate of 62 mm/h, prothrombin time 12.5 s, and partial thromboplastin time 29.2 s. Serologies for Epstein-Barr virus viral-capsid antigen-immunoglobulin M, leptospirosis, rapid plasma regain, and proteus antibody (OX 2, 19 K) were negative. Blood, throat, urine, and viral cultures were also negative. A Gram stain of a skin aspirate of a pustular lesion on the finger and a pustular lesion on the sole of the left foot revealed Gram-negative pleomorphic bacilli which then grown 2 days. A radiograph of the right knee showed a small effusion. A skin biopsy of a purpuric lesion revealed a lymphocytic vasculitis with focal intravascular thrombi.

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The patient was treated with intravenous ceftriaxone and oral doxycycline for 2 days. She then completed a 10-day course of oral doxycycline. The resolution of her symptoms occurred within 3 days. The rash faded and the right knee swelling decreased, allowing the patient to ambulate without assistance. The isolate was sent to the New York State Health Department and subsequently to the Centers for Disease Control in Atlanta, GA, where it was confirmed to be *S. moniliformis*.

During a follow-up visit, the patient revealed that she allowed her pet rat to lick her tongue.

DISCUSSION

Our patients had classical findings of RBF. *S. moniliformis* is usually acquired through rat bites or scratches.^[8-10] In the US, 55% of reported cases occur in children aged 12 years.^[11] Animal laboratory personnel are also at risk. Rats are the natural reservoir of *S. moniliformis*.^[12] It is part of the normal commensal flora of the upper respiratory tract and is found on the teeth and gums of many rats. It is found in the nasopharynx of 50–100% of wild rats and 10–100% of healthy laboratory rats.^[1] *S. minus* is found worldwide, but predominantly in Asia and Africa. *S. moniliformis* is a pleomorphic, Gram-negative, non-motile rod measuring 1–5 mm in length.^[12] Occasionally, filaments with lateral bulbar swellings give the appearance of a string of beads, hence the origin of the name moniliformis, which means “necklace shaped.”^[13] These organisms grow optimally under microaerophilic conditions. The organism is fastidious and requires media supplemented with blood, serum, or ascitic fluid. There are two variants of the organism as follows: the bacillary form and the L form (apathogenic) variant, which exhibits a “fried-egg” colony morphology. In broth media, the organism has a cottonball-like appearance.^[12] Rapid identification of *S. moniliformis* is made by cellular fatty acid profiling using gas-liquid chromatography.^[14] Currently, there is no serologic test available for *S. moniliformis*. A previous slide agglutination test is no longer available due to performance limitations.

The initial clinical manifestation following the rat bite is swelling at the bite site. Following a short incubation period, usually of 10 days, there is abrupt onset of a viral-like illness with fever and rash. The fever may be intermittent or relapsing. The rash then appears between the 1st and 5th days of the disease.^[15] It is characterized as morbilliform, with petechiae being present in 75% of cases. They are present on the lateral extensor surface at the distal ends of the extremities. Petechial hemorrhage may present along with the dorsal and inner aspects and on the plantar

surface of the feet.^[15] Arthritis is common, occurring in 49% of cases.^[2] Non-suppurative migratory polyarthritis is a hallmark of the disease, occurring in 50% of cases.^[16] Lymphadenitis is usually regional and is present in 25% of cases.^[2] Leukocyte counts are generally in the range of 10–30×10⁹/L. A false-positive serology for syphilis is seen in up to 25% of cases.^[17] Complications of RBF include anemia, endocarditis, myocarditis, meningitis, pneumonia, focal abscess, and amnionitis.^[18]

Laboratory personnel need to use protective gloves and to handle rats properly in order to avoid rat bites. Furthermore, laboratory personnel who develop fever and malaise following a rat bite should seek immediate medical attention.^[19] Both causative agents of RBF, *S. moniliformis*, and *S. minus*, are susceptible to penicillin. The current recommendation is 600,000 units penicillin i.v. every 12 h for 10–14 days.^[18] Patients who experience rapid resolution of symptoms can complete therapy with oral penicillin V or ampicillin 500 mg every 6 h. For penicillin-allergic patients, oral tetracycline 500 mg every 6 h is recommended.^[18] The constellation of fever, rash, and arthritis can be found in other conditions, such as meningococemia, Rocky Mountain spotted fever, enterovirus infection, disseminated gonococcal infection, Lyme disease, septic arthritis, and secondary syphilis.

There are no definite recommendations for prophylaxis following a rat bite. However, the wound should be thoroughly cleaned and tetanus prophylaxis administered if necessary. Physicians have to maintain a high index of suspicion for this illness, especially in cases with a history of exposure to rats, and to notify the clinical microbiology laboratory in order to ensure that the proper growth requirements for the organism are provided.

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