

# Rat-Bite Fever in a 14-Year-Old Male

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## Abstract

Rat-bite fever (RBF) is a rare, zoonotic infection with an increasing incidence among the pediatric population as rats become more popular household pets. Here, we present a case of RBF in a previously healthy 14-year-old boy. The patient presented with nonspecific clinical findings and a social history significant for close contact with his pet rat, creating a scenario highly suspicious for RBF. Following clinical diagnosis and appropriate treatment, the patient experienced a rapid recovery and complete resolution of symptoms. In light of this case, we support and encourage the long-standing practice of conducting a thorough social history and inquiring about any pets or animal exposure in the home or place of work.

## Introduction

Rat-bite fever (RBF) is a rare, systemic, zoonotic infection that is most commonly caused by *Streptobacillus moniliformis* (North America) or *Spirillum minus* (Asia), and to a much lesser extent, *Streptobacillus notomys* (1, 2). As the name suggests, sustaining a bite from an infected rat is the typical mode of transmission to humans, and each bite carries an approximate 10% risk of infection (1, 2). However, not all infections require a bite. According to current literature, as many as 30% of cases report no history of a bite, suggesting that close contact is another mode through which the disease can be transmitted (1). In fact, it has been reported that 10% to 100% of domestic rats and 50% to 100% of wild rats carry *S. moniliformis*, which resides in the upper respiratory tract, including the nasopharynx, larynx, upper trachea, and middle ear (1). Additionally, several case reports have documented the transmission of RBF via oral contact in children who kiss their pet rats or following accidental ingestion of food and water contaminated with infected rat feces (3, 4).

Historically, RBF was a disease commonly seen among lab technicians and those living in poverty. However, with rats becoming increasingly popular as household pets, the demographics have now changed to include children, representing over half of all cases, laboratory personnel, and pet store employees (1). Here, we present a case of RBF with a typical clinical presentation and resolution following appropriate treatment.

## Case Presentation

A previously healthy 14-year-old male presented to the Emergency Department with his mother for evaluation of a 3-day history of rash and arthralgia. His symptoms began 3 days prior following a minor ankle injury during gym class. The ankle pain resolved, but new pain had developed in the right elbow.

The day prior to presentation, a rash appeared on his arms and legs and spread to his palms and soles over the course of the day. The trunk and genital area were largely spared. The rash on his soles was painful when walking. Associated symptoms included fever with chills and drenching sweats two days prior to presentation, which had resolved. Upon thorough review of systems, the patient reported a headache, but denied any additional symptoms. He was seen the previous day at another facility and was treated with tramadol and diphenhydramine.

Further history revealed that the family spends significant time in the woods but denied known tick bites. The patient and family had no recent travel history. Household pets include two dogs, a rabbit, and a rat. The patient denied any sick human contacts; however, he reported close contact with his pet rat, which he allowed to kiss his nose and clean his teeth. The rat had reportedly been ill recently with sneezing and loud breathing. The patient had an unremarkable birth history, was up to date on his vaccinations and took no medications. Past surgical history was significant for a nasal endoscopy at age 4 for a foreign body removal and a tonsillectomy at age 6.

On physical examination, vital signs were as follows: body mass index (BMI) 42.13 kg/m<sup>2</sup>, temperature 36.72°C, blood pressure 121/72 mmHg, pulse 93 beats per minute, respirations 20 breaths per minute, and oxygen saturation of 98% on room air. Skin exam revealed erythematous macules, papules, and pustules in an acral distribution on all four extremities, particularly on the extensor surfaces and extending to the palms and soles where the lesions were tender to palpation. There was also tenderness to passive extension of the right elbow, with active extension limited to approximately 110 degrees, but no significant effusion or erythema. Cardiovascular, pulmonary, abdominal, and neurological examinations revealed no abnormal findings. Pertinent laboratory results revealed an elevated C-reactive protein and erythrocyte sedimentation rate. The patient's complete blood count with differential revealed a neutrophilic predominance, while his comprehensive metabolic and respiratory viral pathogen panels were negative for any abnormalities. A tick-borne pathogen panel was also obtained.

A differential diagnosis of RBF versus anaplasmosis was considered. After blood cultures were obtained, the patient was started on intravenous ceftriaxone (1 g every 12 hours) and oral doxycycline (100 mg every 12 hours). The rash improved rapidly following initiation of treatment. The right elbow arthralgia was slower to respond but did show improvement prior to discharge. The final results of blood cultures were negative, including those for *Babesia microti*, *Anaplasma phagocytophilum*, and Lyme disease. He was discharged home on hospital day 6 to continue his remaining antibiotic course of 500 mg penicillin V potassium every 6 hours for a total of 21 days as an outpatient.

## Discussion

In the United States, RBF is predominantly caused by infection with *S. moniliformis*. The organism is a highly pleomorphic, extremely fastidious, gram-negative rod that is both filamentous and nonmotile (1). The typical incubation period ranges from 3 to 20 days, but most patients become symptomatic within 7 days or less (1, 2). In general, symptoms are characterized by fever, chills, migratory arthralgias, and a characteristic rash (1, 2). Abrupt, recurring fevers ranging from 38.0° C to 41.0° C with intense rigors are frequently the earliest manifestations, which resolve within 3 to 5 days. Other symptoms reminiscent of viral syndrome may be observed during the initial phase of infection and include nausea, vomiting, headache, and sore throat. As the disease progresses, half of patients will experience migratory arthralgias with swelling and erythema affecting both large and small joints of the extremities, and most commonly the knee or ankle, which can last up to several years in some patients (1, 2). In nearly 75% of cases, patients will also develop a maculopapular and petechial rash on the extensor surfaces of the extremities and can include exquisitely tender hemorrhagic vesicles on the palms and soles (1, 2).

While the prognosis of adequately treated RBF is quite good, mortality rates have been reported as high as 13% if untreated, with an average mortality rate of 10% (1,2). Although it is possible for the infection to resolve spontaneously without treatment or intervention, it could take up to a year, with increased risk for complications (2). Of the reported complications and causes of death for untreated disease, endocarditis carries the highest risk of mortality (1). Other documented complications of untreated RBF include fulminant sepsis, pneumonitis, meningitis, focal abscesses, septic joint, and adrenal failure (1, 2). With proper antibiotic treatment, however, patients typically experience rapid resolution of symptoms. In some cases, the rash can be slow to resolve, with migratory arthralgias and fatigue persisting for months (1).

Regarding appropriate treatment, penicillin is the antibiotic of choice against *S. moniliformis*. However, for reasons including the nonspecific presentation of RBF, broad list of differential diagnoses, and fastidiousness of *S. moniliformis* in culture, most patients experience delays in treatment (1, 2). Therefore, even in the absence of positive blood cultures, antibiotics should be initiated if RBF is suspected (4). It is recommended that children receive 12–30 mg/kg/day of IV penicillin G for 5 to 7 days, followed by an additional 7 to 14 days of oral penicillin V at 25–50 mg/kg/day divided into four doses per day. Adults with RBF should be given 240–360 mg of IV penicillin G for 7 days, and if no improvement is observed within 2 days, should be increased to 720 mg per day (1). Alternatively, IV ceftriaxone at 1 gram per day may be given, and for penicillin-allergic patients, oral or IV doxycycline at 100 mg twice daily is appropriate (2). Lastly, general recommendations for avoidance of contact with rat respiratory secretions, handwashing after contact, and proper cleaning of any bites or scratches with antiseptics should be followed, especially for those who frequently work with or keep rodents as pets (2).

## Conclusion

RBF deserves greater awareness among emergency and pediatric physicians, given its nonspecific presentation, high potential for misdiagnosis or serious complications without treatment, and rising incidence among the pediatric population as rats become increasingly popular household pets (1, 4). A high clinical suspicion for RBF is appropriate for any patient with a known exposure to rats presenting with fever, arthralgias, and a rash, and antibiotics should be initiated early despite negative blood cultures (4). This further highlights the importance of taking a thorough social history and inquiring about any pets in the home. Doing so may additionally provide an opportunity to educate patients on hygienic precautions such as wearing gloves, washing hands, and properly cleaning any bites or scratches to minimize the risk of infection (3).

## References

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