

# Rat-bite fever

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## ABSTRACT

A 23-year-old woman presented with fever, arthralgias and a skin rash. She possessed nine pet rats, and denied that she had been bitten. Blood culture was positive for *Streptobacillus moniliformis*, which can cause rat-bite fever. The patient fully recovered after treatment with clarithromycin.

## KEYWORDS

Rat, rat-bite fever, *Streptobacillus moniliformis*

## INTRODUCTION

Rat-bite fever is a disease characterised by fever, arthralgias and a skin rash. Both *Streptobacillus moniliformis* and *Spirillum minus* have been identified as causative agents. Rat-bite fever is a zoonosis, and the rat is the most important reservoir. The bacterium is transmitted by a rat bite, or by ingestion of contaminated food or water. Little is known about the prevalence of rat-bite fever. We report the case history of a patient with the disease.

## CASE REPORT

A 23-year-old woman without a previous medical history presented to the outpatient clinic with fever (up to 39.0°C), accompanied by rigors. She had been feeling unwell for several weeks and had noticed painful and

swollen joints with her knees and wrists most prominently affected. The swelling had subsided spontaneously, but she was unable to use her joints properly. Prior to the onset of symptoms she had noticed a large red lesion approximately 8 cm in size on the skin of her right upper arm, which had resolved in a couple of days. Several days before her visit to the outpatient clinic she had developed painful, small, red spots on her hands and feet. Especially the palmar side of the hands was affected, with red clear marked lesions located on the hand and fingers. She had not been abroad, and no-one else in her family had been ill. She had a steady relationship with her boyfriend and did not have a history of sexually transmitted diseases. She had not noticed an insect bite. At home she kept nine pet rats, a couple of rabbits and a cat. In her spare time she worked as an assistant at a veterinary clinic, but she had no recollection of being bitten by her rats or other animals.

On examination the patient was not acutely ill. Her temperature was 38°C. Lymphadenopathy was absent. On the lateral edge of the tongue there was a small aphthous lesion. She had slight swelling of the left wrist, with diminished flexion, but without discoloration of the skin. On both hands and feet she had a maculopapular rash with numerous small, dark-red eruptions, some of which with a blister-like appearance (*figure 1*).

Extensive laboratory testing only revealed a mild acute-phase response with a C-reactive protein of 22 mg/l. Chest X-ray and abdominal ultrasound were normal. The patient was admitted to evaluate the fever, skin abnormalities and joint complaints. As differential diagnosis we thought of systemic lupus erythematosus,

**Figure 1** Maculopapular rash with small dark-red eruptions on hands of patient with rat-bite fever



Henoch-Schonlein purpura, a cytomegaly or Epstein-Barr virus infection, or a toxic drug reaction. Secondary syphilis seemed very unlikely. After admission she did not develop any new episodes of fever and the pain in her joints subsided. A gram-negative rod was grown from blood cultures taken on admission, which was identified as *Streptobacillus moniliformis* three days later. A polymerase chain reaction (PCR) for *Streptobacillus moniliformis* using the saliva of our patient's rats yielded a positive result. Treatment with oral clarithromycin was started and the patient recovered fully and was discharged two days later. When she visited the outpatient clinic two months later, she did not have any joint symptoms, and the skin lesions had resolved completely. During that visit she told us that she had bought four new rats from a local pet shop two months before she became ill. At that moment all the rats appeared to be in good health, along with the rats she already owned. We reasoned that the red lesion on her right upper arm, seen on admission, was most likely the result of a bite or scratch by one of the rats, although the patient did not recall this having happened.

## DISCUSSION

Rat-bite fever, a zoonosis, is caused by one of two bacteria, *Streptobacillus moniliformis* or *Spirillum minus*.<sup>1,2</sup> The gram-negative rod *Streptobacillus moniliformis* can be found in the nasopharynx of small rodents, especially rats. Both wild and laboratory rats can be carriers. The percentage of laboratory rats that carry *Streptobacillus*

*moniliformis* varies from 10 to 100%.<sup>3</sup> Rats that are carriers have no symptoms. Rat-bite fever due to *Streptobacillus moniliformis* is predominantly reported after a bite or scratch from a carrying animal. There are no large series and the literature mainly consists of case reports.<sup>4-6</sup> Infections due to contaminated food or water have been reported. Two epidemics of rat-bite fever have been described. In both cases *Streptobacillus moniliformis* was identified as the cause. In the first epidemic, people were infected through water that was contaminated with the excreta of rats (Haverhill, USA, 1926). In the second epidemic contaminated milk was the cause of the disease spreading (Essex, UK, 1983). This form of rat-bite fever is called Haverhill fever.<sup>7</sup>

Rat-bite fever in itself is a systemic disease. Symptoms start after an incubation period of two to ten days, with fever, followed by asymmetrical arthralgias mainly involving the larger joints (50%) and a maculopapular rash. The rash occurs predominantly on the palmar side of hands and feet.<sup>1,8</sup> After a bite or scratch the skin region becomes inflamed and on laboratory testing there is evidence of an acute-phase response, with leucocytosis. The Venereal Disease Research Laboratory (VRDL) test for syphilis yields false-positive results in 25% of the patients. The bite usually heals spontaneously. Numerous complications have been reported such as pericarditis, endocarditis, myocarditis, meningitis, septic arthritis and focal abscesses. These complications predominantly occur in immune-compromised hosts.<sup>9,10</sup>

Cultures taken from skin lesions, blood and aspirated joint fluid are the most commonly used methods to identify the bacteria. *Streptobacillus moniliformis* is a slow-growing bacterium, which is difficult to grow *in vitro*. PCR is a reliable method to identify *Streptobacillus moniliformis* in rats.<sup>11</sup> In laboratory rats this is a common technique to screen rats for the presence of the bacteria. In our patient *Streptobacillus moniliformis* was identified from blood cultures. Cultures taken from the maculopapular lesions as seen on admission remained negative. At that time we were no longer able to identify the location where the patient had probably been bitten or scratched. Since it was unclear whether a bite by one of her rats caused the disease, we decided to test the patient's rats for the presence of *Streptobacillus moniliformis*. A PCR was performed on the rats' saliva. (Dr R. Boot, National Institute for Public Health and the Environment, Bilthoven), and all rats were found to be carriers of the bacteria. The patient was not willing to part with her rats. She stated that she would try to avoid bites in the future.

Penicillin is the number one antibiotic.<sup>1</sup> If the patient is allergic to penicillin, a tetracycline is second choice. When our patient's blood culture became positive our microbiologist advised a macrolide as therapy of choice. A two-week course was advised.

## CONCLUSIONS

Rat-bite fever caused by *Streptobacillus moniliformis* is a systemic disease. Given the intimate contact rat owners and laboratory workers have with their pets, it is unclear why rat-bite fever is relatively rare.<sup>12</sup> Moreover, considering the fact that the bacteria lives as a commensal in the nasopharyngeal flora of many rats, and that these bacteria can be transmitted not only through a bite but also through saliva, it is very unlikely that the infection occurs as infrequently as described. One explanation could be that the bacteria are difficult to grow *in vitro*, and maybe *in vivo* as well, and that, even in infected patients, it rarely leads to symptoms. As the disease can occur without obvious fever, arthralgias and skin changes, many physicians may not take blood cultures, or perform other laboratory tests which results in missed diagnosis. Most cases that have been described are associated with a clear rat bite. In every patient with fever, arthralgias with or without maculopapulous skin rash and who is in close contact with rats, rat-bite fever should be considered, even though there is no evidence of a bite or scratch.

## ACKNOWLEDGEMENT

We would like to thank Dr R. Boot for performing the PCR on the saliva of the rats.

## REFERENCES

1. Ronald G Washburn in Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases, fifth edition, volume 2, 2422-24.
2. Ojukwu IC, Christy C, Rat-bite fever in children: case report and review. Scand J Infect Dis. 2002;34(6):747-7 Review.
3. Anderson LC, Leary SL, Manning PJ. Rat-bite fever in animal research laboratory personnel. Lab Anim Sci 1983;33:292-4.
4. Torres L, Lopez AI, Escobar S, Marne C, Marco ML, Perez M, Verhaegen J. Bacteremia by *Streptobacillus moniliformis*; first case described in Spain. Eur J Clin Microbiol Infect Dis. 2003 May;22(5):258-60.
5. Frans J, Verhaegen J, Van Noyen R. *Streptobacillus moniliformis*; case report and review of the literature. Acta Clin Belg. 2001 May-Jun;56(3):187-90.
6. Schuurman BM, van Griethuysen AJ, Marcelis JH, Nijs AM. Rat bite fever after a bite from a tame pet rat. Ned Tijdschr Geneesk. 1998 Sep ;142(36):2006-9.
7. Shanson DC, Gazzard BG, Midgley J, Dixey J, Gibson GL, Stevenson J et al. *Streptobacillus moniliformis* isolated from blood in four cases of Haverhill fever Lancet. 1983 Jul 9;2(8341):92-4.
8. Stehle P, Dubuis O, So A, Dudler J. Rat bite fever without the fever Ann Rheum Dis 2003 Sep;62(9):894-6.
9. Hockman DE, Pence CD, Whittler RR, SMith LE. Septic arthritis of the hip secondary to rat bite fever: a case report. Clin Orthop. 2000 Nov;(380):173-6.
10. Rordorf T, Zuger C, Zbinden R, von Graevenitz A, Pirovino M. *Streptobacillus moniliformis* in an HIV positive patient. Infection 2000 Nov-Dec;28(6):393-4.
11. Boot R, Oosterhuis A, Thuis HC. PCR for detection of *Streptobacillus moniliformis*. Lab Anim. 2002 Apr;36(2):200-8.
12. Graves MH, Janda JM. Rat bite fever (*Streptobacillus moniliformis*) a potential emerging disease. Int J Infect Dis. 2001 ;5(3) :151-5.

