CASE REPORT

Oh rats! Fever, rash and arthritis in a young woman

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Accepted 6 December 2015

SUMMARY

A 17-year-old girl presented with worsening right-sided hip and low back pain for 2 days. She had also experienced intermittent fevers and a recurring maculopapular rash over the past 2 weeks. Social history revealed the presence of three domestic rats living in the girl's home. Blood cultures returned positive for *Streptobacillus moniliformis*, the causative agent of rat-bite fever. Rat-bite fever often goes undiagnosed, as the clinical presentation is non-specific. Untreated, the infection can result in death due to sepsis or endocarditis. The bacterium is generally susceptible to penicillin antibiotics with full clinical recovery when treated in a timely and appropriate manner. After 4 weeks of intravenous antibiotics, our patient fully recovered without long-term sequelae.

BACKGROUND

Rat-bite fever is a rare disease caused by a bacterium commonly found in the upper respiratory tract of rodents.¹ The causative agent in the Western hemisphere is generally *Streptobacillus moniliformis*, while *Spirillum minus* causes similar disease in Asia. The bacterium, transmitted by rat saliva, causes fever, rash and arthritis in most patients. Rat-bite fever often goes unrecognised and undiagnosed, with only 200 cases reported in the last 150 years.² Obtaining a full and thorough social history is critical in suspecting the disease. It is estimated that over 50% of cases occur in children secondary to domestic rodents.³ However, many clinicians fail to ask about such details on initial evaluation. Untreated, the disease can have mortality as high as 13%.² We describe a case of a young woman who suffered oligoarticular arthritis, fevers and rash due to infection by *S. moniliformis*.

CASE PRESENTATION

A 17-year-old girl presented with a 2-day history of right hip and low back pain. Over the past 2 weeks, she had intermittent fevers, nausea and vomiting. Her nausea and vomiting had improved, but her fevers persisted. She also noticed a pink rash on her hands and feet. She then developed severe pain localised in the right hip and low back, leading to immobility. She had no medical history. No family members had similar symptoms. Social history was significant for numerous pets including a dog, cat, horse and three pet rats. The rodents lived in the patient's bedroom. One of these rats had died 3 weeks prior to onset of the patient's symptoms.

Initially afebrile, the patient developed intermittent fevers every 12–14 h over the next 48 h. Examination revealed tenderness to palpation over the sacroiliac (SI) joint, and pain with abduction

and adduction of the right leg. Skin examination showed pink, coalescing macules localised to the dorsum of the hands and feet, which became more prominent with the fevers.

INVESTIGATIONS

Laboratory evaluation was remarkable for an elevated erythrocyte sedimentation rate of 46 mm/h (normal range (NR) 0–29 mm/h) and C reactive protein of 1.72 mg/dL (NR <1.0 mg/dL). Blood cultures were initially negative for growth. Epstein-Barr virus, parvovirus B19 and Coxsackie viral serologies were negative for acute infection. Plain radiographs of the right hip and lumbar spine were within normal limits. Owing to persistent pain over the SI joint, an MRI of the sacrum and hip was performed. This showed fluid within the SI joint and soft tissue oedema of the surrounding tissues. Aspiration of the SI joint revealed minimal fluid. Culture of aspirated fluid was obtained. Blood cultures were extended, and after 7 days grew *S. moniliformis*.

DIFFERENTIAL DIAGNOSIS

Intermittent fevers, rash and oligoarticular arthritis in a young woman presents a challenging clinical conundrum. Differential diagnosis includes infectious causes such as classic septic arthritis, gonorrhoea, Lyme disease, or Rocky Mountain Spotted Fever. Viral causes including parvovirus B19, Coxsackievirus, or reactive arthritis secondary to viral illness, must be considered. Inflammatory conditions such as juvenile idiopathic arthritis, spondyloarthropathy or neoplasm should also be included in the differential.

TREATMENT

Untreated, rat-bite fever has a mortality ranging from 7% to 13%.² Death often results from endocarditis or uncontrolled bacteraemia resulting in sepsis. The bacterium is uniformly susceptible to penicillins. Treatment duration ranges from 4 to 6 weeks.⁴

OUTCOME AND FOLLOW-UP

Our patient was treated with 4 weeks of intravenous ceftriaxone. After 5 days of antibiotics, her rash and fever resolved completely. Her right SI joint pain improved over the next 2 weeks and resolved completely after 4 weeks.

DISCUSSION

Rat-bite fever has been described in writings dating back 2300 years. Originally described as a disease of the poor, most cases today occur in laboratory workers or in children with pet rodents. The

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To cite: Brown CM, Tsai G, Sanchez-Flores X. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-212240

disease is not reportable; yet over 200 cases of rat-bite fever have been recorded in the USA since 1839.^{1 5} Most believe the disease goes undiagnosed and unrecognised in a majority of cases. Correct and prompt diagnosis is key, as appropriate therapy results in full recovery. This highlights the importance of complete social history taking, including of animal exposure.

In the Western hemisphere, *S. moniliformis* is the most common causal organism of rat-bite fever. The disease usually causes systemic symptoms of fevers, rigours and non-suppurative arthritis after an incubation period of 3–21 days. Many patients develop a non-specific rash, which can range from petechial to macular to vesicular. Rarely, ingestion of *S. moniliformis* can cause a separate clinical syndrome, Haverhill fever. The clinical features are similar, but Haverhill fever occurs as part of a large outbreak involving many individuals secondary to contaminated milk or food supply.⁶

Most cases of rat-bite fever involve a direct bite or scratch from a rodent, although there are several reports of infection without direct bacterial inoculation.^{2 3} Diagnosis is based on positive cultures. This bacterium can take up to 7 days to grow and requires highly specific growth media. PCR is also available and is increasingly used in research settings.

S. moniliformis is susceptible to penicillin. For those with a penicillin allergy, a tetracycline can be utilised. Generally, patients are treated for 4–6 weeks with intravenous antibiotics. Owing to misdiagnosis and delayed therapy, mortality remains elevated. Appropriately treated patients generally experience full recovery, although some do have persistent fatigue and joint pain.^{3 4}

Rat-bite fever is a treatable zoonosis with a confusing clinical presentation. Complete social history taking and a high clinical suspicion in patients with possible exposure is critical for appropriate and timely diagnosis.

Learning points

- Understand the importance of complete social history taking, including of animal exposure.
- List the differential diagnosis of a young patient with fevers, rash and arthritis.
- Recall that *Streptobacillus moniliformis* is the causative agent for rat-bite fever.
- Recognise rat-bite fever as a treatable disease that often goes undiagnosed.

Acknowledgements The authors would like to thank Dr Leah Kaye for her help and wisdom.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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