IDCases 31 (2023) e01663

Contents lists available at ScienceDirect

IDCases

journal homepage: www.elsevier.com/locate/idcases

Case report

Streptobacillus moniliformis right hand abscess and monoarthritis following a rat bite

Silvio Wallemacq [a,*], Mony Hing [b], Bhavna Mahadeb [b], Yousra El Kaderi [c], Sophie Leemans [a], Evelyne Maillart [a], Philippe Clevenbergh [a,*]

[a] *Infectious Diseases Department, Brugmann University Hospital, Université Libre de Bruxelles, Brussels, Belgium*
[b] *Laboratoire Hospitalier Universitaire de Bruxelles, Service de Microbiologie, Université Libre de Bruxelles, Brussels, Belgium*
[c] *Geriatric Department, Brugmann University Hospital, Université Libre de Bruxelles, Brussels, Belgium*

ARTICLE INFO

Keywords:
Streptobacillus moniliformis
Rat bite fever
Rodent borne diseases

ABSTRACT

Streptobacillus moniliformis is a zoonotic agent associated with rat bites. We present a patient with cellulitis, subcutaneous abscess, and septic mono-arthritis after a rat bite of the right hand. The patient had no systemic features of rat bite fever (RBF). *S. moniliformis* was cultured from purulent drainage of a thumb abscess. This case illustrates an unusual clinical presentation of streptobacillary infection after a rat bite.

Introduction

Rodents are reservoirs of a number of human diseases. Rodent borne diseases include leptospirosis, rat bite fever, hantavirus infections, lassa fever, lymphocytic choriomeningitis and plague. Rat bites have been known to cause disease for over 2300 years. The causative agent of rat bite fever (RBF), *Streptobacillus moniliformis*, was first isolated in 1914 by Schottmüller [1]. The pathogen is most often transmitted from the bite of an infected rodent, with 50–100 % of rats colonized in the nasopharynx [2]. It is transmitted to humans through rat bites, scratches, or ingestion of food or water contaminated with rat feces [3].

Streptobacillary RBF is a systemic disease typically presenting with fever, skin rash and arthralgia or arthritis, with minimal inflammatory reaction over the bitten site. Complications of the infection include endocarditis, pneumonia and metastatic abscesses [4]. Arthritis is usually described as non-suppurative arthritis and isolation of the organism from synovial fluid is very uncommon. However, several reports describe septic arthritis with positive cultures, which some authors consider a distinct entity [5–7]. Suppurative septic arthritis is usually a result of hematogenous dissemination. There are only a few reports documenting local infection at the bitten site [8,9]. We describe a patient with *S. moniliformis* cellulitis complicated by subcutaneous abscess and septic arthritis of the right thumb at site of the rat bite.

Case presentation

A 91-year-old Belgian man was admitted to hospital with a five-day history of fever, delirium and asthenia following a rat bite on his right thumb three days before. He was bitten while trying to catch a rat found at home. He presented with swelling of the right hand and wrist with erythema, pain and fluctuance over the right thumb. Cellulitis with subcutaneous abscess was diagnosed. Local incision and drainage was performed. Purulent material was collected using a flocked swab (eSwab with liquid amies medium). Biological inflammatory markers were high with a C-reactive protein at 158 mg/L and leukocyte count of 23.75 × 10^3 cells/μL (90 % neutrophils). Right hand radiograph was not performed at admission. Oral amoxicillin-clavulanate (1 g IV every 6 h) was started empirically. Gram stain of the purulent material showed neutrophils, but no organisms. After 72 h incubation in 5 % CO2 at 37 °C, small, gray colonies grew on sheep blood agar (Fig. 1). The organism was identified as *Streptobacillus moniliformis* by matrix-associated laser desorption ionization-time of flight mass spectrometry (MALDI-TOF Biotyper Sirius IVD version 4.2.100; Bruker Daltonics, Bremen, Germany). Antimicrobial susceptibility testing was performed by minimum inhibitory concentration (MIC) using E-test gradient strips (bioMérieux, Marcy l'Etoile, France) and interpreted following EUCAST v. 8.0 clinical PK-PD breakpoints. The patient was then treated with intravenous ampicillin 1 g every 6 h for seven days followed by oral amoxicillin 1 g every 8 h for seven days. Two sets of blood cultures taken before starting antibiotics were collected and incubated in the BACTEC system (Bactec

* Correspondence to: Infectious Diseases Department, Brugmann University Hospital, Pl Van Gehuchten 4, 1020 Brussels, Belgium.
E-mail addresses: Silvio.wallemacq@gmail.com (S. Wallemacq), Philippe.clevenbergh@chu-brugmann.be (P. Clevenbergh).

https://doi.org/10.1016/j.idcr.2022.e01663
Received 20 October 2022; Received in revised form 17 December 2022; Accepted 19 December 2022
Available online 23 December 2022

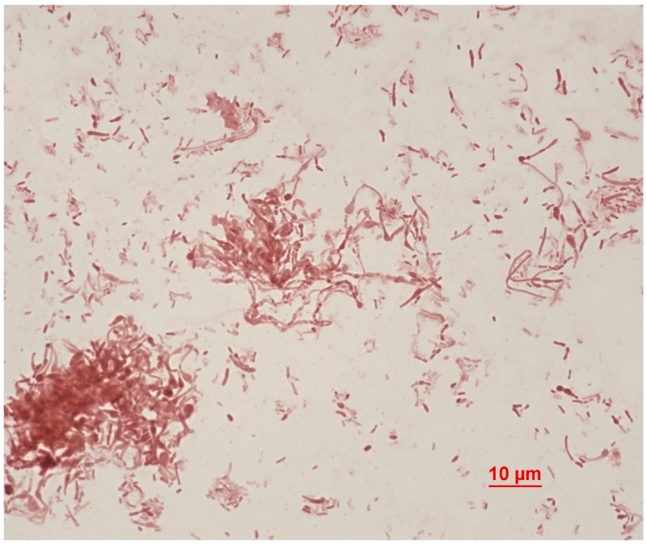

Fig. 1. Microscopic image of a Gram-stained smear of *S. moniliformis* from colonies growth on blood agar medium (Columbia agar; Becton Dickinson, Franklin Lakes, USA), demonstrating pleomorphic Gram-negative rods in chains and clumps with irregular bulbar swellings. Magnification, × 1000.

Plus Aerobic-anaerobic/F med, Becton Dickinson, Erembodegem, Belgium), and remained negative after five days of incubation. Due to persistent swelling and tenderness after 14 days of antibiotic therapy a radiograph of the right hand was obtained and showed radiological features of osteoarthritis of the distal interphalangeal articulation, without articular effusion, exactly at the rat bite site. His antimicrobial therapy was changed to oral doxycycline 100 mg every 12 h for two weeks for better bone penetration with a good clinical response. The patient had reduced mobility of his thumb but no pain or swelling.

Discussion

Human *S. moniliformis* infection is a rarely reported disease in developed countries, with only few cases documented each year. As a result of non-obligatory reporting of infection, nonspecific clinical presentation, broad differential diagnosis and complexities in microbiological diagnosis, RBF is both an underdiagnosed entity and clinical challenge.

S. moniliformis is a fastidious, pleomorphic, microaerophile, Gram-negative bacterium and requires specific culture conditions for growth which leads to delay in growth and even failure of cultivation. Moreover, sodium polyanethole sulfonate, a common anticoagulant present in commercial aerobic blood culture media like BACTEC (BD, Sparks, MD) or BacT/Alert (Biomérieux, Durham, NC), may inhibit *S. moniliformis* growth, and thus, reduces blood culture sensibility [10,11]. Therefore, laboratories need to be notified of potential *S. moniliformis* infection in order to use appropriate aerobic (Trypticase soy agar or broth, resin bead) or anaerobic culture systems [12]. Moreover, synovial fluid specimens from patients with septic arthritis, particularly those with a history of rat exposure, should not be submitted for culture solely in commercial blood culture media. The identification of this organism is challenging. In a 2021 Belgian survey, only 63.5 % of the participating clinical laboratory (n = 126) were able to identify the organism in the quality survey sample. The organism is not part of the databases of Vitek2 (bioMérieux) and API (bioMérieux) but can be identified from culture via MALDI-TOF MS as the organism is included in the Bruker IVD 7854 database [13]. Our laboratory performs all microbiological analyses for five major Brussels hospitals. Over the last ten years, this was the only instance where *S. moniliformis* was recovered from culture in our microbiological laboratory.

As alternative to culture, 16S ribosomal RNA PCR has been reported to be effective in detecting *S. moniliformis* and can be performed from positive blood culture bottles without subcultures on solid media, or directly from blood [14]. Furthermore, detection of *S. moniliformis* from the bitten site or from skin lesions by polymerase chain reaction (PCR) has already been described in the literature [15,16].

The arthropathy associated with RBF is not well characterized. The presentation of arthritis can be varied, appearing as monoarticular or polyarticular, small or large joint, acute or subacute. It can mimic a rheumatological disease such as rheumatoid arthritis, lupus or Adult Still's disease. Considering that joint involvement is a prominent part of the clinical syndrome of RBF, it is interesting that the organism has rarely been isolated from synovial fluid [17]. More recently, several reports documented pyogenic arthritis with positive cultures [5–7]. Some authors hypothesize two mechanisms of arthritis - one immunological and the other due to direct infection of the joint causing pyogenic arthritis [5–7]. The latter seems much less frequent, but this may reflect an inadequate culture technique, poor recognition of joint isolates or infrequency of joint aspiration. To date, only two studies reported subcutaneous abscess at the bite site [8,9]. Indeed, in the classic presentation of RBF, the wound has usually healed at the time of evaluation and most of suppurative arthritis documented are due to hematogenous spread [5–7,18].

Antibiotic susceptibility testing by disk diffusion usually demonstrates sensitivity to penicillins, cephalosporins, carbapenems, clindamycin, erythromycin, bacitracin, tetracycline, and vancomycin; intermediate susceptibility to aminoglycosides and fluoroquinolones; and resistance to trimethoprim-sulfamethoxazole, polymyxin B, and nalidixic acid [19,20].

Given the rarity of the illness, there is no international consensus for antibiotic treatment, and therapy for RBF is mostly guided by case reports and modest clinical experience. Penicillin is the traditional treatment of choice for RBF since most of the published experience has been with the use of this agent. The dose and duration of antibiotic therapy depend on the clinical presentation (5 to 7 days for uncomplicated RBF, up to 4 to 6 weeks for endocarditis or septic arthritis). Arthrocentesis may be useful in distinguishing streptobacillary septic arthritis from reactive arthritis of rat bite fever, to guide treatment duration.

In conclusion, clinicians should consider *S. moniliformis* infection as the differential diagnosis for unexplained febrile illness mimicking rheumatological disease in patients reporting rat exposure, but also in the setting of local infection at rat bite sites to avoid delay in therapy. Clinicians should also be aware of the difficulty in cultivating and identifying the organism and the need for close communication between clinical and laboratory staff. The use of molecular diagnostic techniques should also improve the diagnosis of this disease in case of negative culture.

CRediT authorship contribution statement

Silvio Wallemacq: Writing – original draft, Conceptualization. **Mony Hing:** Writing – review & editing. **Bhavna Mahadeb:** Writing – review & editing. **Yousra El Kaderi:** Conceptualization, Writing – review & editing. **Sophie Leemans:** Writing – review & editing. **Evelyne Maillart:** Writing – review & editing. **Philippe Clevenbergh:** Conceptualization, Writing – review & editing, Supervision.

Funding

The authors have nothing to declare.

Ethical approval

Not applicable.

Consent

Written informed consent was obtained from the patient's next of kin for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Declarations of Interest

The authors have nothing to declare.

References

[1] Schottmüller H. Zur Ätiologie und Klinik der Bisskrankheit (Ratten-, Katzen-, ichhörnchen-Bisskrankheit). Derm Wschr Ergänz 1914;58:77–103.

[2] 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;2:92–4.

[3] Centers for Disease Control and Prevention. Fatal rat-bite fever—Florida and Washington, 2003. MMWR Morb Mortal Wkly Rep 2005;53:1198–202.

[4] Washburn RG. Streptobacillus moniliformis (rat-bite fever). In: Mandell GL, Bennett JE, Dolin R, editors. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 6th edition. New York: Churchill Livingstone; 2005. p. 2708–10.

[5] Wang TK, Wong SS. Streptobacillus moniliformis septic arthritis: a clinical entity distinct from rat-bite fever? BMC Infect Dis 2007;7:56. https://doi.org/10.1186/1471-2334-7-56.

[6] Dendle C, Woolley IJ, Korman TM. Rat-bite fever septic arthritis: illustrative case and literature review. Eur J Clin Microbiol Infect Dis 2006;25(12):791–7. https://doi.org/10.1007/s10096-006-0224-x.

[7] Uddin A, Phan T, Yassin M. Septic polyarthritis caused by Streptobacillus moniliformis. Emerg Infect Dis 2021;27(12):3198–9. https://doi.org/10.3201/eid2712.210649.

[8] Hagelskjaer L, Sørensen I, Randers E. Streptobacillus moniliformis infection: 2 cases and a literature review. Scand J Infect Dis 1998;30(3):309–11. https://doi.org/10.1080/00365549850161016.

[9] Yang FA, Li TJ, Ho MW, Chen CH, Lee YS, Li CH. Rat-bite fever with bacteremia and lower limb abscess formation caused by Streptobacillus moniliformis. J Microbiol Immunol Infect 2022;55(1):175–6. https://doi.org/10.1016/j.jmii.2021.10.003.

[10] Lambe Jr DW, McPhedran AM, Mertz JA, Stewart P. Streptobacillus moniliformis isolated from a case of Haverhill fever: biochemical characterization and inhibitory effect of sodium polyanethol sulfonate. Am J Clin Pathol 1973;60(6):854–60.

[11] Szewc AM, Bell ME, Kelly AJ, Humrighouse BW, McQuiston JR. Using the BDFX40 automated continuous blood culture system to isolate and recover streptobacillus moniliformis in the presence of 0.05 % SPS: a 55-year, 56-strain retrospective study. Lab Med 2021;52(6):536–49. https://doi.org/10.1093/labmed/lmab009.

[12] Shadrin IY, Albitar AAH, Paim AC, Issa M, Wilson WR. Migratory polyarthralgias and skin rash: rat bite fever with a positive anti-cyclic citrullinated peptide. Mayo Clin Proc Innov Qual Outcomes 2020;4(2):223–7.

[13] Rapport global définitif Micro/Sero/Para; Enquête 2021/2 (August 16 2022). Sciensano ⟨https://www.wiv-isp.be/QML/activities/external_quality/rapports/_down/microbiologie/2021/15A)%202021-02-MICROBIO-F%20d%C3%A9finitif.pdf⟩, [accessed 14 September 2022].

[14] Ramanan P, Bryson AL, Binnicker MJ, Pritt BS, Patel R. Syndromic panel-based testing in clinical microbiology. Clin Microbiol Rev 2018;31(1).

[15] Nakagomi D, Deguchi N, Yagasaki A, Harada K, Shibagaki N, Kimura M, et al. Rat-bite fever identified by polymerase chain reaction detection of Streptobacillus moniliformis DNA. J Dermatol 2008;35(10):667–70.

[16] Miraflor AP, Davallow Ghajar L, Subramaniam S, de Abreu FB, Castanedo-Tardan MP, Samie FH, et al. Rat-bite fever: an uncommon cause of fever and rash in a 9-year-old patient. JAAD Case Rep 2015;1(6):371–4.

[17] Brown TM, Nunemaker JC. Rat bite fever: a review of American cases with re-evaluation of etiology. Bull Johns Hopkins Hosp 1942;70:201–37.

[18] Torres A, Cuende E, De Pablos M, Lezaun MJ, Michaus L, Vesga JC. Remitting seronegative symmetrical synovitis with pitting edema associated with subcutaneous Streptobacillus moniliformis abscess. J Rheumatol 2001;28(7):1696–8.

[19] Wullenweber M. Streptobacillus moniliformis—a zoonotic pathogen. Taxonomic considerations, host species, diagnosis, therapy, geographical distribution. Lab Anim 1995;29:1–15.

[20] Rygg M, Bruun CF. Rat bite fever (Streptobacillus moniliformis) with septicemia in a child. Scand J Infect Dis 1992;24:535–40.