

**A Case of *Streptobacillus moniliformis* Bacteremia with Iliopsoas Abscess**

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**Abstract:**

*Streptobacillus moniliformis* is a Gram-negative bacillus usually colonized by rodents and causes rat bite fever as a zoonotic infection; however, it is unusual to develop *S. moniliformis* infection without a history of contact with rodents. Here we report an 87-year-old patient with no history of direct contact with rodents who developed *S. moniliformis* bacteremia with iliopsoas abscess. She had low back pain, and her CT scan showed a left iliopsoas abscess and an aortic aneurysm dissection, Stanford type B. Blood culture was positive for unidentifiable Gram-positive bacillus and finally confirmed to be *S. moniliformis* by ribosomal RNA homology analysis. She was treated with intravenous tazobactam/piperacillin, followed by oral amoxicillin. We should mention that *S. moniliformis* infection can be developed without rodent contact.

**Keywords:** *Streptobacillus moniliformis*, iliopsoas abscess

**Introduction**

*Streptobacillus moniliformis* is a Gram-negative bacillus with a highly pleomorphic stainability on Gram staining. *S. moniliformis* was mainly colonized with

rodents such as rats and caused rat bite fever (RBF) by infection through a bite by rodents and oral infection through contaminated foods.<sup>1</sup> Here, we report a rare case of

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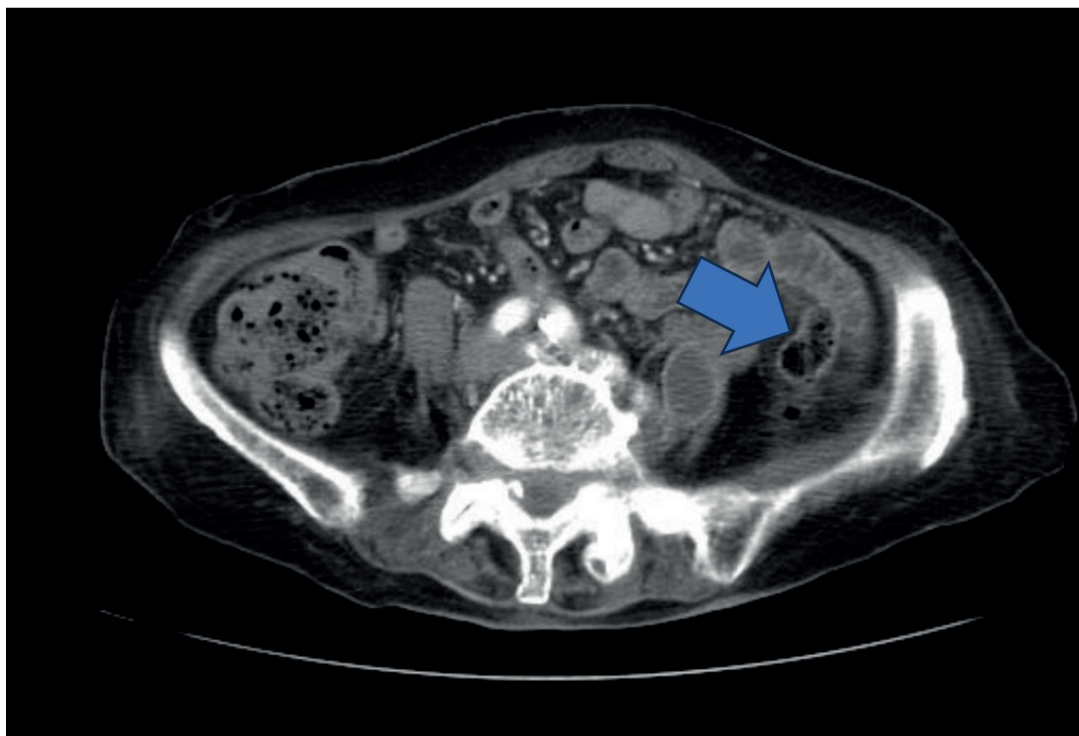
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*S. moniliformis* bacteremia with iliopsoas abscess without apparent contact with rodents.

### Case

An 87-year-old female was consulted from previous hospital with the complaint of back pain. Laboratory testing revealed highly C-reactive protein level as 28.98 mg/dL, and

magnetic resonance imaging (MRI) indicated lumbar spondylosis, resulting in our hospital admission. Three days after admission, she developed fever, and imaging computed tomography (CT) revealed a spot in her left iliopsoas (Figure 1). Iliopsoas abscess was suspected, and administration of 2 g/day of sulbactam/cefoperazone was started after taking blood culture samples.



**Figure 1** Abdominal imaging Computed tomography findings. The blue arrow indicated iliopsoas abscess.

Her blood culture samples taken in her previous hospital were sent to an external commercial laboratory and cultured by BAC TEC FX (Becton Dickinson), and Gram-positive bacillus was identified. The bacteria was subcultured with 5% CO<sub>2</sub> conditions at 35°C using 5% blood agar media. Identification of the bacteria with matrix-assisted laser desorption ionization time-of-

flight mass spectrometry (MALDI-TOF MS) resulted in failure, so the commercial laboratory reported the result of bacterial testing to her previous hospital as “unidentifiable Gram-positive bacillus was positive for the blood culture” with antibiotics sensitivity testing result (Table 1) of the bacteria at nine days after admission.

**Table 1** Susceptibility testing result of *Streptobacillus moniliformis*

| Antimicrobial agents  | Minimum inhibitory concentration (μg/ml) | Interpretation of breakpoint* |
|-----------------------|--|-------------------------------|
| Benzylpenicillin      | ≤0.5                                     | S                             |
| Ampicillin            | ≤0.5                                     | S                             |
| Sulbactam/ Ampicillin | ≤8                                       | S                             |
| Cefmetazole           | ≤16                                      | S                             |
| Ceftriaxone           | ≤16                                      | S                             |
| Flomoxef              | ≤16                                      | S                             |
| Cefepime              | ≤16                                      | S                             |
| Imipenem/Cilastatin   | ≤4                                       | S                             |
| Meropenem             | ≤4                                       | S                             |
| Erythromycin          | ≤2                                       | S                             |
| Clindamycin           | ≤1                                       | S                             |
| Minocycline           | ≤4                                       | S                             |
| Vancomycin            | ≤1                                       | S                             |
| Levofloxacin          | ≤2                                       | S                             |

\*S, susceptible. The breakpoints were interpreted according to the Clinical and Laboratory Standards Institute document M100, Performance Standards for Antimicrobial Susceptibility Testing, 23<sup>rd</sup> ed.

Then, antibiotic was changed to tazobactam/piperacillin (TAZ/PIPC) (4.5 g every six hours) based on the results of the antibiotics sensitivity test 9 days after her admission. However, she was transferred to our hospital ten days after admission because an imaging CT performed eight days after admission revealed her dissection aortic aneurysm (Stanford type B). Imaging CT performed in our hospital also indicated her remaining iliopsoas abscess (Figure 1) and her dissection aortic aneurysm. Administration of TAZ/PIPC was continued, and antihypertensive therapy was started against her dissection aortic aneurysm. An imaging CT performed 25 days after admission revealed shrinking iliopsoas abscess, and her condition tended to improve

without exacerbating of aortic dissection aneurysm. So, antibiotics was changed to amoxicillin (AMPC) (250 mg every eight hours) 31 days after admission, and finally, she was discharged from our hospital 84 days after admission.

We ordered the bacterial strain from the external commercial laboratory to identify the bacteria isolated from her blood culture sample. The bacteria were Gram-negative bacillus with pleomorphic shape (Figure 2) and identified as *S. moniliformis* by MALDI biotyper (BRUKER) with high reliability (score value = 2.438). 16S Ribosomal RNA (rRNA) homology analysis of the bacteria was performed in Yamagata Prefectural Institute of Public Health, and nucleotide sequence of 1,400 bp amplicon derived from

the bacteria (accession no. LC441154.1) showed 100% homology with *S. moniliformis* strain ATCC 14647 (accession no. 599252.1).

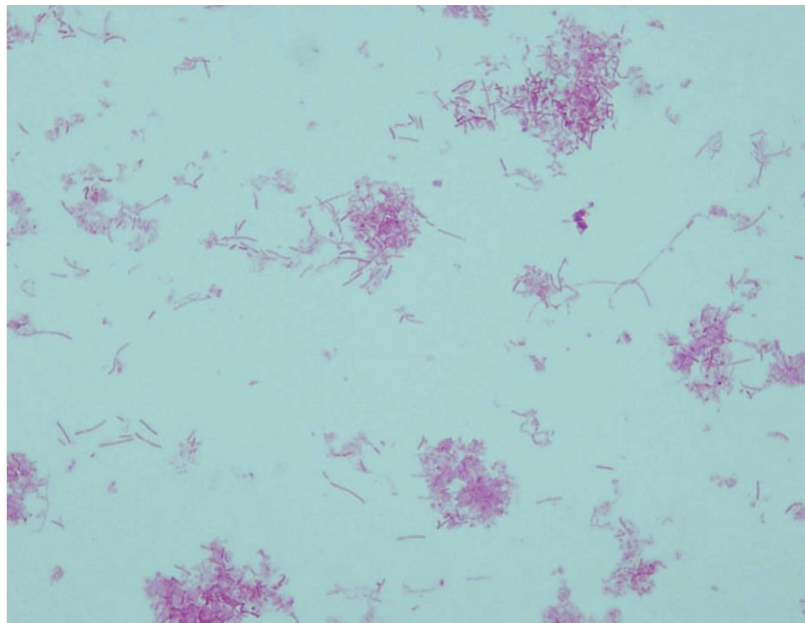
## Discussion

*S. moniliformis* is the causative bacterium of RBF, and between 50 and 100% of rats are colonized in the nasopharynx.<sup>1</sup> *S. moniliformis* infections mainly occur through rat bite but are also associated with the ingestion of contaminated food or water.<sup>1</sup> RBF is a systemic illness generally characterized by fever, rash, and polyarthralgias.<sup>1</sup> A variety of severe complications of RBF such as bacteremia, endocarditis, focal abscesses, septic arthritis, and multiorgan failure have been reported.<sup>2-6</sup> If not treated appropriately, the mortality rate of RBF is approximately 13 percent.<sup>1</sup> The present case was characterized by *S. moniliformis* bacteremia with iliopsoas abscess. Iliopsoas abscess is extremely rare as a complication of *S. moniliformis* infection. To the best of our knowledge, there is no other report of *S. moniliformis* infection with abscess in muscle tissue except for a previous case report<sup>7</sup> and the present case. Three to six weeks of antibiotic treatment following adequate drainage against iliopsoas abscess is empirically recommended in general, whereas there was no clear guideline for the treatment of the disease. Penicillin is first choice antibiotic of RBF.<sup>1</sup> and prompt treatment can prevent severe complications. In the present case as well, TAZ/PIPC and AMPC were successful in patients with iliopsoas abscesses.

In the present case, the patient had no history of rat bites or apparent contact with rats. According to our retrospective interview

with the patient, she had frequently seen rodents in her old house. This fact suggests a possibility that she infected *S. moniliformis* through food or water contaminated by rat excrement. This finding is supported by some previous reports that caused *S. moniliformis* bacteremia without rat bite.<sup>8,9</sup> In addition, consistent with our patients, approximately 30% of the patients could not recollect any bite or other exposure.<sup>10</sup> In the present case, due to the lack of rat bite history of the patient, it was difficult to take into account the possibility of RBF. When outpatients lack specific clinical findings of RBF, detailed interviews, including about their living environment, would lead to considering *S. moniliformis* infection.

When there was no history of rat bites or contact with a rat for the patient, the diagnosis of *S. moniliformis* infection will be based on microbiological testing. However, microbiological diagnosis of *S. moniliformis* is also difficult because *S. moniliformis* is known as a fastidious bacterium. In the present case, the external commercial laboratory reported the result of blood culture as “unidentifiable Gram-positive bacillus was detected,” whereas *S. moniliformis* is Gram-negative bacteria. Indeed, the Gram-staining we performed using subcultured colonies showed the bacteria as Gram-negative (Figure 2). This mismatch of findings accounts for the characteristic of *S. moniliformis* as a highly pleomorphic stainability on Gram staining.<sup>11</sup> Hence, the stainability of *S. moniliformis* on Gram staining should be paid attention to, especially when the bacterium was detected from the blood culture.



**Figure 2** Pleomorphic shaped Gram-negative rods were shown on Gram staining (×1,000)

Microbiological identification of *S. moniliformis* is also difficult. In the present case, MALDI-TOF MS was performed in the commercial laboratory, where her previous doctor used could not identify this bacterium. MALDI-TOF MS is a fast and reliable tool for species identification of *S. moniliformis*<sup>12</sup> whereas whether the device can identify *S. moniliformis* or not depends on the type of device and database the device possessed. Because of the difficulty in microbiological identification of RBF, 16S rRNA gene sequencing has developed to identify *S. moniliformis*.<sup>12</sup> If *S. moniliformis* cannot be identified by MALDI-TOF MS, while we were able to identify this organism, fortunately, using 16S rRNA gene sequencing is desired for the identification of this bacterium. On the other hand, 16S rRNA gene sequencing can be insufficient for definite species resolution because of the highly homologous against *S. moniliformis*, *Streptobacillus felis*, *Streptobacillus notomys*, and *Streptobacillus ratti*<sup>12</sup>, contrary to MALDI-TOF MS. Hence, using MALDI-TOF MS on routine work and if necessary, using 16S ribosomal RNA gene sequencing in combination makes the diagnose of *S. moniliformis* infection

definitive. In order to identify *S. moniliformis* using MALDI-TOF MS more definitely, modification difference between devices and improvement database the device possessed are needed.

The patient had an aortic dissection aneurysm with *S. moniliformis* infection, but the relationship between the aneurysm and *S. moniliformis* infection was unclear. Aortic dissection can generally be triggered by an infectious aneurysm.<sup>13</sup> The fact that infectious aneurysms can occur by the seeding of bacteria<sup>13</sup> leads to a possibility that bacteremia with *S. moniliformis* is involved in the development of aortic dissection in this case. In contrast, no previous report of *S. moniliformis* infection with infectious aneurysms was reported. However, we cannot further discuss these relationships here because the patients have not been treated surgically in this case.

Management of iliopsoas abscess consists of drainage and prompt initiation of appropriate antibiotic treatment.<sup>14</sup> However, drainage from the iliopsoas abscess site was impossible in this case because of her aging and concerns about worsening her aortic dissection aneurysm. Hence,



this case was clinically diagnosed as *S. moniliformis* bacteremia with iliopsoas abscess associated based on isolated *S. moniliformis* from blood culture only. If *S. moniliformis* had been directly detected from the iliopsoas abscess, the diagnosis of iliopsoas abscess accompanied by *S. moniliformis* bacteremia would have been more reliable.

## Conclusion

We report the rare case of *S. moniliformis* bacteremia with iliopsoas abscess without apparent contact with the rat. Iliopsoas abscess is a rare complication of *S. moniliformis* infection. A detailed interview about the possibility of contact with rats and the presence of rats in the patient's living environment is important. Although clinically diagnosing *S. moniliformis* infection without a rat bite is difficult, laboratory testing combining MALDI-TOF MS with 16S rRNA gene sequencing helps a more definitive diagnosis of *S. moniliformis* infection.

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