

CASE REPORT

MALDI-TOF MS Combined with mNGS for the Diagnosis of a Case of Infection with *Sporothrix schenckii*

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ABSTRACT

Background: In October 2025, our hospital confirmed a case of *Sporothrix schenckii* infection in the right calf. The patient visited our hospital due to "redness, nodules, rupture, pus discharge with pain on the back of the right calf for 3 months". Three months ago, there was no obvious cause for a red rash or papule on the back of the right calf. Within one week, the papules continue to enlarge, forming a nail cap sized lump accompanied by ulceration and pus discharge. The patient went to other medical institutions on their own to undergo skin granuloma resection and local skin grafting, taking oral prednisone and applying fish fat ointment externally. After one month, the incision site ruptured and did not heal, and there was pus leakage, but the condition did not improve. She came to our hospital for further diagnosis and treatment.

Methods: Organ pathological biopsy, examination of pathogenic bacteria in pus: bacterial culture, bacterial smear, pus mNGS (Metagenomic Next-Generation Sequencing). Other auxiliary examinations: urine routine, blood routine, liver function, kidney function, biochemistry, blood pathogen examination, coagulation function, blood lipids, electrocardiogram, chest X-ray, abdominal ultrasound.

Results: Blood pathogenic examination: HBsAg hepatitis B: B surface antigen > 125.00 IU/mL, HBsAg hepatitis B: B surface antigen > 250.00 IU/mL, liver function test: total protein 59.1 g/L, albumin 31.2 g/L, Albumin/Globulin ratio (A/G ratio) 1.12, blood lipids: high-density lipoprotein cholesterol 0.88 mmol/L, blood coagulation function: fibrinogen test 4.65 g/L. Abdominal ultrasound: Enhanced intrahepatic echo. Organ pathological biopsy results: Hyperkeratosis compacta, mild epidermal hyperplasia, slight lymphocyte infiltration around superficial and middle blood vessels in the dermis, mixed cell granulomas of clustered lymphocytes, tissue cells, eosinophils, neutrophils, and plasma cells around deep blood vessels and sweat glands, no obvious cellulose like degeneration in the vascular wall, and dense red staining of collagen throughout the entire layer. Fungal culture and identification of pus: *Sporothrix schenckii* complex, pus acid fast staining: negative, pus NGS: *Sporothrix schenckii*. Clinically, treatment includes 0.2 g po qd of itraconazole, 10 mL po tid of 10% potassium iodide solution, 0.5 g ivgtt qd of vitamin C, and local red light irradiation. Fourteen days later, the patient's condition stabilized. There was no rupture or pus discharge from the wound on the back of the right foot, and granulation like new organisms and scabs were visible at the boundary. The patient's condition improved and he was discharged. Continued treatment outside the hospital: Itraconazole 0.2 g po bid, 10% potassium iodide solution 10 mL po tid, entecavir capsules 1 capsule po qd, for a course of 3 months. Regular review.

Conclusions: This article reports a case of infection with *Sporothrix schenckii* in the right calf. *Sporothrix schenckii* was quickly and accurately identified by MALDI-TOF MS (Matrix-Assisted Laser Desorption Ionization Time-Of-Flight Mass Spectrometry) and mNGS testing. Reasonable treatment measures were adopted clinically, and the patient improved and was discharged. We hope that in the future, this case report can provide reference for the clinical diagnosis and treatment of sporotrichosis. In addition, mNGS technology has considerable application prospects in the rapid and accurate diagnosis of pathogens.

(Clin. Lab. 2026;72:xx-xx. DOI: 10.7754/Clin.Lab.2025.251113)

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KEYWORDS

Sporothrix schenckii, MALDI-TOF MS, mNGS

CASE PRESENTATION**Case**

The patient is a 49 year old female farmer who was admitted on September 25, 2025, due to "redness, nodules, rupture, pus discharge with pain on the back of the right calf for 3 months". Three months ago, without obvious cause, there was a red rash and papule on the back of the right calf. Within one week, the papules continued to enlarge, forming a nail cap sized lump accompanied by ulceration and pus discharge. The patient went to another medical institution for dorsal skin granuloma resection and local skin grafting, taking prednisone orally and applying fish fat ointment externally. After one month, the incision site ruptured and did not heal, and there was pus leakage, but the condition did not improve. She came to our hospital for further diagnosis and treatment. Special condition: Scattered erythema, nodules, ulceration, and pus discharge can be seen on the back of the right lower leg, with clear boundary, soft central nodule, wavy feeling when touching, and obvious pressing pain (Figure 1A). After admission, relevant examinations were improved, and before blood transfusion, a complete set of pathogenic examinations were carried out: HBsAg hepatitis B surface antigen > 125.00 IU/mL, HBsAg hepatitis B surface antigen > 250.00 IU/mL, antinuclear antibody test (ANA): weakly positive antinuclear antibody (1:100), inorganic ions 3 items: total calcium 2.04 mmol/L, liver function test: total protein 59.1 g/L, albumin 31.2 g/L, Albumin/Globulin ratio (A/G ratio) 1.12, four blood lipids: high-density lipoprotein cholesterol 0.88 mmol/L, blood coagulation function: fibrinogen test 4.65 g/L, T-SPOT: negative, PPD: negative, four electrolytes, renal function, G test, GM test, routine blood, urine and stool, fasting glucose, glycosylated hemoglobin were all without obvious abnormalities. Chest X-ray: No obvious abnormalities were found. Abdominal ultrasound: Enhanced intrahepatic echo. Pathological biopsy results: Hyperkeratosis compacta, mild epidermal hyperplasia, slight lymphocyte infiltration around the superficial and middle blood vessels in the dermis, mixed cell granulomas of clustered lymphocytes, tissue cells, eosinophils, neutrophils, and plasma cells around deep blood vessels and sweat

glands, no obvious fibrinoid degeneration in the blood vessel wall, and dense red staining of collagen throughout the entire layer 28°C fungal culture in pus: filamentous fungal growth (Figure 1B), 35°C fungal culture in pus: yeast like fungal growth (Figure 1C), filamentous fungal lactophenol cotton blue staining: fungal spore sleeve arrangement (Figure 1D), fungal identification in pus (MALDI-TOF MS): *Sporothrix schenckii* complex (Figure 1E), acid fast staining in pus: negative, mNGS in pus: *Sporothrix schenckii*. Clinically treatment includes 0.2 g po qd of itraconazole, 10 mL po tid of 10% potassium iodide solution, 0.5 g ivgtt qd of vitamin C, and local red light irradiation. After 14 days, the patient's condition stabilized. There was no rupture or pus discharge from the wound on the back of the right calf, and granulation like new organisms and scabs were visible at the boundary. The patient's condition improved and he was discharged. Continued treatment outside the hospital: Itraconazole 0.2 g po bid + 10% potassium iodide solution 10 mL po tid + entecavir capsules 1 pill po qd. The course of treatment is 3 months. Regular follow-up: liver function, kidney function, electrolytes, thyroid function, etc.

DISCUSSION

Sporothrix schenckii complex is an inflammatory granulomatous fungal disease mainly distributed in South Africa, the Americas, Asia (Japan, China, India), and Oceania [1]. Its pathogen is *Sporothrix schenckii* complex, abbreviated as Sporothrix. Sporothrix fungus is a biphasic fungus [2], including seven species including Sporothrix sp. Schenck, Sporothrix sp. Spherical, Sporothrix sp. Brazilian, Sporothrix sp. Mexican, Sporothrix sp. Pale, Sporothrix sp. Luairi, and Sporothrix sp. Chilean [3]. This article reports a case of foot infection caused by *Sporothrix schenckii*. *Sporothrix schenckii* was quickly and accurately identified by MALDI-TOF MS and mNGS detection, and reasonable treatment measures were adopted clinically, achieving satisfactory treatment results for patients.

Sporothrix disease is a chronic infection of the skin, subcutaneous tissue, and nearby lymphatic system that can occur in soil and decaying vegetation such as dead wood, peat moss, corn stalks, and hay. Humans typically contract this disease through traumatic inoculation of this fungus during outdoor activities such as agriculture, horticulture, and animal husbandry [4]. In this case, the patient's occupation is a farmer and there is no obvious cause for symptoms in their feet. The most likely reason is that spore forming bacteria in the soil invaded the human body through the skin and mucous membranes during labor. In recent years, the incidence rate of sporotrichum is on the rise, especially in high incidence areas such as China and Brazil, causing public health events of international concern [5].

Sporothrix disease has a slow course, and pathological changes vary depending on the disease stage and the

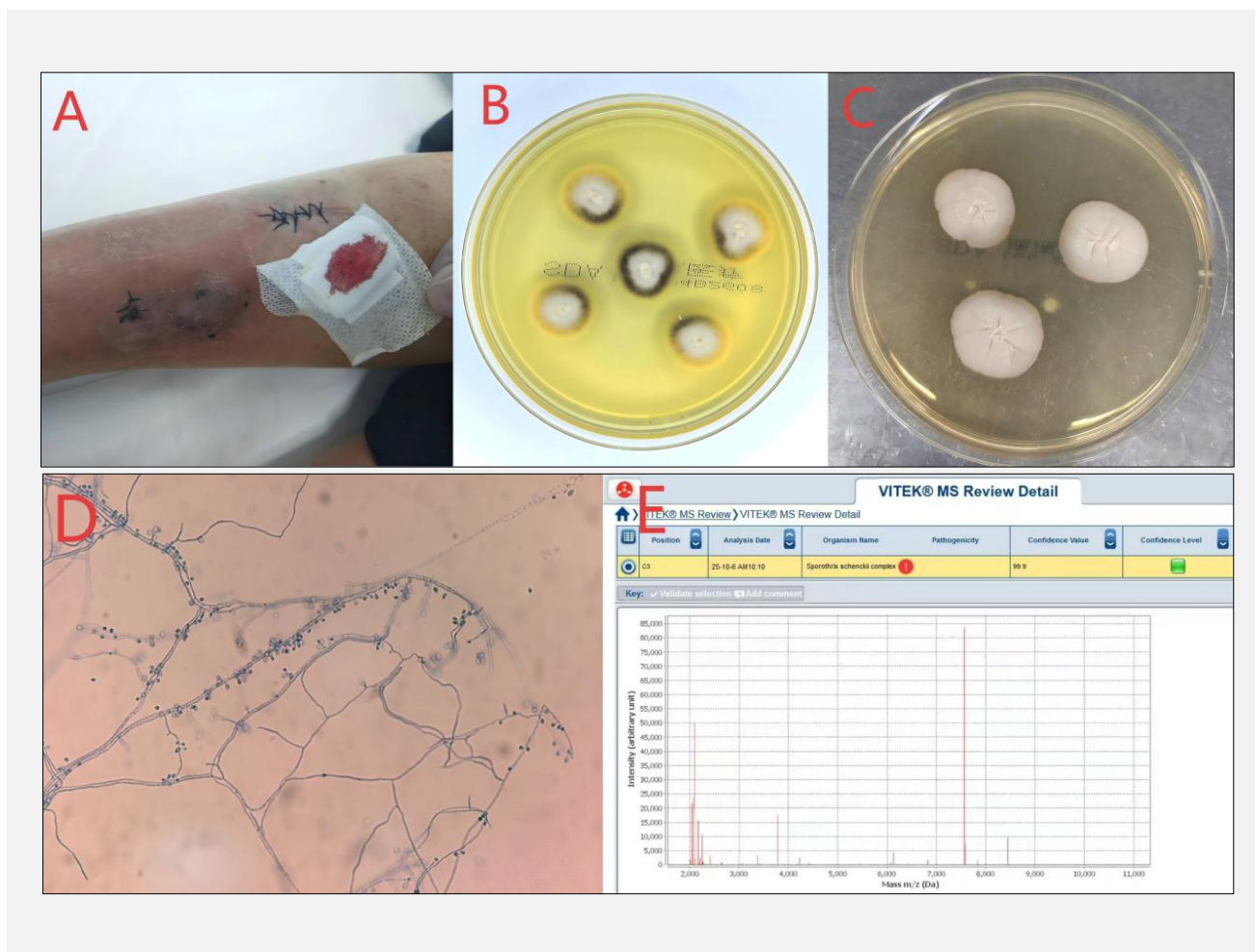


Figure 1. Clinical and bacteriological images.

Figure A: The condition of the patient's right calf wound.

Figure B: Growth of *Sporothrix schenckii* in Sabouraud medium at 28°C for 120 hours.

Figure C: Growth of *Sporothrix schenckii* in Sabouraud medium at 35°C for 240 hours.

Figure D: Observation of *Sporothrix schenckii* stained with Lactic Acid Phenol Cotton Blue under a microscope $\times 400$.

Figure E: Identification results of *Sporothrix schenckii* by MALDI-TOF MS.

body's resistance. Early lesions often present as non-specific inflammatory infiltration composed of plasma cells, neutrophils, lymphocytes, and tissue cells [6]. The patient in this case has no underlying diseases, no family history of inheritance, and no obvious spread of lesions. The clinical diagnosis is early infection of sporotrichosis. In addition, the pathological biopsy results are basically consistent with the early lesions. Related research reports: Sporothrix disease is divided into four types: localized skin type, cutaneous lymphangiopathy type, cutaneous dissemination type, and cutaneous appearance type [7]. Based on the patient's medical history and clinical manifestations, it is determined that the patient has a localized skin type. Localized skin types are more common in exposed areas such as the face, back of the hand, and back of the foot, and are limited to the initial site. The skin lesions are polymorphic, with com-

mon forms including papules, nodules, pustules, infiltrative plaques, ulcers, granulomas, and relatively rare wart like changes and gangrenous skin lesions [8].

At present, the diagnosis of sporotrichosis in clinical practice mainly relies on typical clinical manifestations, fungal culture, and histopathological examination. The gold standard for diagnosis is fungal culture [9]. This case was diagnosed with sporotrichosis infection through examination of pathogenic bacteria in pus. The pus was cultured on Sabouraud medium at 28°C, and after 5 days, small gray brown colonies were visible, gradually growing into surface brown, fuzzy, and wrinkled colonies. We selected bacterial colonies and identified them using matrix assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS). MALDI-TOF MS, as an emerging strain identification technique in recent years, is widely used in the classifi-

cation and identification of pathogenic bacteria and fungi. Its classification results are consistent with DNA sequence based analysis methods [10]. However, in this case, MALDI-TOF MS was unable to identify the bacterial species of the complex of *Sporothrix* sp. We introduced mNGS technology to clarify the diagnosis. MNGS technology is a high-throughput sequencing technique that can identify bacterial strains and has advantages such as high throughput, high sensitivity, high accuracy, and low cost. The principle is to separate and connect DNA or RNA fragments to a vector, amplify them by PCR to obtain a large number of DNA or RNA fragments, and then fix these fragments on a sequencing platform for sequencing [11]. In this study, mNGS detection was used to identify the complex of *Streptococcus suis* as *Sporothrix schenckii*, which enables doctors to more accurately diagnose diseases, personalize treatments, and evaluate prognosis.

The traditional treatment methods for sporotrichosis include medication, adjuvant therapy, and combination therapy [12]. Drug therapy mainly includes antifungal drugs and potassium iodide, while adjuvant therapy includes hyperthermia, cryotherapy, surgery, etc. [13]. Potassium iodide used to be the first-line drug for sporotrichosis, but due to its ineffectiveness and relatively common adverse reactions in some patients, its clinical application has decreased. Itraconazole, due to its broad-spectrum antibacterial effect and good therapeutic effect, has replaced potassium iodide as the recommended first-line drug for the treatment of localized skin and lymphatic type sporotrichosis in guidelines [14]. In addition, amphotericin B is the preferred drug for disseminated and cutaneous sporotrichosis [15]. In this study, the diagnosis of infection with *Sporothrix* sp. was confirmed, and the patient was clinically treated with itraconazole 0.2 g po qd, 10% potassium iodide solution 10 mL po tid, vitamin C 0.5 g ivgtt qd, and local red light irradiation. After 14 days, the patient's condition improved significantly and they were discharged. Treatment was continued outside the hospital according to the doctor's advice, with a course of 3 months. Considering the impact of medication, regularly review relevant indicators such as liver function, kidney function, electrolytes, and thyroid function.

In summary, this article reports a case of foot infection caused by *Sporothrix schenckii*, which was quickly and accurately identified by MALDI-TOF MS and mNGS detection. Reasonable treatment measures were adopted clinically, and the patient improved and was discharged. We hope that in the future, this study can provide assistance for the clinical diagnosis and treatment of *Sporothrix schenckii* infection. Meanwhile, this study confirms that the use of mNGS technology for diagnosing pathogens has promising application prospects.

Ethics Approval and Consent to Participate:

Ethical review and approval was not required for this study. The patient provided written informed consent to participate in this study.

Consent for Publication:

The patient provided written informed consent for study publication.

Availability of Data and Materials:

The original data and materials presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Source of Funds:

This study was supported by the Chongqing Science and Health Joint Medical Research Project Fund (2022-QNXM034).

Declaration of Generative AI in Scientific Writing:

This manuscript and figures were not drafted and edited using artificial intelligence assisted writing tools.

Declaration of Interest:

The authors declare no competing interests.

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