

CASE REPORT

Three Cases of Non-Tuberculosis *Mycobacterium* Skin Infection Outbreak in Beauty Institutions

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SUMMARY

Background: From June 2021 to July 2021, our hospital confirmed 3 cases of *Mycobacterium* infection in skin abscesses. All 3 patients underwent thread embedding and weight loss surgery at the same informal beauty institution, with a history of silk protein injection. None of the patients had any other underlying diseases or surgical history. Symptoms and signs show that the disease is acute and the course of the disease is short. All patients have found subcutaneous masses in different parts of the body. In most cases, the masses show redness and swelling, and some of the masses are accompanied by tenderness, wave sensation, and rupture. After some of the masses rupture, purulent secretions can be seen.

Methods: The pus secreted by the skin lesions of the three patients were cultured to a single bacterium, which was identified by MALDI-TOF MS. Multiple locus sequence typing (MLST) was performed using three specific genes (*hsp65*, *rpoB*, and *secA1*) and seven housekeeping genes (*argH*, *cya*, *glpK*, *gnd*, *murC*, *pta*, and *purH*). The results were queried through the MLST database of *Mycobacterium abscess*.

Results: All three strains of bacteria were *Mycobacterium abscess* type ST279 massiliense subtype. Three antibacterial drugs including cefmetazole, amikacin, and clarithromycin were administered in combination with 5-aminolevulinic acid photodynamic therapy (ALA-PDT). After 3 - 6 months, there was no obvious redness or swelling in the surrounding tissues of the wound, and no obvious purulent secretions were observed. All patients were cured and discharged from the hospital. After a follow-up of six months, there was no recurrence of the lesions.

Conclusions: Medical institutions must strictly follow infection control guidelines and take preventive measures to prevent such incidents from happening again. ALA-PDT as a combination therapy for nontuberculous *Mycobacterium* (NTM) skin infections can improve treatment efficacy and shorten antibiotic usage time.

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KEYWORDS

Mycobacterium abscess, multiple point sequence typing analysis, photodynamics therapy

CASE PRESENTATION

Case 1

Female, 36 years old, admitted due to "multiple masses in the waist and abdomen with redness, swelling, and pain for 14 days". Clinical manifestations: Several subcutaneous masses are palpable in the waist and abdomen, varying in size. Some of the masses are red and swollen, with obvious tenderness, and some of the masses are ruptured, with visible yellow white purulent

secretions (Figure A). Auxiliary examination: Liver function test: Protein 64.6 g/L, Albumin 37.7 g/L, Aspartate aminotransferase 11.6 U/L, Lactate dehydrogenase 117.4 U/L, Blood routine test: White blood cell $10.5 \times 10^9/L$, percentage of neutrophils 79.7%; Positive acid-fast staining in pus; Pus culture indicates the growth of *Mycobacterium abscesses*. Local abscess debridement and drainage surgery, local photodynamic therapy, and symptomatic supportive treatment included 0.5 g oral clarithromycin twice a day, 2.0 g intravenous infusion of cefmetazole sodium twice a day, and 0.8 g intravenous infusion of amikacin sulfate once a day.

Case 2

Female, 51 years old, admitted due to "bilateral hip joint skin mass for 10 days". Clinical manifestations: Skin lumps were found at both hip joints, with surface redness and swelling, obvious tenderness, and a sense of wave motion, without ulceration. Auxiliary examination: Liver function test: Total protein 61.6 g/L, albumin 37.6 g/L. Urinary routine examination: white blood cell neutrophil esterase+, protein+, WBC quantitative examination of 10.0 pieces/ μL , pus culture indicating the growth of *Mycobacterium abscess*, given clarithromycin 0.5 g orally 2/day, cefmetazole sodium 2.0 g intravenous infusion 2/day, amikacin sulfate 0.8 g intravenously 1/day combined with photodynamic therapy and skin lesion debridement as symptomatic support treatment.

Case 3

Female, 40 years old, admitted for 3 weeks due to multiple abdominal masses with redness, swelling, and pain. Clinical manifestations: Multiple subcutaneous masses of varying sizes can be seen in the abdomen, which are red and swollen. Some of the masses are ruptured and discharge yellow purulent secretions, with a small amount of black scab covering them. They are tough and difficult to push, and some of the masses have a sense of wave motion and obvious tenderness. Auxiliary examination: liver function test: albumin 39.9 g/L, aspartate aminotransferase 12.9 U/L, blood routine test: white blood cell $12.4 \times 10^9/L$, urine routine: neutrophil esterase++, protein+, white blood cell counts 160.3/ μL , WBC quantitative examination 140.0/ μL , pus culture indicating the growth of *Mycobacterium abscess*. If the pus acid fast staining is positive, clarithromycin 0.5 g orally 2/day, cefmetazole sodium 2.0 g intravenous infusion 2 times/day, amikacin sulfate 0.8 g intravenous infusion 1 time/day, supplemented by photodynamic therapy, debridement, and dressing change.

DISCUSSION

Non-tuberculosis *Mycobacterium* (NTM) was first isolated from human secretions in the 1980s [1]. The most common non-tuberculosis mycobacteria include *Mycobacterium chelonianum*, *Mycobacterium abscesses*, *Mycobacterium marinum*, *Mycobacterium avian*, *Mycobac-*

terium ulcers, and *Mycobacterium intracellulare* [2]. Both humans and animals can be infected and cause diseases, and there is no evidence of animal transmission or direct transmission between humans [3].

In recent years, there have been more and more reports of infection caused by iatrogenic invasive surgery, such as Botox injection, surgery, acupuncture and moxibustion, skin filler, laser hair removal, etc. [4]. The clinical manifestations of skin NTM infection are not specific, usually with erythema, nodules, abscesses as the first symptoms. It is also difficult to diagnose these infections through traditional bacterial culture. So, clinicians should consider the possibility of NTM infection if a patient has failed to respond to repeated conventional antimicrobial therapy. Once suspected, acid-fast staining and bacterial culture should be carried out in a timely manner to avoid misdiagnosis and delayed treatment. In addition, the negative results of laboratory *Mycobacterium* culture may be related to the sampling method and location. Measures such as multi-site sampling, deep tissue pus extraction, and mass tissue cultivation after grinding can improve the detection rate of positive bacteria [5].

In order to ultimately confirm the patient's disease, it is necessary to perform pus acid-fast staining (Figure B, D) and bacterial culture (Figure C). The results indicate the growth of acid-fast bacteria and *Mycobacterium abscess*, which confirms the preliminary diagnosis and can be confirmed as *non-tuberculosis Mycobacterium* skin soft tissue infection. The bacteria isolated from the three cases were all identified as *Mycobacterium abscess* by MALDI-TOF MS. In order to further epidemiological investigation, MLST was used for validation. It was found that due to the same sequence of *Mycobacterium abscesses* and *Mycobacterium chelonianum*, subtype identification of *Mycobacterium abscesses* cannot be performed using 16S rRNA as the target gene test [6]. In terms of treatment, the treatment of *Mycobacterium abscess* infection is difficult, and there is currently no treatment standard. There are literature reports [7] that only 10% to 20% of patients with normal immune function can spontaneously alleviate local skin infections within an average of 9 months. *Mycobacterium abscess* is highly resistant to traditional anti-tuberculosis drugs such as streptomycin, isoniazid, and ethambutol. In addition, it is also highly resistant to imipenem, tigecycline, compound sulfamethoxazole Linazolamide and doxycycline have a high resistance rate, and are more sensitive to clarithromycin, amikacin, and cefoxitin [8]. Therefore, it is recommended to conduct antibacterial drug sensitivity tests on all clinically isolated strains, and select suitable drug composition treatment plans based on the drug sensitivity test results. It is recommended to combine two or more sensitive drugs for treatment [9]. All three cases in this study were treated with three antibiotics, cefmetazole sodium, amikacin, and clarithromycin, combined with 5-aminolevulinic acid photodynamic therapy (ALA-PDT). After 3 - 6 months of treatment, all patients' skin lesions subsided,

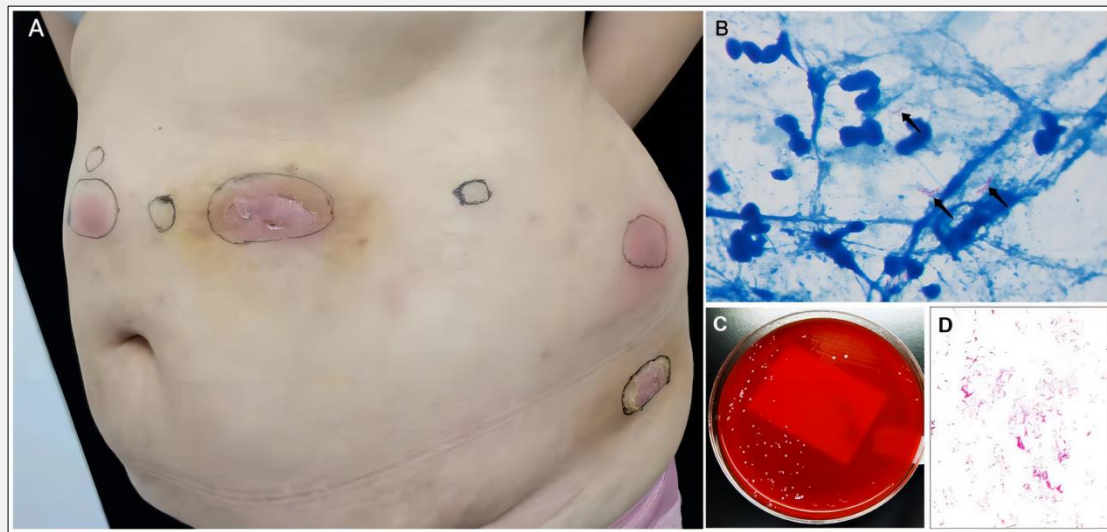


Figure. Clinical and bacteriological images.

Figure A. Skin nodules after infection with *Mycobacterium abscess*.

Figure B. Direct smear acid fast staining of purulent secretions x 1,000.

Figure C. Colony growth of *Mycobacterium abscesses* on blood agar plates.

Figure D. Acid fast staining of *Mycobacterium abscesses* on blood agar plates x 1,000.

no obvious purulent secretions were observed, and there was no obvious redness or swelling in the tissues around the wound. During the treatment process, mild pigmentation was left, and local scars formed. All patients were cured and discharged, and no recurrence of the lesions was observed during a six-month follow-up. These 3 cases of *Mycobacterium abscesses* infection in this study all came from the invasive surgery of informal medical institutions-catgut embedding to lose weight. This surgery belongs to one of the traditional Chinese medicine acupunctures and moxibustion manipulations. Acupuncture and moxibustion is a non-invasive substitute for traditional medicine and is widely used to treat chronic pain, allergy, endocrine system and other diseases [10]. The operation process integrates acupuncture, acupoint sealing and other therapies, forming a unique composite treatment method of embedding thread. Due to improper sterilization technology, invasive infections occur during the treatment process.

Unlike traditional treatment methods for *Mycobacterium abscess* infection, this study combines 5-aminolevulinic acid photodynamic therapy (ALA-PDT), which inactivates NTM by exposing microorganisms to high concentrations of singlet oxygen generated during the photodynamic reaction between light and photosensitizers [11]. This method has been proven to have high efficacy in bacterial and fungal infections, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, par-

tially coagulase negative *Staphylococcus*, yeast-like fungi, and NTM [12]. Studies have shown [13] that ALA-PDT is effective in treating NTM skin infections, usually as a combination therapy that can improve treatment efficacy, shorten antibiotic use time, and reduce recurrence. Due to limited clinical research, as a preliminary study, this study confirms the clinical efficacy of photodynamic therapy.

We have accumulated relevant testing experience in this study. In clinical work, the routine first involves reviewing clinical samples used for diagnosis, followed by conducting smear microscopy identification, and then conducting isolation and cultivation. Among them, isolation and cultivation have always been one of the most effective methods for detecting NTM.

This study reported the infection of humans through invasive surgery in contact with water or operating equipment infected with *non-tuberculosis mycobacteria*. Therefore, in the treatment of invasive surgery such as injection, acupuncture and moxibustion, acupoint catgut embedding, tattoo, laser hair removal, etc., the infection control guidelines must be strictly followed, and infection prevention measures must be taken to avoid the recurrence of similar cases.

Ethics Approval and Consent to Participate:

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

Consent for Publication:

The patients 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.

Declaration of Interest:

The authors declare no competing interests.

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