A CASE REPORT OF *MYCOBACTERIUM MARINUM* INFECTION

Cuc Thi Kim Nguyen, MD[1], Trung Van Le, MD[2], Anh Thi Quynh Luong, MD[2], Giang Thi Ha Quach, MD[1], Doanh Huu Le, MD.PhD[1,2]

ABSTRACT

Mycobacterium marinum infection, also known as swimming pool granuloma, caused by *Mycobacterium marinum*, is the most common non-tuberculous Mycobacterium infection in immunocompromised patients. The bacterium invades the skin through cuts or abrasions in aquatic environments. The the typical lesion presents as a small purple nodules at the site of infection, which gradually expands into a dark red to purple patch, which may ulcerate or suppurate. The diagnosis of *M. marinum* infection on the skin is primarily based on clinical manifestations, along with the supportive role of histopathology and response to treatment. This infection is supposed respond to a variety of antibiotics, either alone or in combination. In this paper, we present a case of a 35-year-old male patient with manifestations of this disease.

Keywords: *Mycobacterium marinum, Non-tuberculous Mycobacterium, Granuloma.*

1. INTRODUCTION

Mycobacterium marinum is the most prevalent among non-tuberculous mycobacterium species responsible for opportunistic infections in humans. *M. marium* is widely distributed in aquatic environments, especially in relatively still or stagnant waters, such as fish tanks, swimming pools, and natural water bodies. The bacterium infects the skin through cuts or abrasions in contaminated water or by direct contact with fish or shellfish. Following an incubation period, a small purple nodule typically appears at the site of infection. The lesions gradually expand into a dark red to purple patch with a scaly surface (60%), and may ulcerate or suppurate and exudate. Lumps or nodules may also develop along the lymphatic pathway (25%). Although the infection is frequently limited to the skin, it can progressively spread deeper, potentially leading to conditions such as tendonitis, arthritis, bursitis, and osteomyelitis. While bacterial culture is the gold standard for diagnosing *M. marinum* infection, in practice, the diagnosis remains largely presumptive, based primarily on clinical presentation, histopathological features, and the response to treatment. This infection can respond to a variety of antibiotic regimens, either used alone or in combination. In this paper, we report a case of a 35-year-old male patient presenting with the symptoms of this condition.

2. CASE PRESENTATION

2.1. Clinical manifestations

A 35 year-old male patient, who worked as a shrimp farmer, with a healthy medical history and no history of food or drug allergies. He was injured by a screw in a shrimp pond that punctured his right knee two years ago. The patient did not seek medical attention and self-treated with various topical medications. Subsequently, a red nodule appeared on his right knee. The lesion

[1]*National Hospital of Dermatology and Venereology*
[2]*Hanoi Medical University*
Corresponding author: Cuc Thi Kim Nguyen, MD
Email: kimcuc190989@gmail.com
DOI: https://doi.org/10.56320/tcdlhvn.49.275

gradually increasing in size and was accompanied by a few small pustules. The patient continued using topical medications and applying herbal medicine, but the lesion kept exacerbating with mild itching. Physical examination revealed a firm, dark red, invasive patch with well-defined borders, covered with scaly crusts, measuring 10 x 5 cm on the right knee.

Functional symptoms: Mild itching at the lesion site.

Figure 1. Skin lesion on admission

2.2. Laboratory examination

- Histopathological findings exhibited pseudocarcinomatous epithelial hyperplasia and ulceration. The dermis was involved by dense inflammatory infiltrate of lymphocytes, eosinophils, and plasma cells in both superficial and deep dermis. No granulomatous reaction, no malignant cells.

Conclusion: Pseudo-tumoral epidermal hyperplasia.

PAS stain: Negative.

Ziehl-Neelsen stain: Negative.

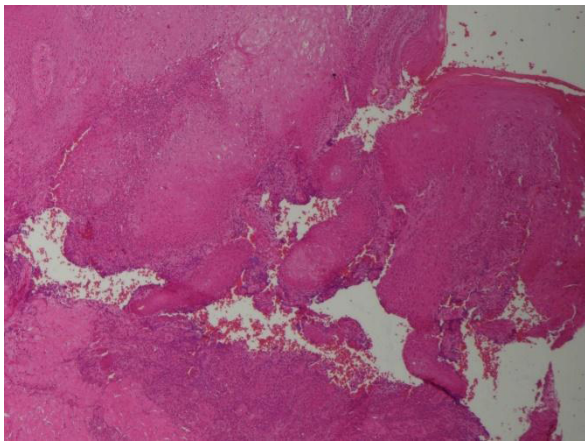

Figure 2. Histopathology of right knee lesion (Hematoxylin & eosin, ×4)

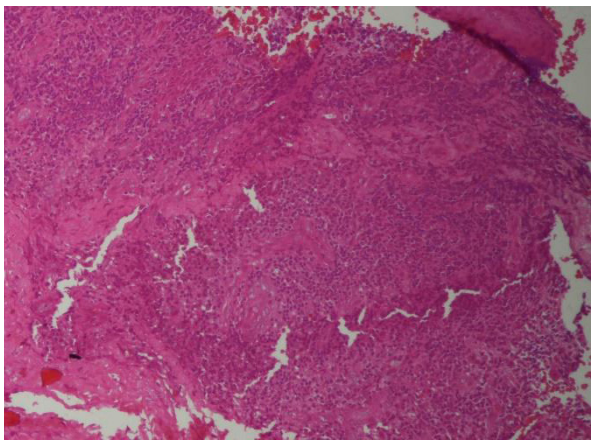

Figure 3. Histopathology of right knee lesion (Hematoxylin & eosin, ×10)

- Direct microscopic examination of fungus on the skin lesions on the right knee: (-).

- Chest X-ray (PA view), abdominal ultrasound, complete blood acount, serum biochemistry test did not detect any abnormalities.

- Mycobacterium tuberculosis IGRA: Undetermined.

- Fungal culture test: Negative after 4 days of cultivation.

2.3. Diagnosis: *Mycobacterium marinum* infection.

2.4. Treatment

The patient was treated with minocycline 100 mg, two tablets per day. The lesions responded well, with reduced erythema, decreased infiltration, reduced itching, and no new pustules appearing.

Figure 4. Skin lesion after 1 month of treatment

Figure 5. Skin lesion after 2 month of treatment

Figre 6. Healed patch after 3 months of treatment

3. DISCUSSION

Mycobacterium marinum is the most prevalent non-tuberculous mycobacterium responsible for opportunistic infections in humans. *M. marinum* was first isolated from a dead fish in a fish tank in Philadelphia in 1926 and was identified as a human pathogen in 1951 after being isolated from granulomatous skin lesions in patients from Sweden.[1] *M. marium* is widely distributed in aquatic environments, especially in relatively still or stagnant waters, such as fish tanks, swimming pools, and natural water bodies.[2] The bacterium infects the skin through cuts or abrasions in contaminated aqueous environment or by direct contact with fish or shellfish. The disease has clear occupational factors: swimmers, fishermen, aquarium keepers, and other marine occupations.[3] The annual incidence of *M. marinum* infection in the USA is approximately 0.27 cases per 100.000 inhabitants.[4] Chlorination to sanitize swimming pools has significantly reduced the number of infected cases.[5] In our case report, the patient has been working as a shrimp farmer, and the lesion appeared after the patient sustained an abrasion on the right knee while working in the shrimp pond. This is considered an important factor suggesting the diagnosis of an infectious disease.

The incubation period typically ranges under 4 weeks, but can be as long as 9 months.[3] After an incubation period, at the site of infection, a small

purple nodule appears. The lesions gradually expand into a dark red to purple patch with a scaly surface (60%), and may develop ulceration and pus. Lumps or nodules may also appear along the lymphatic pathway (25%).[6] Lesions are commonly observed in trauma-prone areas, including the hands, legs, elbows, and knees. Infection is usually limited to the skin, as *Mycobacterium marinum* preferentially grows at temperatures between 25 - 35°C. However, the infection can progressively spread deeper, potentially leading to severe conditions such as tendonitis, arthritis, bursitis, and osteomyelitis. Disseminated infections are extremely rare and almost always occur in immunocompromised patients.[6] Our patient with *Mycobacterium marinum* infection presented with a red, indurated, well-demarcated plaque with purulent discharge and overlying scales and crusts on the right knee. There was no involvement of the joint or synovial membrane. This presentation is consistent with previously reported cases of *M. marinum* infection in the literature.

Culture of *Mycobacterium marinum* from tissue biopsy specimens is considered a gold standard for diagnosis. The positivity rate of cultures ranges from 70% to 80%.[7] A biopsy should be taken from a lesion measuring at least 4 mm in diameter, or multiple lesions should be biopsied. *M. marinu*m grows optimally on Lowenstein-Jensen medium at 32 degrees Centigrade. Colonies appear after 2 to 3 weeks. The colonies are smooth, shiny, and cream-colored, turning yellow upon exposure to light. Observation is recommended within 6 to 12 weeks. Ziehl-Neelsen staining is positive in 9% to 13% of case.[8] Our patient infected with *M. marinum* was ZiehDoanh Hl-Neelsen negative. Fungal culture after 4 days showed no fungal growth.

Histopathology shows non-specific inflammation, with infiltration of lymphocytes, epithelial cells, and giant Langerhans cells, usually with no signs of necrosis. In the early stage, there are numerous neutrophils surrounded by macrophages. In the late stage, typical granulomatous formation is observed (60%).[9] The histopathology of our patient infected with *Mycobacterium marinum* is consistent, showing dense infiltration of lymphocytes, eosinophils, and plasmacytes in both the superficial and deep dermis. No granulomatous reaction has been observed yet.

Although bacterial culture is the gold standard for diagnosing *M. marinum* infection, in practice, the diagnosis remains largely presumptive. The diagnosis of *M. marinu*m infection in the skin is primarily clinical, supported by histopathological features and response to therapy.[10]

At present, there is no consensus on the optimal treatment for *M. marinu*m infection. In certain cases, lesions resolve on their own within 3 years.[7] Treatment depends on the severity of the lesion and the patient's immune status. According to the 2007 treatment guidelines from the American Thoracic Society (ATS) and the Infectious Diseases Society of America (IDSA), treatment should involve at least two antibiotics, continued for 1 - 2 months after the resolution of skin lesions, with an overall treatment duration of 3 - 4 months. Monotherapy may also be considered for patients with mild infections or those with superficial skin involvement only.[11] Consider maintaining the selected treatment regimen for three months before altering the antibiotic therapy, as the response to treatment can be slow.[12] Several antibiotics have been reported as effective options; however, there are no randomized controlled trials, and the final choice depends on clinical experience. Commonly used antibiotics include tetracyclines (primarily minocycline and doxycycline), sulfamethoxazole combined with trimethoprim, rifampicin, and ethambutol. Less commonly used alternatives

include clarithromycin, levofloxacin, amikacin, macrolides, and fluoroquinolones. Monotherapy with minocycline, doxycycline, or clarithromycin has been shown to be effective in multiple cases, especially for superficial skin infections.[6,13] Combination antibiotic therapy, commonly using clarithromycin in combination with rifampicin and/or ethambutol, is used for deep tissue lesions infected with *M.marinum*.[11] Our patient infected with *Mycobacterium marinum* had a culture after 4 days with no fungal growth, and Ziehl-Neelsen staining was negative. Histopathology showed no granulomatous reaction. However, the patient's underlying lesions and epidemiological factors were consistent with *M. marinu*m infection, so we initiated treatment with 200mg of minocycline per day. The lesions responded well, with reduced infiltration and itching. This further supports the patient's diagnosis.

In most cases, particularly in patients with normal immune function, *M. marinum* infection has an excellent prognosis when treated. Treatment failure may occur due to deeper infections and ulcerative skin lesions. The risk of antibiotic resistance is very low. Chronic complications of the disease are extremely rare when the patient is diagnosed early and receives appropriate treatment. However, some patients may develop persistent ulcers at the initial site. Delayed treatment, inappropriate antibiotic selection, or insufficient duration of antibiotic therapy may lead to deeper infections, including osteomyelitis, tenosynovitis, and disseminated disease, which could necessitate amputation of the affected limb.[14]

4. CONCLUSIONS

Mycobacterium marinum is the most prevalent non-tuberculous mycobacterium responsible for opportunistic infections in humans. The bacterium infects the skin through cuts or abrasions in contaminated aqueous environment. The diagnosis of *M. marinu*m infection is primarily clinical, supported by histopathological findings and response to therapy. When diagnosed early and treated appropriately, *M. marinu*m infection generally has a good prognosis. Delayed treatment, inappropriate antibiotic selection may lead to deeper infections, disseminated disease and limb amputation.

REFERENCES

1. NORDEN A, LINELL F. A new type of pathogenic *Mycobacterium*. Nature. 1951;168(4280):826. doi:10.1038/168826a0.
2. Falkinham JO 3rd, Norton CD, LeChevallier MW. Factors influencing numbers of Mycobacterium avium, *Mycobacterium intracellulare*, and other *Mycobacteria* in drinking water distribution systems. Appl Environ Microbiol. 2001;67(3):1225-1231. doi:10.1128/AEM.67.3.1225-1231.2001.
3. Jernigan JA, Farr BM. Incubation period and sources of exposure for cutaneous *Mycobacterium marinum* infection: Case report and review of the literature. Clin Infect Dis. 2000;31(2):439-443. doi:10.1086/313972.
4. Aubry A, Mougari F, Reibel F, Cambau E. *Mycobacterium marinum*. Microbiol Spectr. 2017;5(2):10.1128/microbiolspec.TNMI7-0038-2016. doi:10.1128/microbiolspec.TNMI7-0038-2016.
5. Dailloux M, Hartemann P, Beurey J. Study on the relationship between isolation of mycobacteria and classical microbiological and chemical indicators of water quality in swimming pools. Zentralbl Bakteriol Mikrobiol Hyg B. 1980;171(6):473-486.
6. Aubry A, Chosidow O, Caumes E, Robert J, Cambau E. Sixty-three cases of *Mycobacterium marinum* infection: Clinical features, treatment,

and antibiotic susceptibility of causative isolates. Arch Intern Med. 2002;162(15):1746-1752. doi:10.1001/archinte.162.15.1746.

7. Streit M, Bregenzer T, Heinzer I. Hautinfektionen durch atypische Mykobakterien [Cutaneous infections due to atypical mycobacteria]. Hautarzt. 2008;59(1):59-71. doi:10.1007/s00105-007-1447-1.
8. Rallis E, Koumantaki-Mathioudaki E. Treatment of *Mycobacterium marinum* cutaneous infections. Expert Opin Pharmacother. 2007;8(17):2965-2978. doi:10.1517/14656566.8.17.2965.
9. Cribier B, Aubry A, Caumes E, Cambau E, Jarlier V, Chosidow O. Aspects histopathologiques de l'infection à Mycobacterium marinum [Histopathological study of *Mycobacterium marinum* infection]. Ann Dermatol Venereol. 2011;138(1):17-22. doi:10.1016/j.annder.2010.10.025.
10. Ang P, Rattana-Apiromyakij N, Goh CL. Retrospective study of *Mycobacterium marinum* skin infections. Int J Dermatol. 2000;39(5):343-347. doi:10.1046/j.1365-4362.2000.00916.x.
11. Griffith DE, Aksamit T, Brown-Elliott BA, et al. An official ATS/IDSA statement: Diagnosis, treatment, and prevention of nontuberculous mycobacterial diseases [published correction appears in Am J Respir Crit Care Med. 2007 Apr 1;175(7):744-5. Dosage error in article text]. Am J Respir Crit Care Med. 2007;175(4):367-416. doi:10.1164/rccm.200604-571ST.
12. Akram SM, Aboobacker S. *Mycobacterium marinum* Infection. In: StatPearls. Treasure Island (FL): StatPearls Publishing; July 17, 2023.
13. Cummins DL, Delacerda D, Tausk FA. *Mycobacterium marinum* with different responses to second-generation tetracyclines. Int J Dermatol. 2005;44(6):518-520. doi:10.1111/j.1365-4632.2005.02204.x.
14. Holden IK, Kehrer M, Andersen AB, Wejse C, Svensson E, Johansen IS. *Mycobacterium marinum* infections in Denmark from 2004 to 2017: A retrospective study of incidence, patient characteristics, treatment regimens and outcome. Sci Rep. 2018;8(1):6738. Published 2018 Apr 30. doi:10.1038/s41598-018-24702-7.