

# Methicillin-resistant *Staphylococcus aureus* foot infection after fish pedicure

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**Abstract** Fish pedicure has become a popular cosmetic procedure involving immersion of the feet in a tank with freshwater fish (*Garra rufa*) that nibble off dead skin. There are concerns about the potential transmission of pathogens, but no cases of infections after this procedure have been published so far. We present a patient who developed foot infection with methicillin-resistant *Staphylococcus aureus* (MRSA) after fish pedicure.

**Keywords** Fish pedicure · Fish spa · Cosmetic techniques · Skin infection · *Garra rufa* · MRSA · Zoonosis

## Introduction

Fish pedicure is a procedure that has become increasingly popular in many countries. The widespread use of this cosmetic treatment has raised the question about its safety. Public health authorities from some US states and Canadian provinces have banned this practice. Others, such as the United Kingdom Health Protection Agency, have defined standards for the management of the public health risks from the cosmetic use of fish pedicures [1]. However, to date, there have been no published reports of infections related to fish pedicures. We present a patient who experienced a methicillin-resistant *Staphylococcus aureus*

(MRSA) soft tissue infection of his right foot 6 days after a fish spa treatment during his holidays.

## Case report

A 47-year-old previously healthy man presented to the emergency department because of painful swelling of his right forefoot. A few days before, the patient had returned from a holiday on the Island of Mallorca, Spain. On admission, the patient was afebrile and showed normal vital parameters. The third toe of his right foot was swollen and tender, and a skin erythema extended over the dorsum of the foot (Fig. 1a). Interdigital macerations due to tinea pedis were present. Magnetic resonance tomography revealed diffuse edema of the forefoot with a focal abscess beneath the proximal phalanx of the third toe without signs of deep fascial involvement or osteomyelitis. Incision and drainage of the abscess was performed. Cultures grew MRSA expressing Panton–Valentine leukocidin (PVL). The strain was resistant to penicillin, oxacillin, and fusidic acid, but susceptible to ciprofloxacin, levofloxacin, cotrimoxazole, erythromycin, clindamycin, tetracycline, rifampin, gentamicin, and vancomycin.

After treatment with cotrimoxazole and rifampin for 2 weeks, the patient had fully recovered.

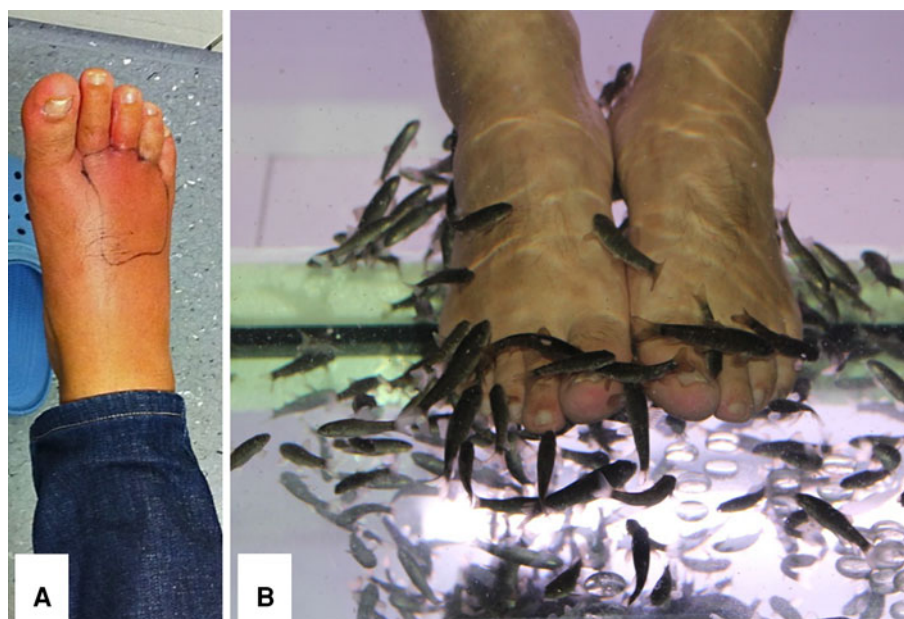
## Discussion

This previously healthy middle-aged man with tinea pedis as the only obvious risk factor was admitted to the hospital because of acute forefoot soft tissue MRSA infection that had occurred a few days after returning from a holiday on the Island of Mallorca. Since the prevalence of MRSA is

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**Fig. 1** **a** Cellulitis of the right forefoot upon initial presentation. **b** The patient's feet immersed in a fish tank containing *Garra rufa* fish



very low in our part of Switzerland (<2 % MRSA of all *S. aureus* isolates sent to the local laboratories which participate in surveillance projects) and the patient did not report any contact with health care facilities, we focused on holiday activities that might have put him at risk for community-associated MRSA infection. The patient had not participated in contact sports activities and did not stay in crowded or unsanitary conditions. However, he had experienced a fish pedicure 6 days before the onset of the first symptoms. This practice involves immersing the feet in a freshwater fish tank containing *Garra rufa*, also called Kangal fish or doctor fish (Fig. 1b). These toothless freshwater fish nibble off dead skin cells from the feet. The natural habitat of *Garra rufa* is the hot springs of Kangal in Central Anatolia. Ichthyotherapy has a long tradition in Turkey, and favorable effects have been reported in patients with psoriasis [2]. Fish spa pedicure is becoming very popular in many countries, including the UK. In a 2011 survey, 279 fish spas were identified in the UK. Every week, up to 20,000 *Garra rufa* fish are imported from Asia to the UK [1]. Since bacterial infections of the fish during transport are a well-known problem, antimicrobials are frequently added to the water of the fish tanks [3]. In April 2011, an outbreak affecting about 6,000 *Garra rufa* fish has been reported, involving *Streptococcus agalactiae* as the causative pathogen [4]. Due to antibiotic selection pressure, ornamental fish and their carriage water can act as a significant reservoir for multidrug-resistant bacteria. Verner-Jeffreys et al. reported that 47 of 94 *Aeromonas* samples found in 25 different consignments of imported warm-water fish were individually tolerant to >15 different

antibiotics [3]. The public health risk from fish spa has recently been assessed by the British Health Protection Agency [1]. Keeping the water free of pathogenic microorganisms is a challenge, since commonly used water disinfection methods will also kill the fish. However, no cases of the transmission of pathogenic microorganisms associated with fish pedicure have been published to date. Nevertheless, the risk of transmission should not be neglected. Patients with psoriatic lesions are frequently colonized with *S. aureus*. In a recent publication, it could be shown that persons who are colonized with methicillin-susceptible *S. aureus* (MSSA) or MRSA strains can shed this microorganism into its bathing milieu [5]. Hence, the waterborne transmission of MSSA or MRSA should be taken into consideration in the setting of fish spa pedicure.

In our case, we were not able to obtain microbiological samples from the fish tank environment for obvious reasons. Thus, the source of infection cannot be definitely proven. However, the close temporal relationship between the fish pedicure and the onset of symptoms is suggestive for a causal role of the fish pedicure procedure. To support this hypothesis, we further analyzed the MRSA strain by pulsed-field gel electrophoresis (PFGE) and *spa* typing. The patient's isolate was compared with a collection comprising all non-repetitive clinical MRSA strains sent to the Clinical Microbiology of the University Hospital Basel since 1994 [6]. This comprehensive collection is thought to accurately reflect the MRSA strain distribution in the northwestern part of Switzerland, where the patient lives. The PFGE pattern was not related with the MRSA strains in the collection. *spa* typing revealed *spa* type t127, which

is not endemic in Switzerland according to the data of the Ridom SpaServer (Ridom GmbH, Würzburg, Germany) [7].

Toe web intertrigo and colonization of the intertriginous area with *S. aureus* and beta-hemolytic streptococci are significant risk factors for the development of lower limb cellulitis [8]. Therefore, patients with toe web intertrigo could either act as vectors for these pathogens in the setting of fish spa treatment or they could become colonized with potential pathogens. In conclusion, the risk of infection associated with fish spa treatment should not be completely neglected, even if it is considered to be low. Patients with underlying conditions, chronic skin diseases, obvious skin breaks, abrasions, or toe web intertrigo should be discouraged from undertaking this cosmetic treatment. In case of infection, a microbiological diagnosis should be attempted, since the presence of multiresistant bacteria must be taken into consideration.

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

## References

1. Health Protection Agency, Fish Spa Working Group. Guidance on the management of the public health risks from fish pedicure. VI, 31 August 2011. [http://www.hpa.org.uk/webc/HPAwebFile/HPAweb\\_C/1317131045549](http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317131045549). Accessed 20 Dec 2012.
2. Grassberger M, Hoch W. Ichthyotherapy as alternative treatment for patients with psoriasis: a pilot study. *Evid Based Complement Alternat Med*. 2006;3:483–8. doi:10.1093/ecam/nel033.
3. Verner-Jeffreys DW, Welch TJ, Schwarz T, Pond MJ, Woodward MJ, Haig SJ, et al. High prevalence of multidrug-tolerant bacteria and associated antimicrobial resistance genes isolated from ornamental fish and their carriage water. *PLoS One*. 2009;4:e8388. doi:10.1371/journal.pone.0008388.
4. Verner-Jeffreys DW, Baker-Austin C, Pond MJ, Rimmer GS, Kerr R, Stone D, et al. Zoonotic disease pathogens in fish used for pedicure. *Emerg Infect Dis*. 2012;18:1006–8. doi:10.3201/eid1806.111782.
5. Plano LR, Garza AC, Shibata T, Elmir SM, Kish J, Sinigalliano CD, et al. Shedding of *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* from adult and pediatric bathers in marine waters. *BMC Microbiol*. 2011;11:5. doi:10.1186/1471-2180-11-5.
6. Fenner L, Widmer AF, Dangel M, Frei R. Distribution of *spa* types among methicillin-resistant *Staphylococcus aureus* isolates during a 6 year period at a low-prevalence University Hospital. *J Med Microbiol*. 2008;57:612–6. doi:10.1099/jmm.0.47757-0.
7. Harmsen D, Claus H, Witte W, Rothgänger J, Claus H, Turnwald D, et al. Typing of methicillin-resistant *Staphylococcus aureus* in a university hospital setting by using novel software for *spa* repeat determination and database management. *J Clin Microbiol*. 2003;41:5442–8.
8. Björnsdóttir S, Gottfredsson M, Thórisdóttir AS, Gunnarsson GB, Ríkardsdóttir H, Kristjánsson M, et al. Risk factors for acute cellulitis of the lower limb: a prospective case-control study. *Clin Infect Dis*. 2005;41:1416–22. doi:10.1086/497127.