Cutaneous Inoculation of Nontuberculous Mycobacteria During Professional Tattooing: A Case Series and Epidemiologic Study

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Background. The increase in popularity of tattoos has coincided with an increase in reports of cutaneous inoculation of nontuberculous (atypical) mycobacteria (NTM) during the tattooing process. We report 3 NTM infections in otherwise healthy persons who received tattoos, which prompted a multiagency epidemiologic investigation.

Methods. Tattoo artists involved were contacted and interviewed regarding practices, ink procurement and use, and other symptomatic clients. Additional patients were identified from their client lists with an Internet survey.

Results. Thirty-one cases of suspected or confirmed NTM inoculation from professional tattooing were uncovered, including 5 confirmed and 26 suspected cases. Clinical biopsy specimens from 3 confirmed infections grew Mycobacterium abscessus strains that were indistinguishable by pulsed-field gel electrophoresis testing. Another 2 skin specimens grew Mycobacterium chelonae, which also grew from a bottle of graywash ink obtained from the tattoo artist.

Conclusions. The pathogenicity and antibiotic resistance patterns of certain NTM isolates highlight the importance of correct diagnosis and potential difficulty in treating infections. Enforcement of new standards for the regulation and use of tattoo inks should be considered.

Keywords. nontuberculous mycobacteria (NTM); antibiotic resistance; tattoo.

Nontuberculous mycobacteria (NTM) are ubiquitous environmental organisms. Cutaneous NTM infections most often occur after exposure to contaminated water or following penetrating trauma with inoculation of the organism into cutaneous tissue [1]. Infection can occur among both immunocompetent and immunocompromised hosts. In addition to postsurgical infections, NTM infections can occur following acupuncture [2], mesotherapy [3], pedicures [4], and body piercing [5]. NTM inoculation during tattooing has been increasingly reported during the last decade; reports from the United States, France, Spain, and Australia [6–19] underscore the public health impact of NTM infections associated with professional tattoos. We investigated 3 cases of primary inoculation of the skin with NTM after decorative tattoo placement. The subsequent epidemiologic investigation revealed a substantial number of suspected infections and implicated the tattoo ink as the source of infection.

CASE REPORTS

During January–March 2012, 3 previously healthy patients presented to our dermatology center with complaints localized to tattoos that were placed October–December 2011. Small (2–4 mm), relatively monomorphic, erythematous papules and pustules occurring primarily
within the tattooed skin (Figure 1) initially appeared 7–21 days after tattoo placement, with new papules developing in the subsequent 1–4 months. Symptoms included pain and pruritus. Superficial culture swabs obtained from all 3 patients were negative for bacteria. Skin biopsies were collected from all patients for culture; histology revealed granulomatous inflammation and tattoo pigment with negative tissue stains for acid-fast bacilli (Figure 2). Superpotent topical steroid therapy and topical antibiotic therapy (mupirocin) were ineffective for all patients. Two patients received an empiric course of trimethoprim/sulfamethoxazole (1 double-strength tablet twice daily for 14 days) without benefit.

NTM was isolated from tissue culture between 6 and 28 days. Empiric regimens of oral moxifloxacin 400 mg daily and oral clarithromycin 500 mg twice daily were initiated while awaiting species identification and sensitivities.

Speciation from patient 1 revealed *Mycobacterium chelonae* that was sensitive to clarithromycin but resistant to minocycline, and adequate clinical improvement in papules and pustules was achieved after 4 months of this regimen. Speciation in patient 2 revealed *Mycobacterium abscessus* with intermediate sensitivity to clarithromycin and resistance to minocycline; clinical cure was achieved after 1 month of therapy, and the patient completed an additional month of treatment.

Culture from patient 3 grew *M. abscessus*; moxifloxacin was changed to ciprofloxacin after 3 weeks because the isolated organism revealed a more favorable minimum inhibitory concentration to the latter. The patient continued to experience new papules and pustules on therapy, and linezolid was substituted for the ciprofloxacin with clinical improvement; however, the patient experienced a drop in absolute neutrophil count (4660–2780 cells/µL) and platelets (201 000–133 000 cells/µL) requiring

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**Figure 1.** Representative clinical findings of nontuberculous mycobacterium (NTM) tattoo infections (A, B). Crusted erythematous papulopustular and papulonodular eruptions caused by NTM confined to the tattooed skin. Photographs were taken approximately 2–3 months after tattooing.

**Figure 2.** Representative histology from skin biopsy showing epithelial hyperplasia, with a lymphohistiocytic and focally neutrophilic perivascular and interstitial inflammatory infiltrate admixed with black tattoo ink (hematoxylin and eosin, original magnification ×50 [A] and ×200 [B]). A limited number of multinucleated giant cells and granulomas were observed. No microorganisms were identified using acid-fast bacilli, Gomori methenamine silver, or Brown-Brenn stains.
discontinuation of linezolid. A peripherally inserted central catheter (PICC) was placed, and the patient was initiated on intravenous tigecycline. The PICC line was removed on day 14 secondary to a presumed insertion site infection (unrelated to NTM infection), and all antibiotics were stopped with sustained clinical improvement.

Side effects during therapy were common; all patients experienced gastrointestinal symptoms including loose stools and abdominal pain, 2 patients experienced vaginal candidiasis, and 1 patient developed tinea corporis.

**EPIDEMIOLOGIC INVESTIGATION**

In response to reports of 3 NTM infections among tattoo recipients during February 2012, Public Health–Seattle & King County (PHSKC) sent out a health alert to King County and Snohomish County healthcare providers and clinical laboratories, and a multiagency investigation was initiated. The 2 tattoo artists involved were contacted and interviewed regarding practices, ink procurement and use, and other symptomatic clients. Additional patients were identified from their client lists with an Internet survey. Persons tattooed during July–December 2011 were classified as having suspected infections if they reported an ulceronodular rash lasting >1 week at their tattoo site. Infections were classified as confirmed if culture-positive for NTM. This investigation revealed 2 unlinked clusters of NTM infections. Cluster A comprised 27 infections, all tattooed by the same artist by using the same bottle of brand A black ink during September–October 2011. Three of these infections were confirmed by biopsy and culture; the remaining infections were suspected. Cluster B comprised 4 infections (2 confirmed through biopsy and culture), all of whom were tattooed by using the same bottle of brand B graywash ink during October–December 2011. No infections were identified among either artist’s clients tattooed with previous or subsequent bottles of ink.

Tattoo ink company officials were contacted regarding manufacturing and distribution practices. Company A allowed PHSKC to conduct a traceback investigation consisting of phone and email interviews, which revealed that company A obtained its ink from another company that bought its ink from a chemical company using a printing company as a broker. Company A had identified a single batch of ink that was associated with these complaints and voluntarily issued a recall. Company B declined to provide ingredients or sources of inks, and denied receiving any complaints.

Clinical isolates from patients and ink samples implicated in both clusters were submitted to the Centers for Disease Control and Prevention for culture, identification confirmation by 16S and rpoB sequencing, and pulsed-field gel electrophoresis (PFGE) testing. No NTM was recovered from brand A ink samples; brand B ink samples obtained from the tattoo artist grew *M. chelonae* indistinguishable from patient 1’s clinical isolate by PFGE [4].

**DISCUSSION**

A 2003 Harris Interactive poll reported that approximately 16% of all adults reported having ≥1 tattoo, and the Food and Drug Administration estimates that as many as 45 million Americans have tattoos [20]. In one review, complications occurred after approximately 2% of tattoos, including infections, neoplasms, and inflammatory dermatoses [21]. Underreporting of problems with tattoos to health providers and appropriate public health organizations may be substantial; indeed, in our investigation, fewer than half of the patients with suspected infection sought medical treatment from a healthcare provider.

NTM infections associated with tattoo placement have been reported worldwide [6–19]. Symptoms occur 1–4 weeks after tattooing and have been described as papules, pustules, or “rash”; secondary descriptors include granulomatous or lichenoid qualities. Itching and pain are common symptoms [7, 16]. The clinical differential diagnosis is broad, and could reasonably include acute pyogenic infection with *Staphylococcus* or *Streptococcus* species, inflammatory reactions to tattoo ink, sarcoidosis, and even isomorphous phenomenon of inflammatory dermatitis such as lichen planus or psoriasis. Skin biopsy is recommended for diagnosis.

NTM infection from tattooing has primarily been associated with contamination of the inks used for tattooing, either from the ink itself [7] (as in our cluster of patients) or when solutions are used to dilute the ink, particularly nonsterile water [10]. The majority of infections have been caused by *M. chelonae* [6, 7, 10, 11, 15, 17] or *M. abscessus* [13, 15], although cases with other NTM including *Mycobacterium haemophilus* [9] and *Mycobacterium immunogenum* [12] have been reported. Although NTM was not isolated from unopened ink samples in this study, company A did report other complaints associated with its ink, implicating the ink rather than practices of the tattoo artist.

Confirmation of NTM infection within tattoos should include culture or polymerase chain reaction data from a skin biopsy specimen. Routine histology from skin biopsies show dermal inflammatory infiltrates ranging from a sparse lymphohistocytic infiltrate to well-formed granulomas [7, 10, 16]. Demonstration of organisms in skin biopsy specimens by special stains (including acid-fast bacilli or Fite) may be attempted, but should not be relied upon to establish or exclude the diagnosis. Despite a high index of suspicion, in all 3 of our confirmed cases, special stains for organism in tissue were negative, and inability to reliably demonstrate organisms on tissue stains has
been demonstrated in other series as well [7, 16]. Culture with sensitivities (when available) is further recommended to establish sensitivity patterns and aid in tailoring therapy.

This investigation also demonstrates the therapeutic challenges associated with treatment of extensively antimicrobial-drug-resistant NTM species, particularly Mycobacterium abscessus. Among immunocompromised patients and those with deep infections, M. abscessus infections can be particularly virulent; however, therapy choices can be severely limited [22]. Mycobacterium abscessus is intrinsically resistant to most currently available antibiotics. Recommendations for the treatment of M. abscessus infections include the use of a macrolide (clarithromycin) or quinolone, either as single agents or in combination. Combination therapy, particularly with a parenteral antibiotic, should be considered in severe infections [23]. The recommended duration of therapy is not clear but can be ≥6 months in some cases [23].

Side effects from therapy are common. In our series, patient 3 endured an extended course of therapy with multiple oral and intravenous antibiotics and experienced myelosuppression, severe fatigue, and recurrent vaginal candidiasis before clinical improvement. Interestingly, patient 2, who also had M. abscessus infection, improved rapidly during the course of therapy despite the fact that this organism was only marginally susceptible to the antibiotics used. That fewer than half of 24 patients with suspected M. abscessus infection sought healthcare indicates that a substantial number of persons might clear the infection without antibiotic therapy. Additional data should be collected to determine if this is indeed the case. The decision whether to treat with antibiotics should be personalized and might depend on antibiotic options, patient immune status, and patient preference. As demonstrated here, no entirely reliable empiric oral antibiotic regimen exists, but an empiric regimen that includes clarithromycin is realistic, possibly with the addition of linezolid if the patient can be tested repeatedly for hematologic toxicity. Ideally, therapy should be tailored on the basis of susceptibility data. Consultation from infectious disease specialists should be considered in most, if not all, cases.

These cases illustrate the potential importance of regulations to standardize tattoo ink preparation and use. Although NTM was not isolated from unopened ink from either company, the number of complaints in separate geographic areas reported by company A suggests that the ink itself (rather than a practice by the tattoo artist) was the source of infection for this cluster. The majority of states regulate licensing of tattoo artists and parlors, but requirements and rules vary substantially [24]. The commercial manufacture of tattoo ink is a primarily unregulated industry. Although company A was cooperative with government health agencies, company B declined to share ink samples or any information regarding complaints associated with the use of brand B ink samples, potentially hindering our investigation.

Instituting reporting protocols for difficult-to-treat or unusual tattoo reactions noted by tattoo artists and tattoo ink companies to public health agencies could help promptly identify and prevent additional cases of potentially serious infections among tattoo clients.

Notes

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Disclaimer. The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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