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An Ongoing Series

Lesions Arising in a Tattoo of an Active Duty US Marine Corps Woman

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ABSTRACT

Tattoos are ubiquitous in modern society; however, they do not come without risk of medical complications. When complications arise in the military community, a particularly thorough differential diagnosis should be considered based on the increased exposures service members have during deployment and throughout their military career. We present a case of a 38-year-old active duty US Marine Corps woman with worsening skin lesions arising within a tattoo 6 weeks after acquiring the tattoo on her right chest. Given environmental exposures from a recent deployment to the Middle East, a wide differential was considered. Ultimately, a skin biopsy revealed early hypertrophic scar formation responsive to therapy with intralesional triamcinolone acetonide (Kenalog® [ILK]). However, given the Marine had recently deployed and is part of the active duty population, consideration of alternative, albeit rare, etiologies was imperative.

KEYWORDS: *scar, hypertrophic; keloid collagen; tattoo; allergy, red ink; Mycobacterium, cutaneous atypical; sarcoidosis, cutaneous; foreign body granuloma; cellulitis*

about half of those Americans with tattoos have two to five tattoos, and approximately 20% have six or more tattoos.¹ Obtaining tattoos does come with medical risks, including superficial infection, hepatitis C virus C infection, hypertrophic scar formation, keloid reaction, dermatitis, and allergy to various ink pigments.²⁻⁵ When complications occur in the military community, owing to Servicemembers' environmental exposures and deployments, a wide differential should be considered. Here, we present the case of a 38-year-old active duty woman in the US Marine Corps with skin lesions arising within a tattoo 6 weeks after acquiring the tattoo on her right chest. She presented with worsening superficial pain and pruritus overlying the red-pigmented area of the tattoo. Initial treatment of oral antibiotics and a topical steroid yielded minimal relief. After referral to dermatology, a skin biopsy revealed early hypertrophic scar formation, which was subsequently responsive to therapy with ILK. However, both the environmental exposures secondary to multiple deployments and the inherent risks in obtaining a tattoo serve to highlight the importance of considering a wide differential in the active duty population.

Introduction

The practice of obtaining tattoos has existed throughout history. In the 19th century, tattoos were becoming common in England as part of honoring a medieval ritual; however, in the United States, the predominant population consisted of US Soldiers and Sailors. Today, tattoos are still commonplace in the military community, but tattoos have gained increasing popularity in general society. Individuals obtain tattoos to define and visually cement elements of their identity, to memorialize, or to show loyalty. Currently, roughly 20% of Americans have a tattoo, and approximately 40% of the people in this group are of the millennial generation.¹ Moreover,

Case Presentation

A 38-year-old otherwise-healthy active duty woman presented to her primary care physician with right-sided superficial chest discomfort in close proximity of a recently acquired red-and-black-pigmented tattoo. Pain radiated to her right breast, although no drainage or induration was noted. This tattoo had been obtained 6 weeks earlier at a tattoo parlor in North Carolina. Of note, during the same session she also acquired a black-pigmented tattoo on her upper back, which had no complications in healing. Four days after receiving her chest and back tattoos, she had presented to an emergency department with erythema, edema, and pruritus in the vicinity of the

tattoo acquired on her chest. She was prescribed a 10-day course of topical clindamycin with no subsequent improvement; the pain and mild pruritus persisted, thus causing her to see her primary care provider.

At her primary care visit, the patient denied significant medical history, drug allergies, and previous keloid or hypertrophic scar formation with prior tattoos or skin piercings. She had obtained a red-pigmented tattoo on her foot 18 months earlier with no adverse reaction. Immediately after returning from deployment in September 2014, she obtained a left chest and back tattoo, both of which healed appropriately. To treat the symptoms of her right chest tattoo, her primary provider prescribed a 10-day course of doxycycline, cefuroxime, and probiotics, with instructions to follow up in 2 weeks if no improvement was seen.

During the subsequent 2 weeks after her primary care visit (now 8 weeks from initial acquisition of the right chest tattoo), the patient's pain and pruritus continued to increase and she developed worsening inflammation and edema. As the course of doxycycline and cefuroxime yielded suboptimal improvement, topical fluocinonide 0.05% cream was added. However, the cream did not improve symptoms, prompting a referral to dermatology.

Focused dermatologic examination revealed a red-and-black butterfly-shaped tattoo over the right upper chest with tender plaque and papules noted mostly within the red tattoo pigment (Figure 1A). Concern for infection persisted despite her minimal response to recent antibiotic course. As she had been deployed just 3 months earlier and was routinely placed in proximity with Servicemembers returning from deployment to the Middle East, another consideration included an atypical mycobacterial infection. Additional concerns included a foreign body granuloma, allergy to the red ink, a granulomatous reaction secondary to underlying sarcoidosis, or—most benign—a hypertrophic scar formation.

A punch biopsy sample was obtained, and routine hematoxylin and eosin staining revealed findings consistent with a hypertrophic scar/early keloid formation. We suggested treating the lesion as an early keloid with ILK injections. The patient was also counseled that an infection not detected on routine staining (i.e., atypical mycobacteria) may still be causative, especially if the patient noted worsening with ILK. The patient wanted to continue with scheduled ILK injections every 4 to 6 weeks and was additionally instructed to follow up sooner if the lesion developed increased tenderness, erythema, or new discharge; such symptoms would prompt additional biopsy at that time with a specific section for acid-fast bacilli (AFB) staining and culture if possible. Four weeks later, the patient's symptoms had improved with reduction in the size of the plaques and papules after ILK treatment. At subsequent visits, the dose of ILK has been increased to 20mg/mL, which has markedly reduced her symptoms (Figure 1B and 1C).

Discussion

Tattooing is associated with multiple health risks. In the military population, acquiring tattoos is a common venture, but it is not without risks of infection and other subsequent complications about which providers can counsel patients. The literature lacks the exact incidence of health dangers associated with tattoos. It is believed that this lack of data is not a product of infrequency of complications but rather a result of infrequent reporting in the literature or to state health departments.² Localized infection is the most common complication, particularly with newly acquired tattoos, due to a temporary reduction in skin integrity.³ A Centers for Disease Control and Prevention (CDC) report found that of 34 methicillin-resistant *Staphylococcus aureus* (MRSA) cases studied, 10 cases were due to secondary exposure that was defined as living in the same house or having close personal contact. Additionally, although the tattoo businesses reported their artists wore gloves and practiced other infection control measures to include

Figure 1 (A) Painful plaques and papules noted in areas of primarily red ink. (B, C) Reduction in plaque and papule formation after treatment with ILK.



changing gloves between clients, hand hygiene, skin antiseptics, and disinfection of equipment and surfaces, these measures were not practiced.²

Although outbreaks of skin infections such as community-acquired MRSA have been reported in military personnel previously,⁴ infections within tattoos have rarely been studied. In a study by Armstrong et al. that questioned 1,835 basic recruits and advanced training students, it was determined that almost half (48%) of Servicemembers were serious to very serious about getting a tattoo.⁶ At the time of the study, 36% of the Servicemembers were already tattooed, of whom 22% already possessed three or more tattoos. These data point to a high incidence of tattooed Servicemembers and evidence for an enduring goal to obtain one or more tattoos, consistent with sectors of military culture. More than three-fourths of tattooed Soldiers partaking in the questionnaire reported procedural bleeding from obtaining a tattoo, which further raises the risk of blood-borne disease transmission should the tattoo facility not follow local county health department regulations.^{2,6} Additionally, the CDC has gathered a plethora of data on the person-to-person transmission of *S. aureus* from draining lesions secondary to obtaining a tattoo.²

Secondary infections, hypertrophic scar, and keloid formation are common reactions after Servicemembers acquire tattoos. Additional skin reactions such as eczematous dermatitis to red ink or IgE-mediated ink allergy have been documented.^{3,7} However, should initial treatments not improve symptoms, as in our case, due to the unique patient population, the differential diagnosis of persistent lesions within a tattoo should spark further workup for more uncommon etiologies. It has been reported in the United States that nontuberculosis mycobacterial (NTM) contamination of inks can occur during manufacturing due to contaminated ingredients, poor manufacturing practices, or even when inks are diluted with nonsterile water.^{8,9} The US Food and Drug Administration (FDA) does not have a regulation that explicitly requires tattoo inks to be sterile.¹⁰ Estimates of the true burden of NTM in younger populations have not been documented, partially because these infections can be asymptomatic, they are not communicable, and reporting is not required in the United States or many other countries, though overall the prevalence appears to be increased with time, likely due to enhanced detection.

In the active duty population, deployment particularly increases risk of exposure to NTM infections, particularly *Mycobacterium fortuitum*, *M. chelonae*, and *M. abscessus*. Most commonly, these organisms are found in water and soil organic matter and are not spread via person to person.¹¹ Therefore, it would not be unreasonable to presume that tattoos obtained outside the con-

tiguous United States come at higher risk for cutaneous NTM infections.

In NTM infections, pulmonary involvement is most common and cutaneous disease is more likely in the immunocompromised patient; in fact, the presence of cutaneous disease likely indicates disseminated disease.^{12,13} Cutaneous *M. kansasii* is almost exclusively seen in HIV-infected patients, second only to *M. avium-intracellulare*. *M. haemophilum* is another atypical mycobacterial infection that most commonly presents in immunocompromised patients with cutaneous findings of painful, erythematous skin nodules as well as arthralgias.^{12,13}

For the healthy patients and immunocompromised patients, such NTM infections are most typically obtained from skin abrasions or penetrating trauma (e.g., piercing, tattoos, acupuncture, and injections).⁸ Cutaneous trauma creates a port of entry for atypical mycobacteria. Incubation periods are variable, ranging from a few weeks to longer than 1 year.¹⁰ Both *M. fortuitum* and *M. chelonae* are abundant worldwide and clinically will present with pustular or nodular lesions. *M. chelonae* outbreaks have been associated with commercially obtained prediluted gray ink and linked to dilution of black ink with nonsterile water to obtain desired shades of gray.^{14,15} The lesions, as with most NTM skin and soft tissue infections, vary in morphology.¹³ Common features include red papules, pustules, lichenoid papules, and plaques. *M. szulgai* is another NTM that can present as cutaneous lesions in an immunocompromised host. Of note, all mycobacteria are acid fast, which means that after staining with carbol-fuchsin or auramine-rhodamine, they do not decolorize with acidified alcohol. Therefore, the title of AFB is effectively identical to mycobacteria.¹³

In general, tattoo ink reactions can be classified as acute inflammatory reactions (infectious or noninfectious), allergic hypersensitivity, and granulomatous, lichenoid, and pseudolymphomatous types.³ Of these other skin reactions, a temporary eczematous dermatitis can usually manifest as dry, xerotic skin with associated flaking and pruritus. Treatment with a low-potency topical steroid such as hydrocortisone 2.5% or desonide 0.05% along with antihistamines would be indicated unless the lesion is draining or has other evidence of infection. For moderate symptoms (including excoriations and erythema with skin thickening and/or disturbed sleep), treatment with medium-potency topical steroid would be indicated, such as triamcinolone 0.1%. However, initial therapy should always begin with a low-potency steroid.

Additional skin reactions can include acquired hypersensitivity reactions to the tattoo pigment. Tattoo pigments are not FDA approved for intradermal use and the

ingredients are not standardized. In a study of 30 pigment samples, the most commonly identified elements were aluminum, oxygen, carbon, and titanium.¹⁶ Some pigments are industrial grade, used for printer ink or automobile paint.¹⁶ Hypersensitivity reactions are typically secondary to metallic salts, mercury, chromium and cadmium (red), cobalt (cobalt blue, cobalt aluminate, azure blue), and nickel. Red pigment most commonly causes hypersensitivity reactions, and such reactions would have a positive patch test demonstrating IgE-mediated sensitivity. The specific ingredients of red ink known to incite reactions include cinnabar/mercuric sulfide, cadmium red, iron oxide/common rust, and naphthol-AS pigment.³ Both cinnabar and cadmium are also important to note as they are the most common ingredients of red tattoo pigment.³ One case report details an anaphylactic reaction secondary to tattoo ink in which the patient had no symptoms at time of injection 12 hours earlier.¹⁷ When ink allergies occur, the patient will typically present with pruritus, local edema, eczematous eruption with serous drainage, or, rarely, exfoliative dermatitis.³

Granulomatous reactions and lichenoid hypersensitivities are less frequent than eczematous reactions, and are most frequently associated with red pigment (mercury).^{3,7} This reaction pattern would have a negative patch test, unlike a hypersensitivity reaction. Red ink is also associated with pseudolymphomatous reaction, of which the mechanism is unknown.³ Typically, the red-to-violet indurated nodules and plaques are clinically similar to cutaneous B-cell lymphoma; therefore, histology is required to differentiate.

The final most common skin reaction to tattoos is tattoo sarcoidosis.³ This condition occurs when sarcoidal granulomas develop within the cutaneous surface of tattoos. In some patients, this can be the initial presentation of sarcoidosis. The timeline to first cutaneous symptoms may vary from within 1 year of obtaining the tattoo to decades after the tattoo was obtained.¹⁸ As with other skin reactions, red ink (cinnabar) is the most common pigment in which a sarcoidal infiltration occurs.³ Clinical characteristics would include edematous, firm papules or plaque at the tattoo site in addition to pain or pruritus. Histopathology is required for definitive diagnosis. Because a sarcoidal tattoo reaction can be the presenting sign of sarcoid, a patient with these confirmed lesions should be evaluated for systemic disease.¹⁸

Conclusion

From honoring a lost friend to commemorating a victory, tattoos are avenues of expression that are ubiquitous in military culture. However, along with the aforementioned risks associated with tattooing, body art can hinder progression to officer candidacy and this

career limitation should be emphasized to active duty patients considering a tattoo.¹⁹ Additionally, should a Servicemember voice intent of obtaining a tattoo, providers should stress only visiting licensed tattoo parlors. While tattoo parlors are required to be licensed, it is prudent to note that freelance or individual tattoo artists may not be required to have a license, depending on the state. In fact, not having an individual tattoo artist license is a misdemeanor in certain states. Businesses that hire tattoo artists are more closely regulated than are individual artists because the business must pass annual inspections by local county health departments.²⁰ Amateur tattoo artists are more likely to use elemental carbon particles compiled from cigarette ash, pencil particles, graphite, or India ink, increasing the risk of a skin reaction.¹⁶ Although regulations vary state to state, only California requires an itemization of ink ingredients. For the health and safety of the Servicemember, obtaining tattoos while outside the contiguous United States should be strongly discouraged due to unclear or lack of regulations. Moreover, repercussions of acquiring body art should be highlighted to active duty personnel in addition to counseling regarding potential medical complications and the need to seek medical evaluation should these complications occur. Ultimately, in the setting of a cutaneous complication, a broad differential is prudent to rule out unusual etiologies due to the unique environmental exposures faced by Servicemembers.

Disclosures

The authors have indicated they have no financial relationships to disclose.

Disclaimers

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