



## DERMATOLOGIC DISQUISITIONS AND OTHER ESSAYS

Edited by Philip R. Cohen, MD\*

# Complications of decorative tattoo

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**Abstract** Decorative tattoo is a popular practice that is generally safe when performed in the professional setting but can be associated with a variety of inflammatory, infectious, and neoplastic complications, risks that may be increased with current trends in home tattooing. Modern tattoo inks contain azo dyes and are often of unknown composition and not currently regulated for content or purity. Biopsy of most (if not all) tattoo reactions presenting to the dermatologist is recommended, given recent clusters of nontuberculous mycobacterial infections occurring within tattoo, as well as associations between tattoo reactions and systemic diseases such as sarcoidosis.

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## Introduction

Tattoo is an ancient practice and has been performed for therapeutic purposes (such as the charcoal marks seen over degenerating joints on Otzi the iceman), cultural identification, decoration, and even punishment. Tattoos can be dehumanizing, as were those applied to Jewish prisoners in the Auschwitz concentration camp. Modern tattoos are placed to make people feel sexy, rebellious, attractive, and even spiritual, and are popular, with 21% of US adults reporting at least one tattoo (Harris Interactive Poll, 2012).

Modern tattoo uses a variant of the electric pen originally designed by Thomas Edison, which punctures the skin with needles at a rate of 50–3,000 rpm, depositing ink into the dermis. Any pigmented substance can be used as tattoo ink, from soot to industrial grade pigments. Modern tattoo inks are suspensions of metal salts and/or organic pigments in water, alcohol, or glycerin. The most popular tattoo inks in the

United States contain variants of azo dyes, which are synthetic pigments generally used for industrial purposes (eg, automotive paint) and are valued for their brilliant colors (Figure 1). The exact composition of tattoo inks can be nearly impossible to determine, because tattoo inks in the United States are largely unregulated and there is no requirement for labeling.

In the United States, professional tattoos are performed by licensed tattoo artists in licensed tattoo parlors using aseptic or clean technique (Figure 2). Components that directly contact clients' skin or body fluids are generally single use or sterilized by autoclave, tattoo artists wear gloves, and components that cannot be sterilized are covered or disinfected before the next client.

## Tattoo complications

The rate of complications from tattooing has been estimated as high as 2%,<sup>1</sup> and the total number is sure to increase as more of the population gets tattooed. After the tattoo artist who performed the tattoo, dermatologists are often called upon to diagnose and manage tattoo complications. A wide variety of inflammatory, infectious, and neoplastic complications can occur within tattoos (Table 1). Skin biopsy of most, if not all,

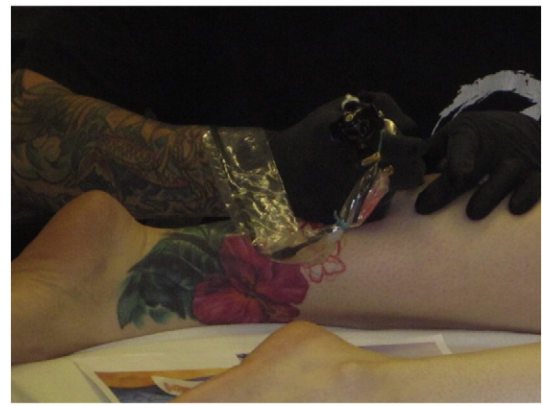
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**Fig. 1** Examples of commercially available tattoo inks containing azo dyes.



**Fig. 2** Tattoo technique. Components of the tattoo machine are either single use, sterilized, or cleaned and covered for use.

patients presenting with a tattoo reaction is recommended, because most entities occurring within the tattoo cannot be reliably distinguished on clinical examination alone. Some tattoo reactions deserve particular attention due to their frequency or as possible indicators of systemic disease, and are discussed in more detail later.

### Inflammatory tattoo reactions

Although the incidence is unknown, inflammatory tattoo reactions are probably the most commonly encountered by the dermatologist. Inflammatory tattoo reactions begin anywhere from days to decades after tattooing and can occur in any color tattoo ink. Patients who seek care for their tattoo reactions usually do so due to itching and have been found to have reduced quality of life on par with psoriatic patients.<sup>2</sup>

Most inflammatory tattoo reactions are likely delayed-type hypersensitivity or allergic type reactions, though there are some examples of isomorphic response occurring after tattoo. What component of tattoo ink causes delayed-type or allergic reactions has proven difficult to answer. When metal salts were the primary pigment in tattoo inks, red mercury/cinnabar-containing salts were blamed; however, red tattoo reactions remain the most common despite a transition to azo dyes (Figure 3). Other metal salts may play a role; many tattoo inks contain allergenic levels of nickel, as well as chromium.<sup>3</sup> Introduction into the skin or exposure to ultraviolet (UV) light could alter the chemical component of tattoo inks, making them more allergenic; yellow azo dye, for example, has been found to photodecompose.<sup>4</sup> Other substances, including thimerosal and unknown proprietary ingredients (Figure 4), are used in tattoo inks and are potential sources of allergy. The role of patch testing in tattoo reactions was explored in a series of 90 patients; the authors found a generally low incidence of positive reactions even when a sample of the same ink presumed to cause the reaction was applied, and they hypothesized that haptentization plays a role in tattoo reactions.<sup>5</sup>

Granulomatous tattoo reactions are among the most common inflammatory tattoo reactions and can be foreign body–like, sarcoidal, and even granuloma-annulare– or necrobiosis lipoidica–like. Sarcoidal tattoo reactions are worth particular mention, because they may, in some cases, represent true scar sarcoid. Tattoo sarcoidosis can occur decades after tattooing (Figure 5). Sarcoidosis can be triggered by medications, particularly interferons, and in this setting there is a high incidence (approximately 60%) of skin involvement.<sup>6</sup> Given this, all patients presenting with suspected tattoo reactions, regardless of the duration of the tattoo, should reasonably undergo questioning about eye or pulmonary symptoms, a complete skin examination looking for other skin lesions, and skin biopsy to both confirm the diagnosis as well as exclude infection.

In addition to reactions to permanent tattoos, reactions to temporary tattoos can occur, including allergic contact dermatitis to henna tattoo (Figure 6). Henna is a naturally occurring red-brown dye that is used in Indian, Asian, and African cultures and is often mixed with paraphenylenediamine (PPD), a well-known contact allergen.

### Infectious tattoo reactions

Although often discussed, obtaining a tattoo in a professional tattoo parlor under aseptic conditions is no longer high risk for acquiring hepatitis C virus,<sup>7</sup> and there have been no reported outbreaks of human immunodeficiency virus transmission from professional tattoo. Tattoos performed in jail or prison, however, remain risky,<sup>7</sup> and those considering tattoo should be counseled to only visit a licensed, professional tattoo parlor.

Although the majority of infections occurring within tattoo, such as acute pyogenic infections, are merely nuisances, some<sup>8</sup> can be serious or even life threatening. Memorial tattoos are tattoos placed to commemorate a person or beloved pet; “cremains” (cremated remains) can be mixed with tattoo ink during this process, which has been associated with death from necrotizing myositis in at least one case.<sup>9</sup>

Among the numerous infections reported in tattoo (Table 1), nontuberculous mycobacterial (NTM) infections

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