

Histopathologic Reaction Patterns in Decorative Tattoos

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Decorative tattoos have been part of human history and culture for thousands of years. In recent years, they have gained increased popularity and social acceptance. Professional tattoos are created as the tattoo artist uses a needle or a tattoo gun to inject pigment of various colors and composition into the dermis to depths of 1-2 mm. Amateur or self-administered tattoos involve injection of exogenous pigments and dyes using a sharp object. There is growing variability of the composition of tattoo ink, and most professional artists utilize a mixture of metallic salts and organic compounds, the majority of which are inert substances. Currently the estimated rate of complications attributable to decorative tattoos is approximately 2 percent. This rate is expected to steadily increase with the introduction of new substances that may be used in the tattooing process. The inoculation of foreign material into the dermis may elicit an immunologic response that is clinically and histopathologically heterogeneous. Both the clinical and histopathologic features of pathologic reactions to decorative tattoos will be reviewed, with greater emphasis on the latter. In the absence of pathology, microscopic examination of decorative tattoos typically reveals pigment either lying freely within the dermis or within perivascular macrophages. Decorative tattoos demonstrate pigment that is discretely restricted to the upper reticular dermis, whereas traumatic tattoos display pigment extending throughout all levels of the dermis. Regardless of the color of ink, pigment usually appears black with H and E staining. However exceptions to this rule are commonly demonstrated, especially with red or yellow ink. The main histopathologic reactions observed in complications arising from decorative tattoos can be divided into six distinct categories: allergic hypersensitivity, granulomatous, interface, pseudolymphomatous, oncologic and infectious. This categorization is maintained in the following review, which emphasizes the histopathologic features seen in these specific reactions to decorative tattoos.

Tattoos have been reported in association with various cutaneous malignancies, including basal cell carcinoma, squamous cell carcinoma, melanoma and leiomyosarcoma. The development of neoplasms in tattoos may be due to local skin trauma. In addition, the composition of tattoo inks has been shown to contain potentially hazardous compounds that could be carcinogenic. For example, black inks contain hazardous carbon byproducts of soot in amounts far above the acceptable level for drinking water. Nevertheless, a wide variety of cutaneous malignancies may develop within tattoos, including melanoma. A thorough skin examination is advisable to avoid delayed clinical recognition of melanomas arising in tattoos. The histopathologic identification of melanomas in tattooed skin may be challenging, since macrophages laden with tattoo pigment can appear similar to areas of regression in melanoma. In such instances, immunohistochemistry is essential in obtaining an accurate diagnosis. In patients with confirmed melanoma who are undergoing sentinel node biopsy, documentation of a tattoo (if present) is important since tattoo pigment may be deposited in lymph nodes and clinically mimic metastatic melanoma. Finally, the histopathologic differentiation of nonmelanoma skin cancer in association with decorative tattoos should include pseudocarcinomatous hyperplastic inflammatory reactions, as these reactions can mimic squamous cell carcinoma and keratoacanthoma. Tattoos and infections Infections with bacterial, viral and fungal species can occur after tattooing, sometimes with considerable delay. They can occur anywhere from a few weeks (as in the case of acute pyogenic infections) to decades, as in inoculation leprosy. Acute bacterial infections are clinically recognizable and are rarely biopsied. While there are no data regarding incidence, pyogenic infections caused by *Staphylococcus aureus* or *Streptococcus pyogenes* (such as impetigo, folliculitis, furunculosis, abscesses, or cellulitis) likely occur with relative frequency. The presence of a tattoo should not alter the treatment

approach in these situations. Conclusion With the rising popularity and social acceptance of decorative tattoos, dermatologists are more likely to encounter tattoo-related complications. As newer tattoo inks are developed and utilized, it is expected that the rate of reactions will rise. A deeper understanding of the most common histopathologic reaction patterns ideally will result in increased clinical detection of situations requiring additional evaluation, whether it is for an underlying infection, systemic involvement of disease, or to rule out a potentially deadly malignancy

In recent years, the practice of decorative tattooing has seen rising popularity and increased social acceptance. As newer tattoo inks are developed and utilized, it is expected that the rate of reactions will rise. Thus, dermatologists are more likely to encounter tattoo-related complications. An understanding of the most common histopathologic reaction patterns ideally will result in increased clinical detection of situations requiring additional evaluation, whether it is for an underlying infection, systemic involvement of disease, or to rule out a cutaneous malignancy. This review will describe both the clinical and histopathologic features of pathologic reactions to decorative tattoos. The main histopathologic reactions are divided into six distinct categories: allergic hypersensitivity, granulomatous, interface, pseudolymphomatous, oncologic and infectious.

Keywords: Tattoo pigment; Tattoo reaction;
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