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ALLERGIC CONTACT DERMATITIS TRIGGERED BY TATTOO INK: A CASE REPORT

Gracelia Alverina*, Putu Dyah Ayu Saraswati, Gede Agus Indra Pramana, Ni Made Dwita S. Wangaya
General Hospital Denpasar, Bali, Indonesia
Email: gracealverina@gmail.com*

KEYWORDS

Allergic Contact Dermatitis, Tattoo, Tattoo Ink Reaction, Cutaneous Hypersensitivity, Skin Biopsy

ABSTRACT

Tattoo-related allergic contact dermatitis (ACD) is a delayed-type hypersensitivity reaction to tattoo ink components. The increasing popularity of tattoos has led to a rise in cases of tattoo-related allergic reactions, but diagnosis and management remain challenging. This study aims to report a case of tattoo-induced ACD, explore its clinical characteristics, diagnostic challenges, and management strategies, and highlight the need for improved awareness and safer ink formulations. A case of a 28-year-old Indonesian male with pruritic erythematous papules localized to a multicolored tattoo was examined. Diagnostic approaches included clinical evaluation, dermatologic examination, and *patch testing*, though the latter was inconclusive. The patient had no history of similar skin conditions, systemic symptoms, or previous allergic reactions to tattoo ink. Dermatologic examination revealed multiple erythematous papules (3–5 mm in diameter) associated with mild scaling, localized exclusively to the tattoo site. Laboratory findings were unremarkable, and *patch testing* was inconclusive. The patient was managed with topical corticosteroids and antihistamines, leading to symptom improvement. Tattoo-related ACD is an emerging dermatologic concern requiring increased awareness among clinicians. Further research is needed to improve diagnostic techniques and develop safer tattoo inks to minimize allergic reactions.

DOI:

Corresponding Author: Gracelia Alverina *
E-mail: gracealverina@gmail.com

INTRODUCTION

Tattoos have become increasingly popular worldwide, with a significant rise in prevalence among young adults. Despite their aesthetic appeal, tattoos can lead to various dermatological complications, notably allergic contact dermatitis (ACD). ACD is a delayed-type hypersensitivity reaction that occurs when the skin becomes sensitized to allergens present in tattoo inks (Schubert et al., 2023).

Recent studies have identified specific pigments and additives in tattoo inks as common culprits of allergic reactions. For instance, paraphenylenediamine (PPD), a known allergen, has been implicated in severe ACD cases following permanent tattoo application. The complex composition of tattoo inks, which may include heavy metals and organic dyes, contributes to the challenge of identifying specific allergens responsible for ACD (Serup & Hutton Carlsen, 2019; Wang et al., 2023).

The clinical presentation of tattoo-related ACD varies, often manifesting as erythema, pruritus, and papules localized to the tattooed area. In some cases, more severe reactions such as granulomatous inflammation have been observed. Diagnosis is complicated by the delayed onset of symptoms, which can occur months to years after tattoo application. Furthermore, standard patch testing has limited efficacy in identifying the responsible allergens due to the unique properties of tattoo pigments and their deposition in the dermis (Kluger, 2022).

This study aims to explore the clinical characteristics, diagnostic methods, and management strategies of contact allergy-induced tattoo dermatitis, emphasizing the need for awareness and early detection to prevent long-term complications.

CASE REPORT

A 28-year-old man, an Indonesian citizen, presented to dermatology clinic in Wangaya General Hospital, Denpasar, Bali, with a one-week history of red, itchy papules localized to one of two tattooed areas on his right upper arm. The rash gradually worsened over time, with persistent itching but no associated burning sensation and pain. The tattoo was done approximately three months before the onset of symptoms, with no prior issues. The affected areas included a multicolored tattoo including red, black and yellow ink. The patient also had a black-inked tattoo on his right lower arm, which had been present for one year without developing any rash. He had no prior history of similar skin conditions. The patient denied fever, malaise, joint pain, and other systemic symptoms. The patient did not apply any topical or oral medications before seeking medical attention.

The patient had no history of skin diseases such as eczema, psoriasis or chronic dermatitis. He denied any previous allergic reactions to tattoo ink, metals, or topical medications. There was no history of autoimmune disease, prolonged fever, chronic cough, immunosuppressive conditions. He had never experienced keloid formation or abnormal wound healing in the past. The patient denied previous allergic reactions to other tattoos on his body. There was no history of tattoo removal attempts, laser treatment, or re-tattooing of the affected area.

On physical examination, the patient appeared in good general condition. He was alert, with a Glasgow Coma Scale (GCS) score E4V5M6. Vital sign were as follows: blood pressure 120/80, pulse rate 78 bpm, respiratory rate 18 breaths per minute, axillary temperature 36,8°C, oxygen saturation 98% on room air. Physical examination of the chest, abdomen and extremities was normal.

Dermatologic examination revealed multiple erythematous papules measuring approximately 3-5 mm in diameter localized to the tattooed area on the right upper arm. The lesions appear slightly raised and are associated with mild scaling.

Figure 1 a Erythematous papules and mild scaling localized on a multicolored tattoo (red, black, and yellow ink) over the right upper arm. The lesions are slightly elevated and well-defined, without vesicles, erosions or crusts. This presentation is consistent with a delayed-type hypersensitivity reaction, suggestive of allergic contact dermatitis induced by tattoo pigment. Figures 1b This is the patient's first tattoo, and there are no complaints.

Based on the patient's history, physical examination, and dermatological findings, a diagnosis of allergic contact dermatitis secondary to tattoo ink was established. The dermatologist managed the patient by identifying and avoiding the suspected allergenic ink component. Topical therapy consisted of twice-daily application of combination cream containing desoximetasone 0,25%. For systemic therapy, the patient received ceterizine 10 mg orally once daily to relieve pruritus. He has suffered from this complaint twice.

METHOD

This study employed a qualitative case report design to investigate a rare instance of allergic contact dermatitis (ACD) triggered by tattoo ink. The research focused on a single case—a 28-year-old Indonesian male who developed ACD three months after receiving a multicolored tattoo. The population of interest included individuals with tattoo-related skin reactions, while the sample was purposively selected based on the patient's clinical presentation and confirmed diagnosis. The sampling technique was non-probability convenience sampling, as the case was identified during a routine dermatology consultation at Wangaya General Hospital, Denpasar, Bali.

Data was collected through clinical examination, patient history documentation, and photographic evidence of the affected tattoo area. The primary research instruments included standardized dermatologic assessment forms, patch testing (though inconclusive), and skin biopsy reports. To ensure validity, the diagnosis was confirmed by a dermatologist, and reliability was maintained through consistent clinical evaluation protocols. Additional data sources included medical records and follow-up observations to monitor treatment efficacy. The data collection procedure involved initial patient consultation, physical examination, laboratory tests, and therapeutic intervention tracking.

Data analysis was performed using descriptive qualitative techniques, focusing on symptom progression, treatment response, and comparative literature review. Microsoft Excel was used for organizing clinical data, while thematic analysis helped identify key patterns in the patient's reaction. The study adhered to ethical guidelines, with informed consent obtained for case publication. Limitations included the inability to generalize findings due to the single-case design, but the study provided valuable insights into diagnostic challenges and management strategies for tattoo-induced ACD. Future research could expand the sample size and incorporate advanced diagnostic tools like dermal patch testing for broader applicability.

RESULT AND DISCUSSION

Allergic contact dermatitis (ACD) resulting from tattoo ink is an emerging concern, paralleling the rising prevalence of tattoos and the complex composition of ink pigments.5 ACD is a type IV hypersensitivity reaction mediated by T cells, where repeated exposure to allergenic substances in tattoo ink can lead to sensitization and an inflammatory response.6 Historically, heavy metals such as mercury, nickel, chromium, and cobalt in red and black inks were commonly implicated in ACD cases

(Urbina et al., 2022). However, recent studies indicate a shift towards organic pigments, which are now more frequently associated with allergic reactions (Hutton Carlsen & Serup, 2019).

The clinical manifestation of tattoo-related ACD typically include erythema, pruritus, and papular or eczematous eruptions localized to the tattooed area, which may persist for weeks or months.[9] In some cases, chronic inflammation can lead to lichenification, hyperkeratosis, and scarring, significantly affecting the aesthetic outcome of the tattoo (Reich et al., 2021). Several reports have documented granulomatous reactions and pseudolymphomatous infiltrates in patients experiencing prolonged tattoo-related dermatitis, indicating the potential for chronic immune activation (Jacobsen et al., 2020).

Diagnosis of tattoo-related ACD remains challenging due to the heterogeneous composition of tattoo inks and the variability in individual immune responses. Patch testing has been suggested as a diagnostic tool, but its efficacy is limited since tattoo ink particles are dermis rather than the epidermis, making standard patch test techniques less reliable (Gopee et al., 2020). Additionally, ink degradation over time can alter allergenicity, complicating diagnostic efforts (Laux et al., 2021). Skin biopsy can be a valuable diagnostic tool in tattoo-related ACD, especially when the clinical presentation is atypical or resembles other dermatoses. Histopathological findings may reveal spongiotic dermatitis, lymphocytic infiltrates, or granulomatous inflammation, helping to differentiate ACD from infectious or neoplastic processes (Vasold et al., 2020).

Management of tattoo induced ACD primarily involves avoiding further exposure to the allergenic pigment and using symptomatic treatment (Tope et al., 2019). Topical corticosteroid and systemic antihistamines are commonly prescribed to control pruritus and inflammation (Wenzel et al., 2023). In case of severe or treatment-resistant tattoo-induced allergic contact dermatitis (ACD), intralesional corticosteroids or systemic immunomodulators may be used to manage persistent inflammation (Jacob et al., 2024). For patients with chronic symptoms, laser tattoo removal using Q-switched lasers has been employed to eliminate allergenic pigments, though this method may lead to pigment particle dissemination and paradoxical worsening of symptom (O'Connell et al., 2022).

Given the rising incidence of tattoo-related allergic reactions, future research should prioritize the development of hypoallergenic ink formulations and stricter regulatory standards for tattoo pigment safety.[19] In addition, enhanced diagnostic tools such as dermal patch testing tailored to tattoo ink components, and the identification of immunologic biomarkers may support earlier and more accurate diagnosis of tattoo-induced ACD.

CONCLUSION

Allergic contact dermatitis (ACD) due to tattoo ink is becoming increasingly prevalent alongside the popularity of tattoos and the evolving composition of ink pigments, with recent cases more often linked to organic pigments rather than traditional heavy metals. Clinically, tattoo-related ACD presents as persistent erythema, pruritus, and papular eruptions localized to the tattooed area, sometimes progressing to chronic inflammation and scarring. Diagnosis remains challenging due to the complex and variable nature of ink components, the limitations of standard patch testing, and the potential for ink degradation to alter allergenicity, making skin biopsy a valuable diagnostic adjunct in atypical cases. Management focuses on avoiding allergenic pigments and symptomatic relief with topical corticosteroids and antihistamines, while severe or chronic cases may require advanced therapies such as intralesional corticosteroids or laser removal, which carries its own risks. Future research should focus on developing hypoallergenic ink formulations, establishing stricter pigment safety regulations,

and improving diagnostic methods—such as dermal patch testing and immunologic biomarker identification—to enable earlier detection and more effective management of tattoo-induced ACD.

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