Cutaneous Complications Related to Tattooing

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The author of this educational review is normally situated in Montpellier, France but is currently practising in the Helsinki University Central Hospital. His main interests are tattooing, piercing and their skin complications, genodermatosis, skin vasculitis and internal medicine. He summarizes here the complications connected with tatooing, and makes some suggestions for treatment and what to take into considerations before performing a tatoo. The bottomline is "the main complication is *regret*".

Decorative permanent tattooing involves the introduction of exogenous pigments and/or dyes into the dermis to produce a permanent design (1). For the past 20 years tattooing has gained tremendous popularity, especially among young people (2, 3). However, the frequency of cutaneous complications related to tattooing is unknown. Kazandjieva & Tsankov (4) estimated the prevalence of complications in their series of 234 tattooed patients as 2.1%. A recent national survey of 3411 individuals in Germany (3) found that 6% mentioned persistent skin problems in the tattooed area. In both cases no further details of the types of complications were provided.

Cutaneous complications may be categorized as follows: (*i*) according to the length of their development, as acute or chronic reactions; (*ii*) according to the delay in onset after tattooing; or (*iii*) according to the type of reaction: e.g. infection, hypersensitivity reaction, etc. None of these classifications is perfect as there may be overlap between reactions and delay after tattooing. Classification (*iii*), which is simply clinical and pathological, appears to be the easiest and most convenient method (4–8).

We review here the cutaneous complications related to tattooing, based on the author's experience and previous extensive reviews of the literature (4–12), to which the reader can refer for more in-depth references.

Non-infectious acute reactions occurring after tattooing

Individuals having a tattoo experience transient immediate reactions during the procedure and healing phase. An acute aseptic inflammatory reaction of variable intensity, with erythema, induration and an oedematous "peau d'orange" with dilatation of the hair follicles of the tattooed skin develops immediately during the session (9, 10). The fresh tattoo is surrounded by tender erythematous reddened borders and the lines of the drawing are palpable. Petechial purpura and an underlying haematoma may sometimes be visible. The tattoo heals within 2–3 weeks with superficial crusts, and the ink retained in the epidermis is shed as the epidermis peels away (9, 10). Such reactions occur in all tattooed individuals, and thus should not be considered "complications", but rather as belonging to the "natural history" of tattoos (10). Tattoos of the lower limbs sometimes lead to disabling sterile oedema, necessitating rest (13). Acute transient lymphadenopathy of the tattoo draining area may be palpated during the healing phase. Some cases of a ''blurry halo'' surrounding the main tattoo after its completion, due to spreading of tattoo pigment in the superficial subcutaneous fat have been described. This condition is known as "blue-foot" or "tattoo blow-out" and can be treated with a laser (14). Acute contact dermatitis to any topical agent applied during the healing phase (e.g. disinfectant, ointments, etc.) may occur in sensitized individuals and delay healing.

Cutaneous infections

Acute superficial and pyogenic infections (e.g. folliculitis, impetigo, ecthyma, furunculosis, erysipela, cellulitis) are rare (8, 11, 12). Gangrene, amputations and deaths were reported among sailors at the end of the 19th century. Inoculation syphilis, the major complication of tattooing during the 19th century in Europe, has now disappeared. Hygiene measures, modern aseptic tattooing techniques and better education of tattooists have helped reduce such complications. However, unlicensed tattoo activity and asepsis can still lead to dramatic infection, with cutaneous abscesses or necrotizing fasciitis. Minor infections may be underestimated, as patients may seek medical attention only in cases of severe or chronic infection.

Tattoo inoculation mycobacterial infections include tuberculosis, leprosy and atypical mycobacterias. Cutaneous tuberculosis is rare nowadays. Inoculation leprosy is restricted to India,

a high endemic country for leprosy. Atypical mycobacterial infections, especially with *M. chelonae* infection, have emerged in recent years. Several outbreaks in tattoo parlours have been reported in France, the USA and Australia. The lesions are unspecific (chronic papules, pustules, lichenoid plaques, plaques with scales) and usually occur within 1–3 weeks after the procedure. Use of tap water mixed with ink by the tattooist may be the cause of inoculation (15). Such a cause should be suspected when multiple cases originate from the same tattooist/tattoo shop during a given time-frame. Skin biopsies and bacterial cultures of skin and inks should confirm the diagnosis.

Viral warts and molluscum contagiosum have been reported on tattoos. Skin lesions occur from one month to 10 years after tattooing, in variable numbers and size, and may be restricted to one colour. Inoculation may be related to contaminated instruments, modification of local immunity related to the ink itself or to intense exposure to ultraviolet (UV) light or to pre-existing infra clinic skin lesions disseminated through the drawing by a Koebner phenomenon during the procedure.

Numerous cutaneous infections have been reported as case reports, as summarized in Table I (8, 11, 12).

Hypersensitivity reactions to tattoo pigments and dyes

Introduction of exogenous pigments and dyes during tattooing may trigger a wide range of cutaneous reactions, with histological patterns ranging from eczematous and lymphohistiocytic reactions (Fig. 1) to more "organized" patterns, such as lichenoid, granulomatous (Fig. 2), sarcoidosis-like and pseudolymphomatous reactions (Fig. 3) (4–8). They are probably currently the main complications related to permanent tattooing. Delay is highly variable, ranging from immediately to 45 years after tattooing. Red is the most common colour involved, but reactions have been described with almost all colours. The symptoms are non-specific, including tenderness, swelling, asymptomatic or itchy papules or nodules, isolated pruritus, swelling and induration. Photosensitivity may be the only symptom. A precise diagnosis, made by the histopathological examination of a punch skin biopsy specimen, is mandatory. Any granulomatous reaction should prompt examination for underlying idiopathic sarcoidosis, whereas a lichenoid reaction may be associated with genuine cutaneous or mucous lichen planus. The composition of elements in tattoo inks varies greatly, even among like-coloured pigments. Epicutaneous tests can be performed, but are usually negative. It may be related to limited transcutaneous absorption of the ink. Tests can be performed if the culprit ink is available and

Table I. *Overview of the cutaneous complications related to tattooing*[a] *(8)*

Acute inflammatory reaction and other reactions occurring after the tattoo session
Pain, bleeding, purpura/haematoma, crusts, inflammation, contact dermatitis, blue-foot/tattoo blow-out, improper healing with scars
Acute and chronic infections occurring on tattoos
Pyogenic infections: Folliculitis, furunculosis, erysipela, necrotizing fasciitis, gangrene, death
Non-pyogenic infections: Atypical mycobacteria, inoculation leprosy, inoculation tuberculosis, inoculation syphilis, Tetanus
Viral infections: Viral wart (*Verruca vulgaris*), molluscum contagiosum, herpes (*Herpes compunctorum*)
Mycosis and other infections: Tinea, leishmaniasis, sporotrichosis, zygomycosis, blastomycosis, mycetoma
Tattoo – hypersensitivity reaction
Eczematous infiltrate, lymphocytic-histiocytic infiltrate, lichenoid reaction, foreign-body granuloma, sarcoidal granuloma, cutaneous lymphoid hyperplasia (pseudolymphoma)
Benign and malignant tumours occurring on tattoos
Melanoma, basal cell carcinoma, squamous cell carcinoma
Eruptive or isolated keratoacanthoma, pseudo-epitheliomatous hyperplasia
Cutaneous lymphoma, leiomyosarcoma, dermatofibrosarcoma protuberans
Traumatized naevus, seborrhoeic keratoses, histiocytofibroma, epidermal cysts, milia
Localization of skin disorders
Sarcoidosis, psoriasis, discoid lupus, subacute lupus, cutaneous vasculitis, Darier's disease, vitiligo, lichen planus, lichen sclerosus and atrophicus, perforating dermatosis (perforating collagenosis, perforating granuloma annulare), granuloma annulare, morphea, post-inflammatory scleroderma-like reaction, pyoderma gangrenosum
Interference with medical devices and imaging results disturbance
Disturbance of dermoscopy examination on tattooed areas, keloid/burn after laser therapy, tingling/burning sensations during RMN (nuclear magnetic resonance) examination, false positive marker uptake on lymph nodes on positron emission tomography (PET)-scan, false-positive sentinel lymph node, axillary lymph node calcifications on mammography

[a]Acute and/or chronic lymphadenopathies occur as extra-cutaneous complication.

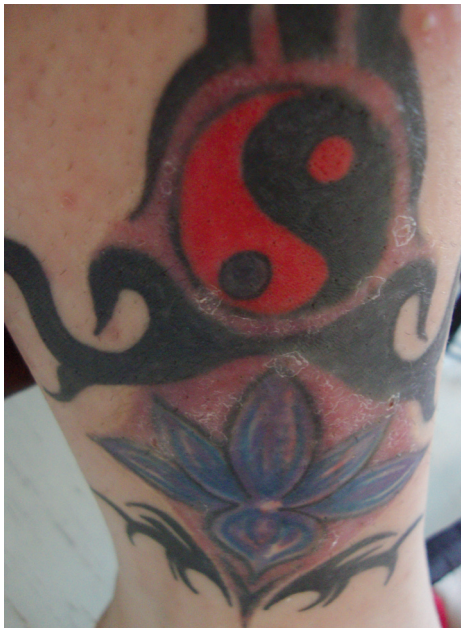

Fig. 1. Hypersensitivity reaction limited to the red part of a tattoo. Histopathology disclosed a lymphohistiocytic reaction in the dermis.

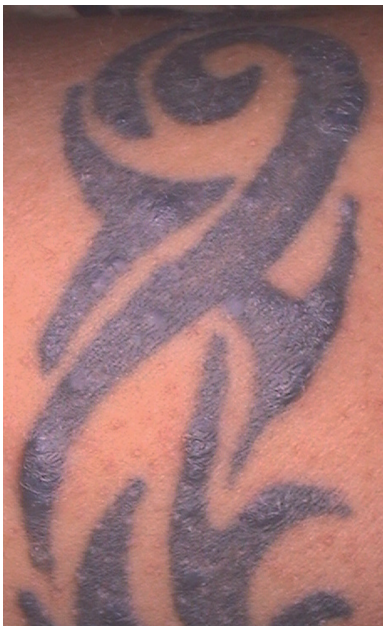

Fig. 2. Nodules restricted to a black tattoo revealing a granulomatous reaction. (Photo courtesy of Dr Hervé Garat, Tournefeuille, France).

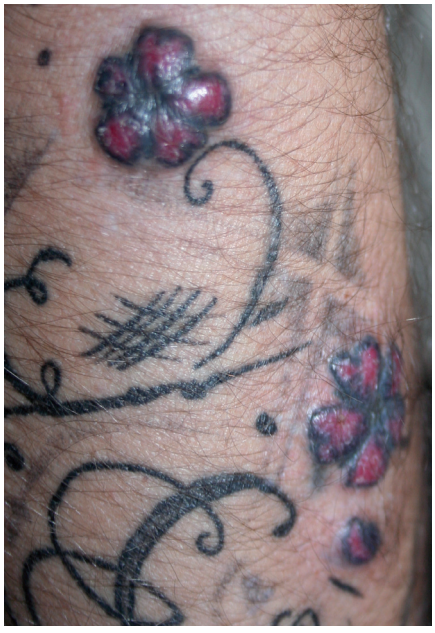

Fig. 3. Infiltration restricted to the red part of a tattoo, 6 weeks after its completion, disclosing pseudolymphoma.

its composition is known; however, it is not always possible to reproduce the reaction induced with tattooing. X-ray analysis may be performed on cutaneous biopsies and/or on the ink, but identification of the compound responsible is difficult, and it is not always possible to rule out that another unidentified compound may be responsible for the reaction. If a patient has experienced a colour-specific tattoo reaction, he or she should be discouraged from getting tattooed with the same colour, even if the ink brand is different. Moreover, the patient should be warned of the potential risk of reaction to another colour due to a common substance in both inks. Hypersensitivity reactions can resolve spontaneously, remain active, or wax and wane for years. In our experience, tattooed individuals seem to experience periodic episodes of skin reactions, but seek medical attention only if the reaction becomes disabling or severe. Treatment is often difficult and usually only temporary as long as the ink responsible is still present in the skin. Topical corticosteroid ointment, tacrolimus or intralesional corticosteroids are possible treatments. If the reaction continues, surgical excision or destruction by CO_2 or Q-switched Nd:YAG laser may be proposed. Some authors advise caution when performing laser treatment of a tattoo with hypersensitivity reaction, following the publication of a case report of a generalized allergic reaction after CO_2 laser (16).

Skin tumours arising on tattoos

Tattooing over a benign melanocytic naevus may trigger a sudden clinical change, requiring surgical removal and pathological examination in order to distinguish between a traumatized naevus and malignant degeneration (17). In addition, there is a potential risk that a malignant lesion may develop coincidentally at the same location as a tattoo, preventing early diagnosis and management. Dermoscopy is also more difficult on tattooed areas. Patients with a personal history of melanoma should therefore avoid tattoos. Young patients with a familial history of melanoma, numerous naevi, or even atypical mole syndrome may be advised to avoid having a tattoo. A less radical solution is to apply the tattoo to an area with as few pigmented lesions as possible, such that the design avoids the lesions (18).

Cutaneous malignancies arising in tattoos have been reported over the past 40 years in the literature, primarily melanoma, basal cell carcinoma and squamous cell carcinoma. They occur within a broad time period from 3 months to 55 years after tattooing (19). Keratoacanthomas (KA) and pseudoepitheliomatous hyperplasia (PH) develop as a fast-occurring cutaneous reaction, occurring strictly in the area of tattoo. Distinguishing between PH, KA and squamous cell carcinoma can be challenging and requires full-thickness biopsies and/or surgical removal of the entire lesion with thorough histological examination. Precise diagnosis is not always possible, and long-term follow-up should be suggested to the patient. Trauma-induced KA usually develops quickly within the first year after the trauma, and this is also the case in tattoo-induced KA. KA and PH should be considered as distinct from squamous cell carcinoma in cases of recent tattooing. Caution is mandatory in case of "KA" or "PH" in an "old" tattoo (20).

The pathogenesis of cutaneous malignancies in tattoos is far from clear. It may be the result of various factors. To-date, the relative scarcity of such cases and the combined increased prevalence of skin cancers and of tattoos among young people suggest that the association is coincidental (19). However, studies on ink composition and their potential carcinogenicity are needed, as well as studies to define the true prevalence of skin cancers on tattoos. Benign cases of seborrhoeic keratosis, histiocytofibroma and epidermal cysts and milia have been reported (8).

Localization of skin disorders to tattoos

Individuals with a chronic skin disease that is known to koebnerize should be warned of the potential risk of localization of the skin disease to a tattoo, especially if the dermatosis is active (4–8).

Sarcoidosis on tattoos has been known for years. Granulomatous reactions to tattoos, whether restricted to one colour or not, may reveal or accompany systemic sarcoidosis (Fig. 4). Cases of cutaneous sarcoidosis restricted to one colour raise the question of a true sarcoidal hypersensitivity reaction to the exogenous pigment or the first (and sole?) manifestation of a systemic disease. Any granulomatous reaction should prompt examination for sarcoidosis. The presence of other cutaneous lesions or extracutaneous granulomata should distinguish genuine sarcoidosis from a hypersensitivity reaction (4–8).

Koebner phenomenon was described initially in patients with psoriasis (Fig. 5). The risk of localization of psoriasis to tattoos is related to the genetic background of the individual and the activity level of the disease at the time of tattooing (4–8).

Chronic discoid lupus lesions have been reported on tattoos, either in an isolated fashion or associated with other localization (4–8). The interaction of ultraviolet (UV) light with the ink may play a role in the physiopathology. Few cases have also been reported during subacute cutaneous lupus.

Cases of lichen planus have been associated with localization to the site of the tattoo (4–8). Any lichenoid reaction to a tattoo should prompt examination for oral, genital or cutaneous lichen planus. In the case of generalized lichenoid eruption following a tattoo, it is sometimes difficult to determine if this represents a generalized lichenoid tattoo reaction or a true lichen planus.

Miscellaneous complications

Various cutaneous complications have been reported in anecdotal case reports. Numerous cutaneous curiosities have been described within tattoos: e.g. pyoderma gangrenosum, vasculitis, perforating dermatosis, granuloma annulare, Darier's disease, and erythema multiforme (8). Burns and keloids may occur if laser hair removal is performed on tattooed areas. Tattoos may also interfere with medical diagnostic studies (e.g. RMN (nuclear magnetic resonance), positron emission tomography (PET) scan, sentinel lymph nodes).

Conclusion

Tattooing can result in a variety of complications, the incidence of which are unknown. Infections are nowadays related directly to lack of asepsis and hygiene during the tattooing procedure and can be avoided by education and training of tattooists. Patients with a known cutaneous disease should be warned of the potential risks of localization of their disease to the tattoo. A skin eruption restricted to a tattoo may reveal sarcoidosis. Hypersensitivity reactions to tattoo pigments are not predictable. Therefore, regulatory control of ink manufacturing is important in order to avoid the introduction of toxic, carcinogenic and/or immunogenic products. However,

Fig. 4. Papules and nodules restricted to the blue and black parts of a 2-year-old tattoo on the hand. Biopsy revealed epithelioid granuloma. Further explorations confirmed systemic sarcoidosis. (Photograph courtesy of Dr Antoine Mahé, Centre hospitalier de Colmar, France).

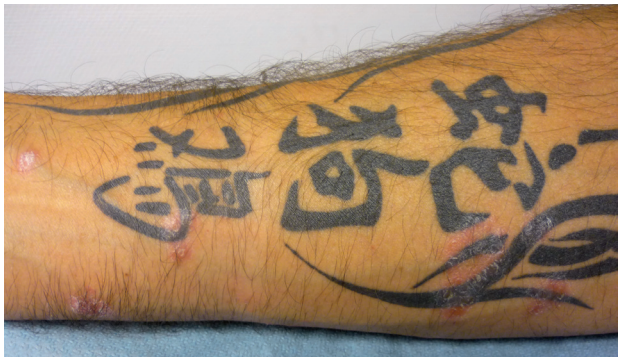

Fig. 5. Psoriasis restricted to some parts of a tattoo.

despite any control measures that may be instituted, complications will still occur. In addition, patients with impaired immunity related either to treatments (such as corticosteroids or biologics) or to the disease itself should discuss this with their physician before deciding whether to have a tattoo. There has been a recent case report of death after tattooing in a patient with a history of acute myeloid leukaemia (20).

Finally, and most importantly, we should not forget that the most common complications of tattooing remain regret and an undesirable ugly tattoo.

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