

A tattoo might not be as safe as one believes

The skin should not be a canvas to express one's personality.

The flight TG 042 from Suvarnabhumi to Khon Kaen at around ten o'clock in the morning has quite a mixture of passengers waiting for boarding. There are the Thai passengers and the 'ex-pats' from Europe, on the last leg of their flights during the preceding night. Most 'farangs' are of retirement age, but some middle-aged ones are among them, sporting huge tattoos on both arms and legs. Even one man has a big tattoo on the right side of his face and a shaved skull, which looks frightening. Tattoos on the Thai passengers are seldom seen. One has to follow international sports events on TV where especially the western competitors the Thais are tattooed. To a certain extent tattooing makes its inroads into Thailand, mainly because teenagers and young adults are fond of (1).

Tattooing in the West and throughout history

It is estimated that 45 million people in the USA have at least one tattoo (2), and tattooing is a booming business. Similar tattoo prevalence is found in Germany, where one out of five fourteen-year-olds and older persons has one, and in Norway, over 20% of those above sixteen got at least one tattoo (3, 4).

Several states in the USA enforce strict hygiene and safety standards and require tattoo artists to be licensed. Modern, computerized machines replace the former rudimentary tools, diminishing pain and reducing infection. Contemporary tattoo parlors offer various services and particular kinds of tattoos, such as horror and fantasy, illustrative, neo-traditional, floral, black and grey (5).

The advertisements are compelling and attractive and emphasize tattoos as a form of 'expression, allowing individuals to showcase their personal beliefs, values, and perceptions.' Hints about the cultural significance of different societies, religions, and spiritual practices are quoted. The history of tattoos goes back to ancient Egypt, the Maori in New Zealand, the Hindu culture, and 'sak yant' in Thailand and Cambodia, featuring religious and spiritual motifs (2, 5). That the ancient Greeks and Romans related tattoos to 'criminality' is not so often mentioned. However, that was the general perception of tattoos also in the West not so long ago.

Perception of tattoos before the hype

A 2002 publication reported on the administrative and clinical problems with tattooing among prisoners. Using a sample of 8,574 convicts in the Colorado prisons, tattooing was related to personality types such as antisocial, sadistic, negativistic, and borderline behavior. Clinical syndromes included mania, drug abuse, post-traumatic stress disorder, and thought disorders (6). In 1990, psychiatric disorders frequently associated with tattoos were related to antisocial personalities and drug and alcohol abuse (7). In Switzerland, an investigation of 2,177 males (in the military service) revealed that only 135 persons (6.2%) had 1 to 9 tattoos per person. 87% were done by the male himself or his friend, and only 13% were professional tattoos on the upper arm or shoulder. About 30% of all tattoos had a mental background, and 14% were related to

love affairs. Only a few linked the tattoo to drug abuse, the criminality of gangs, or magic symbols (8). As far as young women with tattoos were compared with counterparts without tattoos, it appeared that those with tattoos had some problems with self-esteem, ideal body, and ideal self (9).

Up to a decade ago, tattoos were not socially accepted and seemed of no public health concern. This, however, might have changed. Tattooing in Thailand is advertised online as a 'soft power' tourist magnet (10, 11). The skin, a complex human organ involved in body temperature regulation and a first barrier against infective agents and foreign bodies, is exposed as a canvas for debatable picturesque motives.

Medical therapeutic tattooing, though, is acceptable. For instance, hiding the loss of skin color in patches (vitiligo), breast areola after surgery, hair loss followed by craniofacial surgery, and scars are meaningful medical interventions. Medical tattoo assistants and trained nurses in the clinical setting should be involved (12).

Content of tattoo ink

Whether proficiency and safety can also be expected in connection with the increasing popularity of decorative tattooing remains to be seen. Tattoo artists are currently supposed to use tools and needles as well as high-quality colors. There is a wide variety of tattoo inks consisting of organic and inorganic color pigment, together with byproducts from pigment additives. Colored inks contain primary aromatic amines (PAA), and black ink often contains polycyclic aromatic hydrocarbons (PAH) with arsenic, chromium, cobalt, lead, and nickel (13).

Green dye comprises chromium oxide, lead chromate, phthalocyanine dyes, ferrocyanides, and ferricyanides. Cobalt is used for blue color and cadmium sulfide for yellow pigments. Red color could be achieved by mercury sulfide, ferric hydrate, iron oxide, and the purple color with manganese and aluminum (14). In case tattoo applications result in allergic reactions, it is not easy to identify the culprit content since the container's label for ink and pigments is not given in the required details. Certain pigments, especially nickel and chromium, are often causing cross-reaction, especially when linked to red (12).

The skin might not tolerate mistreatment.

If all goes right, such as for a small monochromatic tattoo, an erythematous acute aseptic inflammatory response surrounds the tattoo area by red borders. A superficial crust might form after two to three weeks, and the ink left in the epidermis peels away as an outer layer. If less fortunate, allergic cutaneous reactions could appear, described by dermatologists as papulonodular, plaque-like, lichenoid, hyperkeratotic, or even ulceronecrotic shapes. Allergic reactions will manifest locally, but generalized and eczemas occur for 'sensitized' individuals (15, 16). In addition, even more scary manifestations of the skin might evolve, such as autoimmune reactions, infections with bacteria and viruses, as well as malignant tumors has been noted (12).

Tattoos and skin cancer?

Whether tattoos cause skin cancer is controversially discussed. According to the UN Agency for Research and Cancer, quite a number of the chemicals in tattoo ink are carcinogenic (13). Reviewing the literature about skin cancer and tattoos resulted in 50 cases, 23 of which were squamous-cell carcinoma and keratoacanthoma, 16 of which were melanoma, and 11 of which were basal-cell carcinoma. Reflecting on the vast number of those being tattooed worldwide, the authors concluded that the appearance of the cases in patients with tattoos might be coincidental (17).

However, consider that the ink inserted in the dermis by puncturing the skin is translocated through cell-mediated dynamics into the lymph nodes where a systemic immune response is initiated, and various subtypes of malignant lymphoma might result (13). Over 30% of the injected pigment is translocated after six weeks, most of it over time (18). Most of the tattooed population is young and exposed to ink injections throughout their lives. The carcinogenic property of ink might play a role in the pathogenesis of malignant lymphoma, which is on the global rise, and the role of tattoo inks, hair dyes, and pesticides needs further exploration (13).

Malignant lymphoma

Lymphoma explicitly influences white blood cells, known as lymphocytes, which are part of the immune system. In case of an abnormal reaction, the lymph nodes are swollen. This is often recognized for neck, armpit, or groin nodes. If infection is the underlying reason, the nodes may be painful. If they are painless, then one should be even more eager to consult a medical doctor immediately because painless swelling of the lymph nodes is a sign of malignant lymphoma as a type of blood cancer. The internet offers a wide range of inroad information on symptoms and further advice about the disease, up to the information on how it feels to die soon (19).

Hodgkin- and Non-Hodgkin lymphoma

There is a wide variety of distinct diseases, with an overall incidence rate of 3 to 4%, with an increasing trend. The various subtypes are often categorized into Hodgkin- and non-Hodgkin lymphoma. Ethnic and environmental dynamics seem to result in different geographic areas. Some types of the disease, such as T/NK-cell lymphoma, are more common in East Asia, while other B-cell lymphomas are more common in the West (20).

Tattoos and the risk for lymphoma - a case-control study

Such a pattern might change in the future due to the increasing mistreatment of the skin by tattoos, as a recently published investigation about the relationship between tattoos and lymphoma suggests. Using the Swedish National Authority Register, a population-based case-control study nested within the total Swedish population tested the effect of tattoos on the risk of malignant lymphoma (13). As cases, most malignant lymphomas between 2007 and 2017 were selected from those in the age of 20 to 60 years old. To one case, three age and sex-matched controls were assigned. As cases, 1.398 individuals (response rate 54%) were matched with 4.193 controls (response rate 47%). The tattoo prevalence was 21% of the cases and 18.6% of the controls. A logistic regression was used to estimate the association between tattoo exposure and

malignant lymphoma by calculating the incidence rate ratio (IRR) for statistical assessment. Besides the variables, age and sex, education, marital status, income, and smoking were considered.

The adjusted risks of overall lymphoma of individuals with tattoos were found with an IRR of 1.21 (95% CI 0.99-1.48). The highest risk appeared less than two years after the first tattoo, with an IRR of 1.81 (95% CI 1.03-3.20). If more time elapsed, the risk decreased but increased again after 11 years of tattooing, with an IRR of 1.19 (95% CI 0.94-1.50). The area of the tattoo covering the skin did not influence the risk for lymphoma. The risk was highest for tattoos smaller than one hand palm. While using the matching method, different colors had similar risks compared to the overall adjusted assessment. An unmatched analysis, however, singled out black/grey tattoos with an IRR of 1.32 (95% CI 1.04-1.68) with a high risk. The 'strongest' risks were found for diffuse B cell lymphoma (IRR 1.30 (95% CI 0.99-1.71)) followed by follicular lymphoma (IRR 1.29 (95% CI 0.29-1.82)). A long duration after tattooing and disease increased the risk for large B-cell lymphoma, while follicular lymphomas could occur within two years after tattooing and also after 11 years.

For those who no longer would like to have a tattoo reading "with noy in heaven" want to change into "everlasting love for nong leck" or when finally "pee yai" neither wants to read about "noy" and "leck" on the skin of her husband, tattoo removal increases the risks of lymphoma considerably to IRR 2.63 (95% CI 0.96-7.18) in the matched assessment and trying to find more cases with tattoo removal slightly decreased the 95% CI in the unmatched calculation to IRR 2.66 (95% CI 1.37-6.52).

Conclusion

Overall, the study results in a 21% increase in the risk of overall lymphoma relative to nontattooed individuals (13). However, more investigation is needed into the causative relationship between tattoos and lymphoma. Although more epidemiological and in-depth investigations are required, it is interesting to note that there is a rift between the time of cancer incidence and tattooing being either short or for quite a long duration, which should be linked to tumor initiation dynamic. One reason might be that solid material is stored in the lymph nodes, finally posing a threat to tumors, while soluble substances need less time to cause malignancy (13).

Laser treatment used for tattoo removal considerably increases the risks for lymphoma and is a very worthwhile topic for further investigation. The manipulation of cleavage of particular carcinogenic amines might be the culprit. Tattoo removal, therefore, is an exciting research topic for public health. Of more clinical use would be the investigation of risk variation to different kinds of particular lymphoma diseases.

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