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Fig. 4.—Color photograph of right deltoid muscle of 23-year-old man with second-degree burns. Black thunderbolts have multiple white areas, which were raised and swollen 24 hr earlier. Red areas outlining thunderbolts are normal, and skin with Chinese symbol is normal.



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Tattoo-Induced Skin Burn During MR Imaging

MR-induced skin burns caused by permanent coloring techniques (tattooing) are extremely rare [1]. Eyeliner materials containing metallic substances are known to cause artifacts on cranial MR studies, but rarely is the patient affected [2, 3].

A 23-year-old man sustained a second-degree skin burn in two skin tattoos while undergoing cervical spine MR imaging at 1.5-T using a phased array coil. The study consisted of a sagittal spoiled gradient-refocused acquisition in the steady state localizer (23 sec), sagittal T1-weighted spin-echo imaging (3 min 44 sec), sagittal T2-weighted fast spin-echo imaging with multiple (16) 180° radiofrequency (RF) pulses (3 min 16 sec), and axial multiplanar gradient-recalled sequences using gradient acquisition with a 20° flip angle (4 min 23 sec). At the end of the examination the patient complained of a burning sensation in his right deltoid area, which was raised and swollen. The patient was treated in the

emergency department for a second-degree skin burn and returned 24 hr later, when multiple color photographs were obtained (Fig. 4).

The burns occurred only in the two jet-black thunderbolt tattoos, but not in the Chinese symbol (Fig. 4). Although his shoulder may have touched the wall of the magnet, the Chinese symbol tattoo did not cause him to be burned at all. The two adjacent thunderbolt tattoos could have approximated an RF pick-up loop and therefore would have been more prone to preferentially absorb the RF energy.

The tattoo studio was contacted, and the artist stated that all the ink used in their studio was obtained from a single national supplier. He also stated that he had never had a client complain of a skin burn caused by MR imaging. The major supplier of tattoo ink in the United States is Spaulding & Rogers Manufacturing, located outside Albany, NY. A spokesperson for that company stated that the Food and Drug Administration does not give its approval to the use of tattoo ink. Extremely dark tattoo ink contains a high concentration of iron oxide, and this ferrous pigment can become quite concentrated if sedimented ink is used during the tattoo process. He also stated that there is little quality control over foreign-manufactured tattoo ink, especially from China, which is a major international supplier of tattoo ink.

Artistic tattoos have now become mainstream and are no longer found exclusively on sailors and bikers. The tattoos are often very fine and intricate and do not typically use high concentrations of jet-black ink. Iron oxide is both potentially magnetic and an electrical conductor; therefore, the heating could come either from the oscillations of the gradients or, more likely, from the RF-induced electrical currents. Heating raises intracellular water temperature in the skin, resulting in a burn.

In 14 years of experience with thousands of MR studies, we have never had a single skin burn caused by tattoo ink. This report provides graphic proof that a tattoo can potentially cause a second-degree skin burn, particularly if the ink is concentrated (dark) or if the tattoo is in the form of an RF pick-up loop.

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