
Prevention of thermal burns from magnetic resonance imaging in patients with tattoos



Jason F. Wang, BA,^a and Nicole M. Hindman, MD^b
New York, New York

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CLINICAL CHALLENGE

Patients with tattoos undergoing magnetic resonance imaging (MRI) are at risk for thermal burns. This burn risk is due to the presence of metals in the tattoo.¹ The risk of burning increases with tattoo size and magnet strength.

SOLUTION

Clinicians should be aware of the minimal but increased risk for burns in patients with tattoos, particularly tattoos that are very large (ie, 30 cm) or in sensitive regions. In brief, the increased risk is due to the tattoo acting as an antenna for the radiofrequency (RF) pulse, which the magnet sends out, and the risk increases as the tattoo size approaches that of half the size of the RF wavelength in free water. For a 1.5-T magnet, half the RF wavelength in free water is 52 cm, and for a 3-T magnet, half the wavelength is 32 cm (wavelength formula: $\lambda \approx \lambda_0 \div \sqrt{\epsilon_r}$, where ϵ_r equals 63.8 in muscle with a 3-T magnet). Therefore, the 3-T magnet is more likely to see the tattoo than the 1.5-T magnet and more likely to produce a current in it.

We recommend that hospitals adopt MRI screening forms with a field that addresses tattoos (Fig 1) and patients be told about possible heating of the tattoo. MRI-compatible ice packs can be placed over tattoos during the scan,² particularly for patients with tattoos on the eye, breast, or nipple and for unconscious patients. Patients should be given a heating warning along with instructions on how to activate the notification system at the slightest feeling of warmth so that the clinician can assess the tattoo.

REFERENCES

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From the New York University School of Medicine^a; and Department of Radiology, New York University School of Medicine.^b

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Reprint requests: Nicole M. Hindman, MD, Department of Radiology, NYU School of Medicine, 660 First Ave, New York, NY 10016. E-mail: nicole.hindman@nyumc.org.

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Sample portion of a MR Safety Screening Questionnaire Form

Do you have?

Yes	No		Yes	No	
<input type="radio"/>	<input type="radio"/>	Cardiac Pacemaker	<input type="radio"/>	<input type="radio"/>	Bone/Joint pin, screw, nail, wire, plate
<input type="radio"/>	<input type="radio"/>	Previous cardiac pacemaker removed	<input type="radio"/>	<input type="radio"/>	Tattoos (Decorative, makeup, or any other type)
<input type="radio"/>	<input type="radio"/>	Implanted cardiac defibrillator	<input type="radio"/>	<input type="radio"/>	Body piercing(s)
<input type="radio"/>	<input type="radio"/>	Carotid artery vascular clamp	<input type="radio"/>	<input type="radio"/>	Dentures or Dental Braces
<input type="radio"/>	<input type="radio"/>	Aneurysm clip(s) in Brain	<input type="radio"/>	<input type="radio"/>	Removable dental item (Remove before MRI)
<input type="radio"/>	<input type="radio"/>	Implanted drug infusion device	<input type="radio"/>	<input type="radio"/>	Claustrophobia, Anxiety, Motion Disorder
<input type="radio"/>	<input type="radio"/>	Bone growth/fusion stimulator			
<input type="radio"/>	<input type="radio"/>	Neurostimulator (TENS-Unit)			
<input type="radio"/>	<input type="radio"/>	Any type of Biostimulator			
<input type="radio"/>	<input type="radio"/>	Cochlear, otologic, or ear implant			
<input type="radio"/>	<input type="radio"/>	Hearing aid (Remove before MRI)			
<input type="radio"/>	<input type="radio"/>	Transdermal Medication Patch: If yes, type: _____			
<input type="radio"/>	<input type="radio"/>	Any type of implanted item: _____			
<input type="radio"/>	<input type="radio"/>	Any type of prosthesis (Heart, Valve, Eye, Penile, etc...)			
<input type="radio"/>	<input type="radio"/>	Artificial limb or joint			
<input type="radio"/>	<input type="radio"/>	Electrodes (on body, head, or brain)			
<input type="radio"/>	<input type="radio"/>	Intravascular stents, filters, or coils (ie Gianturko, Greenfield)			
<input type="radio"/>	<input type="radio"/>	Shunt (spinal or intraventricular)			
<input type="radio"/>	<input type="radio"/>	Vascular access port and/or catheter			
<input type="radio"/>	<input type="radio"/>	Swan-Ganz catheter			
<input type="radio"/>	<input type="radio"/>	Any implant held in place by a magnet			
<input type="radio"/>	<input type="radio"/>	IUD or diaphragm			
<input type="radio"/>	<input type="radio"/>	Any metal fragments – Shrapnel or Bullet			
<input type="radio"/>	<input type="radio"/>	Internal pacing wires			
<input type="radio"/>	<input type="radio"/>	Aortic clip			
<input type="radio"/>	<input type="radio"/>	Metal or wire mesh implants			
<input type="radio"/>	<input type="radio"/>	Wire sutures or surgical staples			
<input type="radio"/>	<input type="radio"/>	Harrington rods (spine) or metal rods on bones			
<input type="radio"/>	<input type="radio"/>	Joint replacement: _____			

Fig 1. Example of magnetic resonance imaging safety screening form.