

THE CLINICAL PICTURE

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A second-degree burn after MRI



FIGURE 1. (A) Articulating 1-cm lesions developed after magnetic resonance imaging. The black and red tracings on the right inner thigh indicate the original area of cellulitis. (B) A bullous lesion with clear serous fluid on the right medial thigh.

A 48-YEAR-OLD NICARAGUAN man underwent magnetic resonance imaging (MRI) 3 days after admission to a South Florida hospital for treatment of cellulitis of the right thigh with vancomycin. MRI had been ordered to evaluate for a possible drainable source of infection, as the clinical picture and duration of illness was worsening and longer than expected for typical

uncomplicated cellulitis despite intravenous antibiotic therapy. The MRI showed multiple enlarged inguinal lymph nodes and cellulitis of the superficial soft tissues of the thigh without discrete drainable collections.

After the procedure, the patient was noted to have a bullous lesion on each thigh, each lesion roughly 1 cm in diameter and filled with clear serous fluid (Figure 1). He reported that his legs had been pressed together before entering the MRI machine and that he had felt a burning sensation in both thighs during the test. Examination confirmed that the lesions indeed aligned with each other when he pressed his thighs together.

Study of a biopsy of one of the lesions revealed subepidermal cell blisters with focal epidermal necrosis and coagulative changes in the superficial dermis, consistent with a thermal injury (Figure 2).

■ HOW BURNS CAN OCCUR DURING MRI

Thermal burns are a potential cause of injury during MRI. Most have been observed in patients connected to external metal-containing monitoring devices, such as electrocardiogram leads and pulse oximeters.^{1,2} Thermal burns in patients unconnected to external devices have occurred when the patient's body was touching radiofrequency coils³ or, as with our patient, when skin touches skin.^{2,4,5} Skin-to-skin contact during MRI can cause the scanner to emit high-power electromagnetic radiofrequency pulses that are conducted through the body, creating heat. Tissue loops are created at points of skin-to-skin contact, thus forming a closed conducting circuit. The current flowing through this circuit can produce second-degree burns.⁴

We believe that during placement in the scanner, our patient inadvertently moved his

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thighs together, forming a closed loop conduction circuit and resulting in a thermal burn.

This case illustrates the importance of correct positioning during MRI. The MRI technicians had taken standard precautions, placing a sheet over the patient and ensuring no direct contact with the radio-frequency transmitter receiver (MR unit). However, precautions against skin-to-skin contact were not taken, and the patient's legs were not separated.

LESSONS LEARNED

Appropriate positioning prevents closed skin-to-skin loops, but this may be more challenging in a larger patient.⁶ While the patient is in the scanner, a “squeeze ball” alert system allows the patient to signal the technologist should unexpected distress or heating occur.^{6,7} A patient's inability to utilize the squeeze ball contributes to the risk of a severe injury. Further, in this instance, there may have been a language barrier. Also, proximity of the anatomic skin-to-skin loop to the imaged body part (and therefore the center of the MRI coil) may have conferred risk related to field strength in this patient.

The MRI technologist, under supervision of a radiologist, is primarily responsible for positioning the patient to decrease the risk of this complication and for following institutional MRI safety protocols and professional guidelines.^{6–8} MRI technologist certification training highlights all aspects of safety, including skin-to-skin conducting loop prevention.^{7,8}

REFERENCES

1. Dempsey MF, Condon B. Thermal injuries associated with MRI. *Clin Radiol* 2001; 56:457–465.
2. Haik J, Daniel S, Tessone A, Orenstein A, Winkler E. MRI induced fourth-degree burn in an extremity, leading to amputation. *Burns* 2009; 35:294–296.
3. Friedstat J, Moore ME, Goverman J, Fagan SP. An unusual burn during routine magnetic resonance imaging. *J Burn Care Res* 2013; 34: e110–e111.
4. Eising EG, Hughes J, Nolte F, Jentzen W, Bockisch A. Burn injury by nuclear magnetic resonance imaging. *Clin Imaging* 2010; 34:293–297.
5. Landman A, Goldfarb S. Magnetic resonance-induced thermal burn. *Ann Emerg Med* 2008; 52:308–309.
6. Expert Panel on MR Safety; Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document on MR safe practices: 2013. *J Magn Reson Imaging* 2013; 37:501–530.
7. Magnetic resonance safety. *Radiol Technol* 2010; 81:615–616.
8. Shellock FG, Crues JV. MR procedures: biologic effects, safety, and patient care. *Radiology* 2004; 232:635–652.

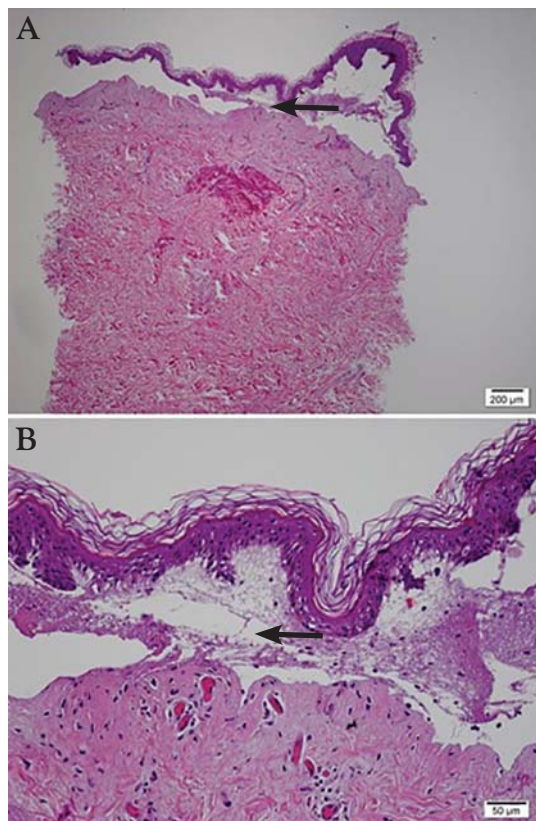


FIGURE 2. Focal epidermal necrosis (arrows) and coagulative changes in the superficial dermis were consistent with thermal injury (hematoxylin and eosin; panel A magnification $\times 2.5$; panel B magnification $\times 10$).

Afterward, the patient said his legs had been pressed together before he entered the MRI machine

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