

Christopher B. Powe, RN, MSN, CCRN, CFRN, ACNP
Section Editor

Body Piercing/Tattooing and Trauma Diagnostic Imaging: Medical Myths vs Realities

Scott DeBoer, RN, MSN, CEN, CCRN, CFRN

Donald Fishman, MD

Walter Chwals, MD, FACS, FAAP, FCCM

Christopher Straus, MD

Troy Amundson, EMT-B

In the emergency and trauma settings, diagnostic imaging has become an integral part of the trauma resuscitation process. A recent study of undergraduate college students found that 23% of students had tattoos and 51% had body piercings of their face, torso, abdomen, or genitalia.¹ As body piercing and tattooing are certainly on the rise, the medical implications of these body modifications are becoming more and more evident.²⁻⁴ However, when it comes to diagnostic imaging and body jewelry, the motto of “when in doubt... just take it out” is not always practical, reasonable, or even possible. This article will illustrate some of the controversies and medical realities of body modifications and emergency imaging.

REVIEW OF THE LITERATURE: TATTOOS/ BODY PIERCING AND DIAGNOSTIC IMAGING

What really happens when patients with tattoos and/or piercings undergo diagnostic imaging? Many healthcare

Scott DeBoer, RN, MSN, CEN, CCRN, CFRN, is Flight Nurse, University of Chicago Hospitals, Chicago, Ill, Founder, Peds-R-Us, and Medical Education and Medical Consultant, Association of Professional Piercers, Dyer, Ind; Donald Fishman, MD, is Director of Trauma Surgery, Advocate Christ Medical Center, Oak Lawn, Ill; Walter Chwals, MD, FACS, FAAP, FCCM, is Professor of Surgery and Pediatrics, Case Western Reserve University School of Medicine, Rainbow Babies and Children's Hospital, Cleveland, Ohio; Christopher Straus, MD, is Attending Radiologist, University of Chicago Hospitals, Chicago, Ill; and Troy Amundson, EMT-B, is Professional Body Piercer, Apocalypse Piercing, Seattle, Wash, and CEO, Med-Pierce.

Corresponding author: Scott DeBoer, RN, MSN, CEN, CCRN, CFRN, Association of Professional Piercers, PO Box 601, Dyer, IN 46311 (e-mail: scott@peds-r-us.com).

providers fear that jewelry will fly across the room during a magnetic resonance (MR) scan and the imaging artifact from jewelry or tattoos will make computed tomography/MR studies unreadable.⁵⁻¹⁰ However, the experiences of the authors and a review of the literature show that this is not accurate. Most published articles that address MR and piercings focus not on the potential artifact but on the safety of performing the procedure. Higher-quality body jewelry containing LVM 316 or 316L stainless steel, titanium, or niobium has been found to be safe even if worn during an MR examination.^{5,10} Testing the jewelry before entering the MR suite with a handheld magnet, although not fail-safe, has been suggested as a rapid screen to determine ferromagnetism.⁵⁻¹⁰

COMPUTED TOMOGRAPHY/MRI STUDIES AND BODY ART

There are many more published studies concerning computed tomography/MR studies and tattoos. Again, the concerns are artifact and patient safety. Even if a tattoo has been removed with lasers before the test, artifact can still be present and potentially confusing.¹¹ However, the larger concern is for patient safety.¹¹⁻¹⁹ Especially with older/larger tattoos, but also with recently placed ones, during the MR procedure, some inks that include small quantities of ferrous materials can potentially cause a visible burn to the patient.¹⁹⁻²¹ However, there have been only 5 documented cases of this occurrence.²⁰⁻²⁴

Many pre-MR questionnaires ask specifically about tattoos and piercings, and if they are present, simply remind the patient to inform the technician immediately if an area feels warm at any point during the procedure. Taking that idea one step further, some authors have advocated placing a cold pack on the tattoo during the procedure as a precaution with positive past experiences.^{10,23,25} With the introduction of permanent cosmetics, especially on the facial areas, the MR imaging-induced heating of ink has been noticed as well. However, much as with the tattoo cases,

there are less than 10 cases in the literature with permanent cosmetics who experienced warm sensations during the procedure, and none suffered a burn of any sort.^{10,12–14,16,17,19,26–28}

■ PLAIN FILMS AND BODY ART

If the radiologist and technicians are aware of the piercings and/or tattoos, they are generally able to alter the techniques to maximize the image quality and avoid potentially confusing findings. Specifically, the literature indicates that cervical spine odontoid views can be obscured by tongue jewelry, and chest radiographs can be confusing due to nipple jewelry (Koenig 1998).^{29,30} However, in the experience of coauthor Dr Christopher Straus, this has not been the case, especially if the technicians are aware of the jewelry before obtaining the radiographs. Obscuring of the injury might occur if the piercing is directly over the fracture, and only one view is obtained (ie, lip jewelry and mandible fractures), but with multiple views, the chances of this are greatly decreased (Koenig 1998).^{29–31} If images of acceptable quality are not obtained (ie, for clearance of cervical spines), the jewelry should be removed for patient safety.

■ ULTRASONOGRAPHY AND BODY ART

In theory, tattoos should not be an issue for ultrasonography. However, as sound waves cannot be transmitted through jewelry, when ultrasonography is being performed, simply not placing the transducer directly on the jewelry should allow for adequate imaging. In the literature, there is only one case describing the ultrasonographic findings of a patient presenting with a hypoechoic lesion after attempting self-body piercing several weeks prior.³²

■ IMAGING EXPERIENCES

The ongoing findings of diagnostic imaging with pierced patients are quite surprising. In the past experiences of the surgical and radiology coauthors, the amount of artifact from body jewelry is highly variable and dependent on the location and size of the jewelry. Significant distortion of the nose and mouth has been found on trauma scans in patients with common oral/nasal jewelry; however, the brain and spinal cord were able to be adequately visualized without removal of the jewelry sometimes. Abdominal images can be diagnostic throughout as well, with only a minimal loss of the subcutaneous fat from the jewelry (Figure 1). However, much as with conventional radiographs, the amount of distortion is unpredictable, and jewelry may need to be removed for imaging if adequate visualization of structures is not possible.^{5,8,9,25,30,33} The time/financial expenses of repeat scans, when coupled with the signif-

Figure 1. Diagnostic imaging with body jewelry in situ. **AQ4**
Photographs courtesy of Dr Christopher Straus.

icant amounts of radiation exposure and scan interpretation concerns, lead some of our surgical coauthors to recommend removal of all body jewelry that is near the imaged areas.³⁴

■ REMOVAL

If removal is being considered, the following questions should be considered:

1. Why is the jewelry being removed? If it is not in the way of what is to be imaged and it is not ferromagnetic, there is probably no reason to remove it.^{8,9}
2. Is the patient willing to have the jewelry removed? If they are not willing to have it removed, it is most likely due to concerns as to the piercing not being fully healed and piercing tract closure. Healing times can range from several weeks to several months, and there is no hard and fast rule as to how long piercing tracts stay open post-jewelry removal.^{8,35,36} In the experience of the surgical coauthors, especially with fully healed piercings, tract closure is very unlikely during the short time that imaging is being performed. However, the Association of Professional Piercers reminds us that “even healed piercings can shrink or close in minutes after having been there for years.”³⁷
3. Do you know how to remove the jewelry? A study of Emergency Department physicians showed that only 6 of 28 were able to remove the most common types of body jewelry.³⁸ If not removed properly, injury to the patient, especially bleeding and local tissue trauma, can occur. Removal without the proper tools is possible but, as with any procedure, much

more difficult. Having nonserrated hemostats, gauze, and ring opening pliers is recommended for proper, safe, and rapid removal.^{30,33,39} The proper equipment is essential, but so is training as to removal techniques. If the patients are awake and able/willing to remove the jewelry, asking them to remove it can be the easiest removal technique.^{25,39} However, with some of the larger gauge or intricate jewelry, removal without a professional piercer's assistance can be not only very time consuming but also nearly impossible (J. Weber, personal communication, August 16, 2006).⁴⁰ With an increasing number of patients presenting with complex body piercings, emergency departments may soon find the idea of a "professional piercer" on call to become a reality, but the key is to find a local professional piercer before the emergency need arises.⁴⁰ The Association of Professional Piercers (<http://www.safepiercing.org>) is an excellent resource for learning what constitutes a professional piercer and where and how to find one.^{41,42} Lastly, if the jewelry is removed, is it possible to insert a retainer of some sort to maintain piercing tract patency? The use of epidural catheters, sutures, or simply an intravenous catheter, all have been described in the literature. The most important step in removing jewelry and maintaining the piercing tract patency is never to completely remove the jewelry and then try to place the retainer. In the emergency room/trauma arenas, using a sterile intravenous catheter to carefully push the jewelry out allows the intravenous catheter to thread into the piercing tract tunnel. This technique is quick, easy to perform, and nonferromagnetic and does not induce artifact for trauma diagnostic imaging.^{2,43,44}

■ PEDIATRIC CONSIDERATIONS

Body piercing and tattooing is not only for adults. Several studies detail the rise of these practices in the pre-adolescent and teenage population as well.^{1-4,45,46} Although rare when in context of the number of piercings performed per year, complications postpiercing and tattooing do occur. Although most documented complications are local in nature (irritation/infections), there have been cases of life-threatening endocarditis, septic shock, and tetanus.^{33,41,47,48} Whether done for financial or parental restrictive reasons, self-piercing brings additional risks and can result in additional medical issues as well.^{45,49} In the dentistry literature, several articles detail the complications of oral/tongue piercings such as dental fractures and damage to the gingival tissue.⁵⁰⁻⁵² Parents and patients of young patients with body art need to be aware not only of the potential complications but also of suggested aftercare techniques and healing times. This is crucial, especially with carti-

lage (ear) piercings and navel piercings, as healing times can be as long as 9 months or longer until the tissue is completely healed. Unless proper and ongoing aftercare is performed, the risk of complications is increased significantly (APP aftercare).^{36,53}

In summary, although adverse events such as burns from tattoos/MR imagings and artifact from body jewelry have been described, they are, in comparison with the amounts of imaging studies that are done, exceedingly rare. As with any procedure, screening and patient safety are paramount, but with a knowledge of the research and an open mind, many emergency diagnostic imaging procedures can be very safely performed despite the presence of tattoos and without removing body jewelry.

REFERENCES

1. Mayers L, Judelson D, Moriarty B, Rundell K. Prevalence of body art (body piercing and tattooing) in university undergraduates and incidence of medical complications. *Mayo Clin Proc.* 2002;77(1):29-34.
2. Makkai T, McAllister I. Prevalence of tattooing and body piercing in the Australian community. *Commun Dis Intell.* 2001;25(2):67-72.
3. Carroll S, Riffenburgh R, Roberts T, Myhre E. Tattoos and body piercings as indicators of adolescent risk-taking behaviors. *Pediatrics.* 2002;109(6):1021-1027.
4. Gold M, Schorzman C, Murray P, Downs J, Tolentino G. Body piercing practices and attitudes among urban adolescents. *J Adolesc Health.* 2005;36(4):352. e17-24.
5. Bendel L, Shellock F, Steckel M. The effect of mechanical deformation on magnetic properties and MRI artifacts of Type 304 and Type 316 L stainless steel. *J Magn Reson Imaging.* 1997;7(6):1170-1173.
6. Shellock F. MR imaging of metallic implants and materials: a compilation of the literature. *AJR Am J Roentgenol.* 1988;151:811-814.
7. Emergency Care Research Institute. Patient death illustrates the importance of adhering to safety precautions in magnetic resonance environments. Available at: www.ecri.org. Posted August 6, 2001. Accessed August 16, 2006.
8. Ward J. Body piercing and MRI scans. *Point.* 2001;18:4.
9. Boock M. The hole story. *Nursing Spectrum 2004 Career Fitness Guide.* 2004:178-180.
10. Shellock F, Cruces J. MR procedures: biologic effects, safety, and patient care. *Radiology.* 2004;232(3):635-652.
11. Kobayashi H, Togashi K. CT of tattoos removed with laser therapy. *AJR Am J Roentgenol.* 2000;174(5):1468-1469.
12. Lund G, Wirtschafter J, Nelson J, Williams P. Tattooing of eyelids: magnetic resonance imaging artifacts. *Ophthalmic Surg.* 1986;17(9):550-553.
13. Sacco D. Permanent eyeliner and MR imaging [a reply]. *Am J Radiol.* 1987;149:1080.
14. Sacco D, Steiger D, Bellon E. Artifacts caused by cosmetics in MR imaging of the head. *Am J Radiol.* 1987;148:1001-1004.
15. Kanal E, Shellock F. MRI interaction with tattoo pigments. *Plast Reconstr Surg.* 1998;99(6):1717-1720.
16. Weiss R, Saint-Louis L, Haik B, McCord C, Taveras J. Mascara and eyelining tattoos: MRI artifacts. *Ann Ophthalmol.* 1989;21(4):129-131.
17. Carr J. Danger in performing MR imaging on women who have tattooed eyeliner or similar types of permanent cosmetic injections. *AJR Am J Roentgenol.* 1995;165(6):1546-1547.
18. Honegger M, Hesseltine S, Gross J, Singer C, Cohen J. Tattoo pigment mimicking axillary lymph node calcifications on mammography. *AJR Am J Roentgenol.* 2004;183(3):831-832.

19. Armstrong M, Elkins L. Body art and MRI. *Am J Nurs*. 2005; 105(3):65–67.
20. Vahlensieck M. Tattoo-related cutaneous inflammation (burn grade I) in a mid-field MR scanner. *Eur Radiol*. 2000;10:197.
21. Wagle W, Smith M. Tattoo-induced skin burn during MR imaging. *Am J Radiol*. 2000;174(6):1795.
22. Kreidstein M, Giguere D, Freiberg A. MRI interaction with tattoo pigments: case report, pathophysiology, and management. *Plast Reconstr Surg*. 1997;99:1717–1720.
23. Ratnapalan S, Greenberg M, Armstrong D. Tattoos and MRI. *AJR Am J Roentgenol*. 2004;183(2):541.
24. Klitscher D, Blum J, Kreitner K, Rommens P. MRT-induced burns in tattooed patients: case report of a traumatic surgery patient. *Unfallchirurg*. 2005;108(5):410–414.
25. Blazys D. Patients with body piercings. *J Emerg Nurs*. 2003;29(1):44.
26. Jackson J, Acker H. Permanent eyeliner and MR imaging. *AJR Am J Roentgenol*. 1987;149:1080. (letter).
27. Tope W, Shellock F. Magnetic resonance imaging and permanent cosmetics (tattoos): survey of complications and adverse events. *J Magn Reson Imaging*. 2002;15:180–184.
28. Society of Permanent Cosmetic Professionals (SPCP). Available at: <http://www.spcp.org/MRIinfo.htm>. Posted 2005. Accessed August 16, 2006.
29. Healey T. Nipple-piercings: unusual artifacts. *Radiography*. 1979; 45:164–165.
30. Hadfield-Law L. Body piercing: issues for A&E nurses. *Accid Emerg Nurs*. 2001;9:14–19.
31. Pendergrass R. Tattoos in radiographs. *Med Radiogr Photogr*. 1955; 31(1):41–43.
32. Lehmann J, Jancke C, Retz M, et al. A hypoechoic lesion found on testicular ultrasound after testicular piercing. *J Urol*. 2000;164(5): 1651.
33. Thiem L. Body piercing: clinical considerations. *Clin Rev*. 2005; 15(1):30–35.
34. United States Food and Drug Administration: Center for Devices and Radiological Health. Whole body scanning using computed tomography (CT). Available at: <http://www.fda.gov/cdrh/ct/risks.html>. Accessed August 17, 2006.
35. Caliendo C, Armstrong M, Roberts A. Self-reported characteristics of women and men with intimate body piercings. *J Adv Nurs*. 2005; 49(5):474–484.
36. Norton L, Norton G. Body art: tattoos & piercings information for pharmacists. *US Pharm*. 2005;5:39–50.
37. Association of Professional Piercers. 2006. Available at: <http://www.safepiercing.org/bodyAftercare.html>. Accessed August 16, 2006.
38. Khanna R, Kumar S, Raju B, Kumar A. Body piercing in the accident and emergency department. *J Accid Emerg Med*. 1999;16(6):418–421.
39. Edmunds K. Practice makes perfect: the removal of body piercings. *Emerg Nurse*. 2006;14(21):21.
40. DeBoer S, Amundson T, Angel E. Professional piercer on-call: it's time has come? *Australas Emerg Nurs J*. 2006;8(4):137.
41. Tweeten S, Rickman L. Infectious complications of body piercing. *Clin Infect Dis*. 1998;26:735–740.
42. Association of Professional Piercers. 2006. Available at: <http://www.safepiercing.org/choosePiercer.html>. Accessed August 16, 2006.
43. Jacobs V, Morrison J, Paepke S, Keichle M. Body piercing affecting laparoscopy: perioperative precautions. *J Am Assoc Gynecol Laparosc*. 2004;11(4):537–541.
44. Muensterer O. Temporary removal of navel piercing jewelry for surgery and imaging studies. *Pediatrics*. 2004;114:384–386.
45. Armstrong M, McConnell C. Tattooing in adolescents, more common than you think: the phenomenon & risks. *J Sch Nurs*. 1994; 10(1):22–29.
46. Armstrong M. Adolescent tattoos: educating vs. pontificating. *Pediatr Nurs*. 1995;21(6):561–564.
47. Stirn A. Body piercing: medical consequences & psychological motivations. *Lancet*. 2003;361:1205–1215.
48. Wodka R. Piercing infections: are oral antibiotics always the answer. *Point*. 2004;30:16–17.
49. Nedbalski T, Laskin D. Loss of a sewing needle in the tongue during attempted tongue piercing: report of a case. *J Oral Maxillofac Surg*. 2006;64(1):135–137.
50. De Moor R, DeWitte A, DeBruyne M. Tongue piercing & associated oral & dental complications. *Endod Dent Traumatol*. 2000;16: 232–237.
51. McGeary S, Studen-Pavlovich D, Ranalli D. Oral piercing in athletes: implications for general dentists. *Gen Dent*. 2002;50:168–172.
52. Kieser J, Thomson W, Koopu P, Quick A. Oral piercing and oral trauma in a New Zealand sample. *Dent Traumatol*. 2005;21(5): 254–257.
53. Koenig L, Carnes M. Body piercing—medical concerns with cutting edge fashion. *J Gen Intern Med*. 1999;14:379–385.