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# Outpatient Surgery

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## Getting Paid for Implants

Reimbursement  
strategies for  
those expensive  
devices. **P. 28**



Cape Fear Hospital's  
Surgical Services  
Director Kathie  
Wheeler, RN, BHA,  
CNOR, and orthopedic  
surgeons Jack W.  
Bowling, MD (left),  
and Walter W. Frueh,  
MD, convinced their  
vendors to accept the  
hospital's cap on what  
they'll pay for implants.



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- Jorge Leal, M.D.

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Radiology Supervisor

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imagination at work



# 5 C-Arm Safety Tips

Simple steps you can take to reduce radiation exposure.

Brian Giordano, MD | Los Angeles, Calif.

**▲ GET THE LEAD OUT** Every member of your surgical team must wear protective shields when the C-arm is in use, even those standing far from the X-ray source.

**A**re you doing all you can to protect your staff, surgeons and patients from fluoroscopy's invisible dangers? Be sure you're following these 5 simple and effective strategies.

**1 Understand the risks.** My study, published in the February 2009 issue of the *Journal of Bone and Joint Surgery*, compared radiation exposure levels sustained by patients and surgeons during use of standard and mini C-arms. I discovered, along with a team of researchers, that overall exposure risks are greater when conventional C-arms are used. However, the study showed that patient and surgeon exposure to radiation is amplified when either conventional or mini C-arms are used in judiciously to image extremities with large cross-sectional areas and high tissue densities. In addition, patient exposure during mini C-arm use in the worst-case configuration (specimen placed 2 inches from the radiation source) was about 5 times greater than exposure rates when large C-arms were used in the best-case configuration (specimen placed as close as possible to the image intensifier).

As my research shows, mini C-arms are just as capable as their standard-sized counterparts of putting patients and surgeons in harm's way if used improperly. Mini C-arms are designed for imaging small body parts — the hand, foot or ankle — but the devices are also used to image larger anatomies that fit in the imaging arc. Imaging larger extremities, however, creates greater exposure risks because X-ray beams can scatter off of dense tissue with a high fat content. While mini C-arms can and should be used to image larger body parts, the surgeon must be conscientious to limit the number of exposures, as radiation scatter can be much higher under such conditions.

**2 Focus on patient positioning.** Small changes to a patient's positioning within the imaging arc can significantly limit exposure risks. As demonstrated by the inverse square law — when the distance between the X-ray source and the target is doubled, exposure risks are reduced to a quarter of the former dose — the X-ray beam's intensity weakens as it spreads. So place the target extremity directly over the C-arm's image intensifier to keep it as far as possible from the X-ray source. Positioning extremities, especially those with large

surface areas, away from the radiation source lets the cone of the X-ray beam widen and lose intensity as it emanates. That loss of intensity reduces the amount of radiation scatter when the beam bounces off the extremity being imaged.

**3 Reduce doses.** Proper patient positioning is important, but you ultimately have little control over the patient factors that impact radiation exposure (extremity size and tissue fat content, for example). That's why it's equally important to adjust a C-arm's technical components with an eye toward delivering effective doses that limit radiation scatter.

- **Beam collimation.** Use the lead shutters on your C-arm to focus the X-ray beam on areas of interest. By zeroing in on a specific area of the extremity, you'll limit radiation scatter and produce high-quality images.

- **Number of exposures.** Employing live fluoroscopy is a cavalier way to image. Doing so keeps X-ray beams firing during the C-arm's full range of motion, which needlessly increases exposure risks. Instead, use pulsed fluoroscopy, which emits radiation intermittently rather than continuously, to capture and save spot images. Reviewing spot images is intraoperative imaging's gold standard.

**4 Use just enough.** The ALARA concept — As Low As Reasonably Achievable — should be the governing principle behind your imag-



▲ **CLEAR ENOUGH** C-arm manufacturers are producing units that generate high-quality images with limited radiation exposure.



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“Employing live fluoroscopy is a cavalier way to image — reviewing spot images is intraoperative imaging’s gold standard.”

— Brian Giordano, MD

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ing protocols. Producing the crispest images with the highest possible resolution is often unnecessary. Instead, dial down your C-arm’s doses to generate images that, while perhaps lacking the highest quality, are clear enough to give surgeons the anatomical views they need. The technical settings of newer C-arms are more adept at producing high-resolution images while reducing radiation risk factors.

**5 Always wear protection.** Lead aprons are said to shield wearers from 90% of scattered radiation, although that level of protection is dependent on how you care for and store aprons when they’re not in use. Aprons should be hung when stored, and never folded or crumpled into a ball. Inspect them between uses, looking for imperfections that can put wearers in jeopardy. The better you care for your aprons, the longer their protection will remain at a high level.

While it is true that exposure rates decrease the further you stand away from the X-ray tube, the

risks are not eliminated. In fact, during our research, the highly sensitive dosimeters (they measured radiation readings below 10 millirems) we wore captured readings 40 times baseline at 20 feet from the X-ray tube. Considering that many healthcare professionals believe exposure risks are next to nil if they stand more than 6 feet away from the C-arm, those findings were eye opening. The findings take on greater significance if you also consider that most dosimeters don’t register readings less than 10 millirems, even though exposure below that threshold is not negligible. The upshot: Everyone in the room should be shielded during fluoroscopic cases, even staff members who are standing at what they might consider a safe distance from the C-arm. Make lead aprons required wherever C-arms are in use, but don’t rely on them to be your sole defense against radiation exposure.

**OSM**

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