New imaging modalities raise the bar for safety

Since the days of the first rudimentary radiographs, radiation safety has been a concern in the OR, but that concern has risen as the number of hybrid ORs and procedures with imaging has risen.

“The level of image guidance in the OR, whether it’s radiographic or fluoroscopy, has become highly technical,” says Robert Schleipman, RT, CNMT, MSc, health physics educator at Brigham and Women’s Hospital (BWH) in Boston.

“About a third of our procedures include some type of imaging, and that doesn’t include our newest hybrid AMIGO suite,” he adds, referring to the Advanced Multimodality Image Guided Operating Suite. The 3-room complex—said to be the first of its type in the world—gives interventional radiologists and surgeons access to a full array of advanced imaging modalities, including fluoroscopy, ultrasound, CT, high field strength MRI, and high resolution PET.

As ORs add more imaging devices, managers are partnering with their radiology counterparts to ensure staff and patients are as safe as possible.

A close partnership
At Massachusetts General Hospital (MGH) in Boston, Lisa Morrissey, MBA, RN, CNOR, nursing director for the OR, says MGH went from 1 hybrid OR to 4, all on 1 floor. “Adding additional technology made us look at our entire department and what we needed to understand about radiation safety overall.” The addition was part of a new building that added 3 floors of OR suites.

When planning the expansion, Morrissey partnered with radiology to answer questions such as: What is the best way to manage radiation safety in the OR? “We looked at what we were currently doing, hospital policy, and standards to determine best practice,” she says.

“We partner very closely with radiology,” says Pearl Cunningham, BSN, MBA, RN, CNOR, nursing director for BWH’s OR.

“Radiology technologists are part of our OR team. They act as stewards for our patients. If there are breaches of safety that aren’t corrected, they let me know so I can follow up.”

The BWH OR suite has a hybrid room with angiography in the main OR and the AMIGO suite. The AMIGO suite’s 3 procedure rooms are separated by sliding doors. One room has an MRI machine that can be moved into the middle room, which is the OR; the third room has a PET CT.

“Three separate procedures could also be done at the same time,” says Angela Roddy Kanan, BSN, RN, CNOR, CRN, charge nurse for the AMIGO suite.

“I can’t impress enough about the importance of the relationship between the operating room and radiology,” says Cunningham.

Both managers have to be open to building that relationship. They meet every day about planned procedures in the OR and meet monthly for discussions such as planning scheduled maintenance.

Teaching the staff
At MGH, a subcommittee worked to ensure policies were clear, and staff received the necessary education. The group includes the medical director for perioperative
services, OR nurse manager, and clinical nurse specialist; radiation safety officer; nurse manager of the neurovascular unit; staff nurses; and representatives from anesthesia, radiation safety, and radiology departments.

“Interventional rooms are like radiology suites,” says Sandra Silvestri, MS, RN, CNOR, the OR clinical nurse specialist who served on the MGH subcommittee. Silvestri adapted training materials from radiology standards and integrated AORN practice standards into an education program on fluoroscopy for OR staff. Staff members have to complete the online self-study annually.

**Advanced imaging preparation**

To prepare staff for the advanced imaging techniques available in the AMIGO suite, staff received special training during the 3 months before it opened. Speakers were from radiation safety, nuclear medicine, the MRI department, and radiation oncology.

“Once we felt we had incorporated people’s questions into the live presentations, we videotaped them for staff to watch,” Kanan says.

Next came in-suite training that included how equipment worked and mock emergency situations. Staff members assigned to the AMIGO suite wear a bright sticker on their hospital ID indicating they have completed training.

Training has to be ongoing. Staff attend an annual in-service, and competence in radiation diagnostics and therapy is assessed annually.

**Protect yourself**

A key part of education is appropriate use of protective gear. Silvestri says that providing the radiation safety education program helped “tighten up” practice.

“Not everyone was wearing a thyroid shield; now they do,” she says. Wearing leaded glasses was a new experience for most staff.

Two-piece wrap-around lead aprons are used, better than heavier 1-piece aprons. Staff who routinely work in the hybrid ORs were fitted for their aprons. At BWH, aprons come in multiple sizes for a better fit.

“OSHA expects that protective equipment should fit the employee,” says Schleipman, who adds that aprons are inspected every year for tears and punctures.

In addition to leaded aprons, both hospitals provide mobile rigid shields.

At MGH, the shields are on wheels so they can be transported. At BWH, the shielding is hung on mobile booms in the room.

**Consult on shielding**

Cunningham advises managers to consult radiology about shielding requirements when implementing new technology.

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**Radiation safety 101**

The goal is to keep risks from ionizing radiation “as low as reasonably achievable” (ALARA).

**Three elements are key in achieving this goal:**

- **Time.** Keep exposure to the least amount of time possible.
- **Distance.** Keep as far away from the source of radiation as possible.
- **Shielding.** Use protective gear to limit exposure.

**Protection recommendations:**

<table>
<thead>
<tr>
<th>Protection</th>
<th>Staff scrubbed at sterile field</th>
<th>Staff not scrubbed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrap-around apron</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Thyroid shield</td>
<td>Required</td>
<td>Recommended</td>
</tr>
<tr>
<td>Lead glasses</td>
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<td>Recommended</td>
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Staff not scrubbed should stand at least 6 feet away from the ionizing beam.

Source: Radiation Safety in the Operating Room Setting: Fluoroscopy. Massachusetts General Hospital, Boston.
“The room has to be shielded differently than if you were just using the standard C-arm,” she says.

At both hospitals, a light outside the OR room automatically turns on when fluoroscopy is in use to alert those who want to enter the room.

At MGH, rings are painted on the OR floor to remind staff of the zones of exposure. The primary area of exposure is the ring around the surgical table, with the most intense area marked by the smallest ring. A larger ring around the primary ring marks the secondary area.

Staff and physicians at BWH wear 1 or 2 dosimeter badges, depending on how close they are to the radiation source. One badge is worn on the chest under the apron, and the other is worn above the lead apron on the collar so it’s close to the neck. MGH staff wear 2 badges.

**Pregnant staff**
Pregnant staff members require heightened protection. At both hospitals, staff who are pregnant wear a fetal monitoring badge over their pelvis.

“The state and national standard for the annual maximum permissible whole-body dose in the US is 5,000 millirems, but for pregnant women, it’s only 500 millirems for the entire pregnancy and only 50 millirems per month,” says Schleipman.

Silvestri says MGH’s radiology department recommends that pregnant employees stay at least 10 feet away from the radiation source when it is activated and not to work with patients who have received therapeutic doses of radioisotopes.

**Protect patients**
Patients must also have appropriate shielding, including protection for the thyroid and ovaries or testes, says Silvestri.

“Remember that the greatest dose of radiation occurs on the patient’s skin where the beam enters the body,” she adds. Staff should document the type of patient protection used, areas protected, and results of a skin assessment before and after the procedure.

Another concern is the cumulative effects of radiation.

“You can harm a patient with fluoroscopy,” says Schleipman. “The FDA recognized that over a decade ago and provided guidance documents.” He adds that new imaging equipment “is far more sophisticated and can display an estimated dose.”

Dosage can be tracked by patient, type of examination, operator, and other parameters, but, of course, patients going to different facilities have no way of knowing their cumulative exposure.

There are initiatives to develop a longitudinal radiation dose record, regardless of where procedures are performed, Schleipman notes.

In August 2011, The Joint Commission released a Sentinel Event Alert on the radiation risks of diagnostic imaging. The alert recommended that health care organizations provide the “right test and the right dose through effective processes, safe technology, and a culture of safety.”

**Physician credentialing**
Radiation safety includes ensuring that those who operate the equipment are trained. At MGH and BWH, physicians have to complete a program to obtain fluoroscopy credentials that must be renewed at set times. BWH’s initial education program for fluoroscopy operators such as surgeons and cardiologists is composed of lectures, reading material, and slides.

“There is a didactic exam, then a senior radiology technologist assesses the sur-
geon’s competence with the equipment,” says Schleipman.

Massachusetts is considering allowing physician assistants to operate imaging equipment, and there is a movement to include nurse practitioners as well.

OR nurses at BWH can easily access the privilege list by computer to verify that physicians are current.

“If a surgeon’s credentialing is not up to date, we let them know they cannot proceed,” says Cunningham. Usually, the surgeon then finds someone who is credentialed to assist.

Radiation safety manages the credentialing, including notifying physicians when they are coming up for renewal.

A team effort
Radiology and OR managers can work together to ensure that staff, patients, and surgeons are protected as much as possible from the negative effects of radiation. “We all want to work toward the same goals of reducing unnecessary radiation exposure and protecting patients,” says Schleipman.

—Cynthia Saver, MS, RN

Cynthia Saver, a freelance writer, is president, CLS Development, Inc, Columbia, Maryland.

References