

Patient Safety Tip of the Week

October 22, 2013

How Safe Is Your Radiology Suite?

So just how safe is **your** Radiology suite? We're not just talking about the risk of radiation to your patients (though we will do a brief update on that at the end of today's column) or the risks of the radiological procedures themselves. And we are not talking about diagnostic errors in interpreting imaging studies or failure to adequately convey critical test results to the appropriate physician. We're talking about all the other potentially bad things that can happen to your patients while they are in the Radiology suite. Things like falls, medication errors, patient mixups, IV connection errors, running out of oxygen, conscious sedation incidents, suicides, and others.

Falls

Many of our columns have highlighted the radiology suite as a site where many patient safety issues occur (see our Patient Safety Tips of the Week for October 16, 2007 "[Radiology as a Site at High-Risk for Medication Errors](#)", September 16, 2008 "[More on Radiology as a High Risk Area](#)", and October 7, 2008 "[Lessons from Falls...from Rehab Medicine](#)" and our January 2010 What's New in the Patient Safety World column "[January 2010 Falls in the Radiology Suite](#)"). In several of these we noted that radiology is an area where falls often happen. Patients are often on a gurney or a table or in a wheelchair and may fall when they attempt to get up to use the bathroom. They may be tethered to IV poles or other equipment that become obstacles to trip over. And they may have received benzodiazepines or other sedating medications for the radiology procedure, further increasing their fall risk. So it is critical that the fall risk of a patient is accurately conveyed to all staff when a patient is sent to radiology. One way to facilitate such handoffs would be to include information on fall risk in a structured communication tool for transports like the "[ticket to ride](#)" we described in our April 8, 2008 column "[Oxygen as a Medication](#)". The use of [color-coded wristbands](#) continues to gain momentum and may be used to identify patients at greater risk for falls.

Most of the literature has focused on inpatients in the radiology suite. In one study of falls in a radiology department ([Abujudeh 2011](#)) 80% of falls occurred in outpatients. However, that reflected the relative proportion of radiological examinations done on outpatients compared to inpatients. 44% of the falls were related to the procedure being

performed (eg. patient fall from an examination table). A majority (72%) occurred while the patient was standing or ambulating and most (61%) were unassisted falls. 85% had at least one known risk factor predisposing to falls. Those who fell were more likely to be older, have altered mental status, have a history of falls, and be taking antihypertensives or CNS-acting medications. Though the overall rate of falls was low (0.46 per 10,000 imaging examinations), almost a third (29%) of the falls resulted in injury. The likelihood of sustaining an injury related to the fall was statistically significantly associated with ambulating at the time of the fall and being on CNS-acting medications.

They recommend consideration of several aspects to develop a fall reduction program in a radiology department. These include adherence to assistance by staff, avoidance of walking in socks, careful observation of surroundings, slow and steady mobilization, use of eyeglasses, and use of extreme caution if using certain medications.

Though they didn't go into details, 5% of the falls in their study occurred in visitors. Since we can't do the risk assessments on visitors, that suggests we need to pay more attention to environmental factors such as clutter, rug edges, etc. (see below).

The Pennsylvania Patient Safety Authority reviewed its reports of serious events involving falls from 2005 to 2009 and found that falls accounted for 8% of reports from Radiology departments ([PPSA 2011a](#)). They note that the interventions put in place on inpatient units to prevent falls may not be replicated in patients transported to Radiology.

They found four themes that occurred in over half the reports of falls in Radiology: syncope, slips/trips/loss of balance, falls from stretchers or tables or stools, and medication-related events.

Cases involving **syncope or near-syncope** accounted for 17% of reports. One factor implicated in some falls in Radiology is fasting. They may have been fasting in preparation for a procedure. In addition, other preparations for some procedures (eg. barium enema) may lead to hypovolemia, predisposing patients to orthostatic hypotension. Remember, some of the studies being done in Radiology require the patient to stand still in the upright position, promoting orthostatic hypotension in vulnerable patients. Others go from a supine position on a table or cart to the upright position for transfer, similarly promoting orthostatic hypotension. And many patients are on medications that have orthostatic hypotension as a side effect.

15% of their Radiology falls involved **slips, trips or loss of balance**. They note both use of walking aids (eg. canes, walkers) and failure to use walking aids contributed to falls. They note that patients are often left unattended in some areas of Radiology prone to falls, such as bathrooms, dressing rooms, and waiting areas. They also noted that patients' clothing or footwear might become entangled with a variety of equipment and other obstacles in Radiology.

Stretchers and tables are also commonly implicated (12% of reports). Patients may fall from transport vehicles or from tables and chairs being utilized for imaging studies. They

note that sometimes patients on gurneys or stretchers with siderails will crawl down to the end of the gurney, resulting in tipping the gurney over and falling.

Medications, particularly those likely to impair mentation (eg. opiates and benzodiazepines), were also commonly implicated in falls in Radiology. Sometimes the medication was even given in Radiology (eg. sedation given for claustrophobia before an MRI).

The PPSA study notes that Radiology staff often do not participate in the falls risk training that inpatient staff participate in. So they recommend educational and inservice interventions for all Radiology staff to promote awareness of fall risk and measures to reduce that risk. Transport personnel should be included in such training. Formal fall risk assessments should be done on patients in Radiology. Whereas many inpatients have had a fall risk assessment prior to going to Radiology, those coming from the emergency department typically have not yet had a formal fall risk assessment. Nor do most outpatients coming to Radiology for imaging studies have fall risk assessments. The Pennsylvania Patient Safety Authority has an excellent radiology falls risk assessment tool ([PPSA 2011b](#)). They also note the importance of involving patients and family in increasing awareness of fall risk. Displaying a poster (eg. “Are you at risk for falling?”) in the waiting area is one recommendation. We’ve previously noted the importance of communicating fall risk in handoffs, particularly on the “Ticket to Ride” tool often used for patients transported to Radiology. The PPSA echoes that strategy. Remember also that patient transport is bidirectional. After a patient has finished in Radiology there should be appropriate communication back to the destination unit.

Environmental conditions obviously must be dealt with to minimize falls. Many corridors in Radiology suites become cluttered with equipment, transport vehicles, chairs, etc. Careful attention must be paid to floor surfaces, rugs, and steps that may lead to patients tripping and falling. Also floors may become slippery due to fluid leaks from IV’s, incontinent patients, moisture brought in from outside on boots and shoes, and other sources. We always look for such conditions when we do Patient Safety Walk Rounds. But such walk rounds should become a daily exercise for staff in the Radiology suite itself. Just as with falls on inpatient units, many falls in Radiology occur in relation to patients using bathrooms so special attention must be paid to them on such rounds. But just as important is ensuring that there is staff available to help patients in Radiology use the bathroom when necessary. Ensuring adequate lighting is also essential.

One frequently overlooked risk factor is footwear. While we usually supply non-slip footwear for inpatients whom we identify as being at high risk for falls, outpatients or ER patients are more likely to be in socks or stockings that might promote falls.

Medication Errors

Our October 16, 2007 Patient Safety Tip of the Week “[Radiology as a Site at High-Risk for Medication Errors](#)” highlighted a United States Pharmacopeia (USP) MEDMARX®

Data Report “A Chartbook of 2000–2004 Findings from Intensive Care Units and Radiological Services” ([USP 2006](#)). Though the overall number of medication errors in radiology areas was small, USP pointed out that the percentage of cases resulting in patient harm was considerably higher than seen with medication errors elsewhere. 12% of the medication errors in these areas were considered harmful to patients, about 7 times higher than the percentage in the overall MEDMARX® database. Using the Pareto principle, almost 80% of the errors fell into 4 types of error: improper dose/quantity, unauthorized/wrong drug, omission error, and wrong administration technique.

Many of the errors were attributable to problems outside the radiology department or had root causes outside the radiology department. This draws attention to a whole host of system issues that interplay to result in errors that happen to manifest themselves while a patient is in the radiology suite. Our July 31, 2007 Tip of the Week “[Dangers of Neuromuscular Blocking Agents](#)” gave an example of an incident where an emergency room resident inadvertently administered a neuromuscular blocking agent to a patient he had accompanied to the radiology suite for a CT scan. Obviously, that had little to do with “radiology” per se but does draw attention to potential high risk situations.

Below are some of the issues, conditions, and circumstances pertaining to radiology areas that may predispose patients to suffer medication (or other) errors:

- Patients often need to wait for tests or wait for transport back to their unit of origin. We have seen numerous examples of patients deteriorating while waiting for a procedure or waiting to be transported back after a procedure.
- Nursing care differs from ICU.
While most radiology departments in large hospitals do have nursing staff dedicated to the radiology area, they may not have the same expertise or skill set that a nurse from an ICU might have. The nurse:patient ratio is usually not what one would have in the ICU. And even when a nurse from the ICU accompanies the patient to the radiology suite, that nurse may be unfamiliar with where medications or equipment are stored in the radiology department.
- Lack of access to current medication lists, allergy lists, etc.
While the patient’s chart usually accompanies him/her to the radiology suite, some important documents (eg. the MAR or medication administration record) may not.
- The patient may be unable to give information and those who could answer questions are not available. The patient may have impaired cognition or impaired level of consciousness. He/she may have been pre-medicated prior to coming to radiology or may have received conscious sedation for a procedure. Typically (at least for an inpatient) a family member or caregiver or the housestaff, individuals who could provide vital information about a patient, may not be present in the radiology suite or otherwise readily available.
- The patients may be incredibly sick and have very complex medical problems, both of which are known to be associated with an increased likelihood of errors
- Sedation of patients for some procedures may have an additive effect to other medications (eg. narcotic analgesics) that a patient may be receiving.

- Some of the hi-tech patient safety technologies available elsewhere in a hospital may be unavailable or underutilized in radiology. This might include things like and electronic medical record (EMR), barcoding, electronic MAR, etc.
- Patients may arrive with multiple lines and tubes.
Not only does this predispose to the rare occurrence of catheter misconnections, but often an IV must be temporarily discontinued and then there may be confusion as to how to restart that IV (especially for medications like anticoagulants).
- Diabetic patients may represent specific problems. Particularly when a patient needs to spend a prolonged time in radiology, there may be confusion about insulin administration, meals, etc.
- Medications, supplies, equipment may have come from somewhere else.
Particularly when medications have been brought with the patient from some other area of the hospital, there is often suboptimal documentation of dosage, time given, etc.
- Personnel in radiology may be unfamiliar with equipment. This may apply to items like infusion pumps. Often a hospital has pumps made by different manufacturers or different models used in different units of the hospital. Personnel in the radiology suite may not have experience with that particular model.
- Inadequate clinical information.
The bane of the radiologist's existence is the requisition lacking sufficient clinical information. How often does a requisition for an X-ray of the hip come down with "stroke" as the only clinical information! The radiologist needs to know what specifically is being looked for and other clinical information so that he/she knows what is the most appropriate study and can better interpret the result of the study.
- Key people to communicate results to may not be readily available. The communication problem on the back end is as important as on the front end. We have talked in previous Tips of the Week about communication of critical reports back to physicians responsible for the care of the patient.
- Time pressures.
The time pressures to move patients through the radiology suite and accommodate not only inpatients but also outpatients and unscheduled cases can be enormous. Add to this staffing issues, particularly around nights and weekends and holidays. And financial pressures (eg. cost issues that lead to use of less expensive contrast agents in many patients).

Medication reconciliation and communication issues are two of the most important issues giving rise to medication errors in any setting, and from the above you can see that the radiology suite is no different. An article in the April 2006 American College of Physicians *Observer*, "Imaging hand-offs: Tips to help prevent medication errors" ([Darves 2006](#)) describes what the internist (or any physician with primary patient responsibility) can do to reduce the likelihood of medication errors relating to the radiology suite. In particular, that article addresses some of the issues related to interactions between certain medications and contrast agents (either directly or indirectly

through effects on renal function). The importance of communication and defining roles (eg. who is responsible for followup actions) is stressed.

There are, of course, issues specific to radiology as well. These often pertain to use of contrast agents. This is especially likely to occur when there is inadequate information about previous allergies or renal function. There have also been numerous cases where the wrong type or wrong dosage of a contrast agent has been injected during myelography with disastrous results, often because of inadequate labeling or storage. And the issue of unlabeled syringes or basins is as big an issue in radiology as it is in the OR. Many remember an unfortunate case a few years ago where a patient was inadvertently given the antiseptic skin prep solution, chlorhexidine, instead of contrast media intraarterially ([ISMP 2004](#)).

The second major study on medication errors in Radiology comes from the Pennsylvania Patient Safety Authority ([PPSA 2009](#)). They reviewed almost 1000 reports of medication errors from Radiology services over a 5-year period. Errors related to contrast agents or other agents used for imaging studies accounted for only about a quarter of the events. Rather, the vast majority of medication errors were related to drugs that are used throughout the hospital. Moreover, many of the leading drugs involved were high-alert medications, like insulin, opioids, and anticoagulants. Some involved moderate sedation being used for the imaging procedure. The most common error types were wrong drug, dose omission, wrong dose or overdose, and wrong rate. Drug omissions were particularly problematic. They cite examples of infusions of insulin or heparin that were stopped for prolonged periods while the patient was in Radiology leading to untoward consequences. Almost 11% of reports involved problems with infusion pumps or IV lines. They also noted errors related to patient information, with lack of concurrent information about medications, lab values, patient weights, etc.

PPSA suggested several strategies to reduce the risk of medication errors in Radiology including:

- Review the medication use processes in Radiology
- Patient care units sending patients to Radiology should carefully and proactively address the plan of care for the patient while in Radiology, recognizing the possibility any infusions may need to be stopped and how the therapy might be affected by the length of the procedure in Radiology
- Have nurses specifically dedicated to Radiology or have nurses accompany the patient to Radiology, particularly if they are on an infusion with a high-alert medication
- Involve radiology staff in training and competency evaluation and keep all in the loop regarding medication safety issues

Because of the frequency of medication errors in Radiology and fact that the errors often involve high-alert medications and seriously ill patients, this is probably the patient safety consideration in Radiology that merits the most attention.

Wrong Patient, Wrong Site, Wrong Test, etc.

As we've often mentioned, over 50% of "wrong-site, wrong-patient, wrong-procedure" events occur outside the OR. In our December 6, 2010 Patient Safety Tip of the Week "[More Tips to Prevent Wrong-Site Surgery](#)" we noted a study ([Stahel 2010](#)) highlighting the continued occurrence of wrong-patient and wrong-site occurrences. Such occurrences also happened in Radiology or Radiation Oncology settings. That study highlights the importance of the "time-out" in multiple venues of patient care where correct identification of patients and clinical information is critical.

The Pennsylvania Patient Safety Authority ([PPSA 2011c](#)) found in its database 652 events in 2009 of wrong procedure or test (50%), wrong patient (30%), wrong side (15%), and wrong site (5%) events occurring in Radiology settings.

Incorrect orders or requisition entries were one of several root causes identified. As we've noted previously in our many columns on wrong-site events, information coming from physicians' offices may contribute to the problem. Given the volume of imaging studies ordered, this may be even more problematic for radiology than for surgery. Unfortunately, one problem we continue to see is that the orders or requisitions for imaging studies are often filled out by someone other than the physician (often a nonclinical person) and inaccurate information appears on the requisitions. This especially applies regarding the question about use of contrast. Other errors might include the type of study. The PPSA study noted that for mammography there were considerable errors in ordering screening vs. diagnostic mammograms. Also, since some imaging studies get ordered on paper requisitions (or simply on prescription forms) illegible handwriting remains a problem.

Failure to confirm patient identity is another major root cause. To comply with Joint Commission standards all facilities must use at least 2 forms of identification for all procedures, including imaging studies. Moreover, such identification must be active rather than passive. It is not acceptable to even ask a patient "Are you Mary Jones?". You must ask the patient to say their full name. Most facilities use the date of birth as the second form of identification so the patient should be asked to say their date of birth aloud. The PPSA study had numerous examples of the wrong patient responding to a call in the waiting room and subsequently getting the wrong study. There were also examples of transport services bringing the wrong patient but the correct chart to the Radiology suite. Especially problematic are cases where the room of a patient has changed and someone wrongly assumes they have the original patient (remember, Joint Commission does not allow room number or location to be an identifying item). Also, don't forget that it is common to have names that sound alike or even names that are identical.

Failure to follow site and procedure verification or procedure qualification processes was the other major root cause in the PPSA study. One error we've previously mentioned for wrong-site procedures is actually being misled by the patient. The PPSA study had

examples of a radiology technologist listening to the patient's symptoms and thinking the exam was for a specific body part when, in fact, the physician was interested in an exam of a totally different body part. But this category also included inadequate screening (for instance failure to screen for implants, etc. before an MRI, failure to screen for pregnancy, failure to look for renal dysfunction prior to use of contrast, etc.).

PPSA notes that failed communication really contributes to all three of the above root causes and notes the need for programs that improve communication, team work and safety culture. But they also note the importance of using the Joint Commission Universal Protocol for imaging procedures and actually provide a nice Radiology Services Patient and Procedure Identification Assessment tool ([PPSA 2011d](#)) to help. The paper also provides multiple other strategies you should consider.

We'd also like to mention that use of patient photographs may have a valuable role, not only in avoiding wrong patient issues but also in improving radiologists' interpretation of images. See our April 30, 2013 Patient Safety Tip of the Week "[Photographic Identification to Prevent Errors](#)" for examples of use of patient photographs to identify wrong-patient cases in radiology.

Later in today's column we also mention two tools that are modifications of the WHO Surgical Safety Checklist, modified for interventional radiological procedures. The WHO Surgical Safety Checklist: for Radiological Interventions ONLY checklist is downloadable [here](#). A second safety checklist for interventional radiological procedures, modeled after the WHO Surgical Safety Checklist, appears in a recent article by Canadian radiologists ([Athreya 2013](#)).

Moderate/Conscious Sedation

Moderate sedation (also formerly known as conscious sedation) is utilized in many procedures performed in the Radiology suite or MRI suite. The physicians must be credentialed to do moderate sedation and the nursing staff have up-to-date competencies in moderate sedation. Appropriate equipment for resuscitation needs to be immediately available. Identification of patients at high risk (eg. those with COPD or sleep apnea or certain neuromuscular disorders) is important and an anesthesiologist's presence might be required for such patients. Monitoring of patients is crucial, particularly since different patients react differently to the same doses of various agents used in sedation. In addition to monitoring vital signs, level of consciousness, and pulse oximetry, there has been an increasing trend to also use capnography for monitoring.

But in addition to the procedure and moderate sedation itself, keep in mind that these patients may be at increased risk for falls for some time after the procedure.

Problems with oxygenation

Some seriously ill patients need imaging studies and many of these can only be done in the Radiology suite. Hence it's not uncommon to have patients on oxygen or even on mechanical ventilation in the Radiology suite. Unexpected extubations may occur in Radiology. We've also mentioned previously that "[Ticket to Ride](#)" handoff tools arose primarily because previous studies showed that half of ICU patients transported to Radiology ran out of oxygen at some point.

The old literature also cites instances where wall-mounted gas lines were transposed. However, we expect that all facilities have addressed the issue and taken steps to prevent inadvertent misconnection to wall-mounted gas sockets.

IV errors

We discussed many errors related to IV lines in the section above on medication errors. These include things like stopping IV infusions for a procedure and forgetting to restart them, misprogramming of infusion pumps, patients getting the wrong drugs, etc.

But the PPSA study on medication errors in Radiology also notes tubing misconnection errors. They describe one case where contrast and saline were injected into a tracheostomy cuff rather than an IV line (the connectors apparently looked similar).

Suicides in the Radiology Suite

We have previously done several columns on preventing suicides in hospitals:

- January 6, 2009 "[Preventing Inpatient Suicides](#)"
- February 9, 2010 "[More on Preventing Inpatient Suicides](#)"
- December 2010 "[Joint Commission Sentinel Event Alert on Suicide Risk Outside Psych Units](#)"

We encourage you to read those columns since they have many practical considerations. You need to be especially cognizant of the risks when patients go elsewhere in your facility. An [AHRQ WebM&M Case & Commentary](#) several years ago noted a **suicide attempt occurred in a bathroom in the radiology suite**. We wonder how many hospitals would have inspected that bathroom for potential suicide risk. We've done that in several hospitals and uniformly found that not only do those bathrooms have numerous "loopable" items that could be used for hanging but also that they can be locked from the inside and there is typically no one readily available with a key to get in. In fact, that is one of the items we added to our patient safety scavenger hunt list (see our March 16, 2010 Patient Safety Tip of the Week "[A Patient Safety Scavenger Hunt](#)"). Bathrooms on non-psychiatric floors may be especially problem prone. Not only are they seldom assessed for tools and implements that could be used for suicide, but some also allow the door to be locked from the inside. So observation protocols for potentially suicidal patients on such units should ensure that doors are not locked (or, if they can be locked,

that the “observer” has keys to access the bathroom). Having observers of the same gender as the patient also is recommended.

Communication of suicide risk to all parties is particularly important during transports within the hospital (such as going to the radiology suite). Your “[Ticket to Ride](#)” handoff tool for hospital transports should also be used to properly prepare for potentially suicidal patients.

Some patients may come to Radiology with a known suicide risk. But sometimes patients may present first to Radiology for a procedure and staff there may identify the patient as being at risk for suicide. Radiology staff therefore need to be aware of identifying patients at risk for suicide and know what interventions to take. A recent article ([Penzias 2013](#)) and a related [story board](#) are good resources to review on this issue.

Infection Risks

Some procedures done in the Radiology suite (invasive procedures, insertion of catheters, etc.) must be done under sterile conditions and require good technique and adherence to good practices such as, for example, use of the central line insertion checklist.

But the Radiology suite is visited regularly by patients with all sorts of infectious illnesses, many with multidrug-resistant organisms. In addition, we are seeing more and more MRSA and C. diff infections in the community so outpatients with these infections are also visiting the Radiology suite.

So not only is strict adherence to hand hygiene guidelines important but you need to be working with your infection control personnel to ensure that other appropriate precautions are taken and that equipment, examination tables, etc. get appropriate disinfection.

Pregnancy

One special consideration for Radiology departments is the issue of potential exposure of a fetus to ionizing radiation. As such Radiology services always inquire about the possibility of pregnancy before doing tests that utilize ionizing radiation unless the situation is a life-and-death emergency.

Nevertheless, the issue is a very complex one. The potential benefits of the procedure must be balanced against the potential risks in all cases. Also, the potential use of alternative imaging modalities that do not use ionizing radiation (eg. ultrasound, MRI) instead must be considered in each case.

Unfortunately, there is no hard and fast standard today about how to screen for possible pregnancy. While almost all facilities ask females of child-bearing age about the possibility of pregnancy and/or timing of their last menstrual period, we've all seen cases where that information did not correctly identify a pregnancy. In fact, no method of screening is likely to be 100% predictive.

The American College of Radiology and the Society for Pediatric Radiology have recently revised their guideline regarding use of ionizing radiation in pregnant or potentially pregnant women and adolescents ([ACR 2013](#)). We encourage you to read it since the issues are too complicated to be summarized here. There are some imaging studies that run a very low risk of potential harm to the fetus and might be done even if pregnancy is known and the woman is likely to benefit from the study. Others, that are likely to expose a fetus to higher doses of ionizing radiation (eg. fluoroscopy of the pelvis, CT scan of the abdomen/pelvis, etc.), would require closer examination of the potential risks and benefits. Many facilities might require a formal pregnancy test before doing those studies in a woman who might be pregnant. The ACR-SPR guideline does not specify or mandate such as a formal standard. However, it does recommend that all facilities specify in their policies which procedures require a pregnancy test in normal circumstances.

Pressure-Related Injuries

Because patients may be in the Radiology suite for prolonged periods (either for prolonged procedures or simply waiting for a procedure or for transport) some may become vulnerable to pressure-related injuries (eg. decubiti, compressive neuropathies) if attention is not paid to repositioning. There should always be a plan in place for overall nursing care of any patient sent to the Radiology area.

Patients Deteriorating During Prolonged Waits in Radiology

Patients often need to wait for tests or wait for transport back to their unit of origin. We have seen numerous examples of patients deteriorating while waiting for a procedure or waiting to be transported back after a procedure. Sometimes this is related to omission of critical medications like insulin or anticoagulants or antibiotics (see the section above on medication errors in the Radiology suite). Other times it may be related to inadequate monitoring (eg. patients on PCA or opioids via other routes).

Our March 13, 2012 Patient Safety Tip of the Week "[Medical Emergency Team Calls to Radiology](#)" highlighted a series of papers by Lora K. Ott and colleagues ([Ott 2012](#), [Ott 2011a](#), [Ott 2011b](#)) on events in the Radiology suite that required medical emergency team calls. The nature of the events in the radiology suite were primarily cardiac in 41%, respiratory in 29%, and neurological in 25% and most required a higher level of care after the event. 44% of the calls involved patients undergoing CT scan and 22% MRI scanning. That should not be surprising, given our many prior articles on safety issues in

the radiology suite. During either procedure the patient is relatively isolated from monitoring staff for periods of time. In addition, sedation may be used to facilitate completion of some of those studies. Dislodging of catheters, tubes and lines during transfer to the CT/MRI platforms could also play a role. Also, the nature of the underlying condition necessitating the CT or MRI scan may also predispose these patients to the types of deterioration seen.

Transport of ICU patients to the radiology suite has for a long time been known to be hazardous. In our September 16, 2008 Patient Safety Tip of the Week “[More on Radiology as a High Risk Area](#)” we noted a paper by Smith et al ([Smith 1990](#)) which reported adverse events during 34% of all ICU transports. Specifically, transport of ICU patients to the CT suite was associated with a 71% incidence of adverse events. Adverse events included disconnection of monitoring equipment, interruption of vasoactive medication drips, unintentional extubations, etc.

So that brings us back to another of our favorite topics – **the handoff**. In our February 14, 2012 Patient Safety Tip of the Week “[Handoffs – More Than Battle of the Mnemonics](#)” we discussed how the structure and format of handoffs needs to be tailored to the specific situation. The “**Ticket to Ride**” concept (see our Patient Safety Tips of the Week for April 8, 2008 “[Oxygen as a Medication](#)” and November 18, 2008 “[Ticket to Ride: Checklist, Form, or Decision Scorecard?](#)”) is a tool ideally suited for the radiology suite. It was originally developed for patients on oxygen therapy needing transport to radiology since studies had shown over 50% of such transports resulted in patients running out of oxygen. However, this concept addressing handoffs has been expanded to include attention to medication management, suicide risk, wandering risk, etc. in patients transported to radiology or other sites within the hospital. Our March 13, 2012 Patient Safety Tip of the Week “[Medical Emergency Team Calls to Radiology](#)” has some good suggestions about what should be included in your “Ticket to Ride” transport handoff tool.

This really fits into the concept of having a well thought out plan before sending patients to the Radiology suite. We must anticipate what sorts of problems the patients might encounter and take steps to mitigate the risks of those problems.

Contrast-Related Events

There are, of course, issues specific to radiology as well. These often pertain to use of contrast agents. This is especially likely to occur when there is inadequate information about previous allergies or renal function. Sometimes patients cannot provide the information about their other medications (eg. metformin) or whether they have an allergy to contrast, or whether they have impaired renal function. Hence it is critical to review the medical record for these issues and appropriately assess labs to ensure that results of current tests of renal function are available.

There have also been numerous cases where the wrong type or wrong dosage of a contrast agent has been injected during myelography with disastrous results, often because of inadequate labeling or storage. And we noted above the issue of unlabeled syringes or basins is as big an issue in radiology as it is in the OR such as the unfortunate case a few years ago where a patient was inadvertently given the antiseptic skin prep solution, chlorhexidine, instead of contrast media intraarterially ([ISMP 2004](#)).

Mishandling or Mislabeling of Specimens

More and more biopsy and tissue specimens are coming from the Radiology suite rather than the OR these days. Such specimens are prone to a variety of errors in mishandling, mislabeling, switched specimens, or simply lost specimens. For insight into some of the issues around such errors see some of our other columns on errors related to laboratory studies:

- October 9, 2007 [“Errors in the Laboratory”](#)
- November 16, 2010 [“Lost Lab Specimens”](#)
- October 11, 2011 [“LEAN in the Lab”](#)
- March 6, 2012 [““Lab” Error”](#)
- April 2012 [“Specimen Labeling Errors”](#)

MRI Safety

Safety in the MRI unit is a whole topic unto its own. We refer you to our prior columns on patient safety issues related to MRI:

- February 19, 2008 [“MRI Safety”](#)
- March 17, 2009 [“More on MRI Safety”](#)
- October 2008 [“Preventing Infection in MRI”](#)
- March 2009 [“Risk of Burns during MRI Scans from Transdermal Drug Patches”](#)
- February 1, 2011 [“MRI Safety Audit”](#)
- October 25, 2011 [“Renewed Focus on MRI Safety”](#)
- August 2012 [“Newest MRI Hazard: Ingested Magnets”](#)

The only additional recent study related to MRI safety we’d like to note is one that used a ferromagnetic detection system to detect implants and other objects ([Shellock 2013](#)). This system has the potential to be used in screening of patients prior to MRI.

Radiation Hazard to Patients

Though not the focus of today’s column, we have done numerous columns on the issues related to the safety hazards of ionizing radiation (see the list at the end of today’s

column). But there have been several recent developments regarding reducing the dose of ionizing radiation and thus reducing the potential downstream risk of cancer. Researchers at Johns Hopkins ([Pindrik 2013](#)) found that limited-sequence head CT scanning provided adequate and accurate diagnostic information in children with shunted hydrocephalus. They were able to demonstrate that consistent sequences of 7 CT slices (instead of the typical 30-40 slices taken) were able to demonstrate the diagnostic information needed. This resulted in a 92% reduction of radiation dose. Use of this type of thinking should be applied to many other CT procedures to determine how many and which slices are necessary for adequate diagnosis.

Another paper ([John 2013](#)) reported on a checklist for pediatric digital radiography safety as part of the Image Gently® campaign. The checklist was developed to help radiology technologists obtain digital radiographs with patient safety in mind. Today not only CT scanning but most imaging uses digital techniques. With digital techniques radiology technologists no longer have the ability to visually determine whether there was overexposure or underexposure like they could in the old film screen world. New grads may be familiar with the new image technologies but older technologists may not. So the checklist and companion educational tools were developed and piloted. The actual checklist is included in the article or is separately downloadable from the Image Gently® website. The latter has great resources on its [Image Gently and Digital Radiography - Quality Improvement](#) page, including links to the [Digital Radiography Safety Checklist](#) itself and the [implementation manual](#). The checklist can also be used as a quality improvement audit tool. The Image Gently® website also has a downloadable [spreadsheet tool for data collection](#) to be used in your quality improvement activities. Note that the John paper also has a good discussion on checklist design (do-and-verify vs. read-and-do, keep it short, include only critical steps, etc.).

Our June 2010 What's New in the Patient Safety World column "[WHO Checklist for Radiological Interventions](#)" highlighted a checklist developed specifically for radiological interventions. That WHO Surgical Safety Checklist: for Radiological Interventions ONLY checklist is downloadable [here](#). Meanwhile, a group of Canadian interventional radiologists ([Athreya 2013](#)) developed their own safety checklist for interventional radiological procedures, modeled after the WHO Surgical Safety Checklist. Note that their checklist also includes items that the ward to which the patient is being transferred has been notified and that aftercare instructions have been communicated to the patient. The checklist is scanned into the medical record after the procedure and can be utilized for quality improvement audits as well. They note the importance of regular review and revision of the tool. Such review led to a revision that made review of any prior imaging necessary (note our Patient Safety Tips of the Week for August 27, 2013 "[Lessons on Wrong-Site Surgery](#)" and January 1, 2013 "[Don't Throw Away Those View Boxes Yet](#)" discussed the importance of reviewing imaging studies in avoiding wrong site surgery).

On the adult side, Image Wisely® has begun to present the [Image Wisely Radiation Safety Case](#), a series of free online and mobile-compatible educational offerings in

conjunction with the American College of Radiology (ACR). They plan to run six radiation safety cases over a year.

Also, this month's [AHRQ Web M&M](#) has two columns pertinent to the issues of balancing risks vs. benefits when considering diagnostic imaging that uses ionizing radiation. One is an excellent interview ([Wachter 2013](#)) with Rebecca Smith-Bindman, MD, whose work on reducing unnecessary exposure to ionizing radiation we have mentioned in several of our prior columns. The other is a perspective by Italian radiologist Antonio Pinto ([Pinto 2013](#))

We bet you never thought what a potentially dangerous area the Radiology suite can be! The Radiology suite is a great place to include in your Patient Safety Walk Rounds and an excellent place to choose for doing a FMEA (Failure Mode and Effects Analysis) exercise.

Some of our prior columns on patient safety issues in the radiology suite:

- October 16, 2007 “[Radiology as a Site at High-Risk for Medication Errors](#)”
- September 16, 2008 “[More on Radiology as a High Risk Area](#)”
- October 7, 2008 “[Lessons from Falls....from Rehab Medicine](#)”
- January 2010 “[Falls in the Radiology Suite](#)”
- August 2010 “[Sedation Costs for Pediatric MRI](#)”
- January 25, 2011 “[Procedural Sedation in Children](#)”
- February 19, 2008 “[MRI Safety](#)”
- March 17, 2009 “[More on MRI Safety](#)”
- October 2008 “[Preventing Infection in MRI](#)”
- March 2009 “[Risk of Burns during MRI Scans from Transdermal Drug Patches](#)”
- February 1, 2011 “[MRI Safety Audit](#)”
- October 25, 2011 “[Renewed Focus on MRI Safety](#)”
- March 13, 2012 “[Medical Emergency Team Calls to Radiology](#)”
- August 2012 “[Newest MRI Hazard: Ingested Magnets](#)”

Some of our prior columns on the “Ticket to Ride” concept:

- April 8, 2008 “[Oxygen as a Medication](#)”
- November 18, 2008 “[Ticket to Ride: Checklist, Form, or Decision Scorecard?](#)”

Some of our previous columns on the issue of radiation risk:

- February 2, 2010 “[The Hazards of Radiation](#)”
- November 23, 2010 “[Focus on Cumulative Radiation Exposure](#)”
- March 2010 “[More on Radiation Safety](#)”
- June 2011 “[Progress in Reducing Radiation from CT Scans](#)”
- April 2013 “[Radiation Risk of CT Scans: Debate Continues](#)”
- June 4, 2013 “[Reducing Unnecessary CT Scans](#)”
- July 2013 “[More on the CT/Cancer Debate](#)”

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