The Centers for Medicare and Medicaid Services (CMS) restructured reimbursement rates for healthcare facilities by adding patient safety as an additional measure to the payment formula. All reimbursement changes are reflected in the National Patient Safety Goals (NPSGs) issued annually by The Joint Commission. Specifically, NPSGs identify areas that need improvement and provide building blocks on how to make those improvements a priority within a healthcare organization. Improving handoff communication, patient identification, and medication administration procedures were some of the improvement goals highlighted in 2014.

Effective handoff communication, proper patient identification, and accurate contrast media administration are all major patient safety concerns in medical imaging departments. New technologies are available to improve staff communication such as electronic medical records (EMRs) and computer provider order entry systems (CPOEs). These technologies are important during patient transfer from one caregiver to another. The use of radiofrequency identification (RFID) and bar code identification procedures assists in the decline in the number of wrong patient-wrong procedure occurrences. Technologists must be knowledgeable and well-informed of the precautions and protocols in place regarding contrast media administration. This review examines the current literature regarding improvements in handoff communication, patient identification, and contrast media administration procedures in the medical imaging department.

Methods

Multiple journal archives and electronic databases were used to search the subject area of patient safety in the medical imaging department including CINHAL, European Journal of Radiology, Journal of Medical Imaging and Radiologic Sciences, and Journal of American College of Radiology. The searches were limited to academic, peer-reviewed journal articles published since 2008. The keywords used in the searches were handoff communication, medication safety, patient safety, contrast safety, radiofrequency identification (RFID), and patient identification. The searches yielded multiple articles, but 25 were selected because they were the most appropriate matches for the topic.
Effective Communication

Patients move through multiple departments in a healthcare facility for a variety of clinical testing. During this process, patients are susceptible to errors and complications considering breakdowns in communication. The Joint Commission’s 2014 survey on root causes for sentinel events listed communication as one of the top reasons for medical mishaps.

Handoff Communication

Handoff communication is defined as the process of passing complete and accurate patient-specific information from one caregiver to another. During handoff communication, important information must be transferred to the receiving personnel to ensure patient safety and continuum of adequate care.

Patient traffic through imaging services has expanded with the increase in numbers and complexity of diagnostic imaging procedures ordered. This increase in patient traffic exposes patients to an increase in medical errors. Errors that occurred in imaging services were estimated to be approximately 11% and involved areas of examination requests, patient identification, image acquisition, radiological reports, and communication with the treating team. There are different protocols for identifying and relaying important patient information. Some protocols examined were situation, background, assessment, and recommendations (SBAR) and introduction, patient, assessment, situation, safety concerns, background, actions, timing, ownership, and next (I PASS the BATON). Use of these standardized tools and other identification protocols and procedures help to inhibit handoff errors.

To have a unified system in place, effective communication and simplicity is key. Integration of handoff communication protocols needs to be simple, effective, and tailored to different personnel. Effective handoff communication can lead to behavior change, but more importantly, it can convey critical information and ultimately save lives.

The Joint Commission’s 2014 survey on root causes for sentinel events listed communication as one of the top reasons for medical mishaps.

This action creates a stronger personal responsibility for healthcare workers at their facilities. However, the processes in place to safeguard patients against breakdown in communication are only effective if they are implemented and utilized at all times.

EMR

The EMR is a digital version of a patient’s chart that contains the medical and treatment history and supports hospital wide patient care communication. The use of the EMR directly aids practitioners in making clinical decisions. The information recorded in the EMR is available immediately and makes treatment plans easier to generate and track a patient’s progress. In one study, during the implementation phase, it was discovered that having too many features in an EMR did not ease the use of the system, but rather increased its difficulty. Collaboration among departments is needed to have a successful implementation of an EMR. One study found a direct correlation with ease of the EMR use with computer efficiency. Those participants that had lower computer efficiency were more reluctant to learn the system. Education and collaboration between departments, allied health professionals, and administrators were important components to the success of an EMR implementation.

CPOE

CPOE systems allow physicians to order exams and medications by computer without written documentation of the order. These systems have been implemented at hospitals nationwide, and CPOEs have improved healthcare communication. CPOE systems were a benefit to hospitals by reducing medication errors because of increased legibility of orders and less reliability of second hand interpretation of a verbal order. Although the use of a CPOE system decreased medical errors approximately 12.5%, only 42.4% of responding hospitals with CPOE systems reported using it for all orders. As technology increases integration of the medical continuum of care, patient safety and medication safety improves.

The potential for HIPAA violations and external information leaks can increase when implementing a CPOE system if proper security measures are not in place. Web security and firewall installation are extremely important to protect online patient information. Internal breach of security is the most common information breach. Explanations for employees violating web security were listed as accidental authorization and employees with limited authorization gaining additional access. Outside entities may also try to gain access to a hospital’s IT infrastructure, but they have to go through the security firewall to access information. These entities include hackers, spies, terrorists, co-intruders, and professional criminals. There are multiple areas of online patient access including PACS, nursing information system (NIS), laboratory information system (LIS), radiology information systems (RIS), and pharmacy information system (PIS). These are all information systems that need software to protect encrypted information from outside sources, and patient information needs to be protected from internal threats to privacy and confidentiality.

Proper Patient Identification

NPSGs for 2014 listed patient identification as a goal for improvement. These include name, date of birth, addresses, or any other information specific to the patient.
Wristbands
An important area of concern is proper patient identification. One study demonstrated lack of patient identification in multiple healthcare facilities. This study was implemented to see if there was improved patient identification after the use of wristbands as a form of identification. Approximately 34% of patients were not arm banded and only one in six was asked to confirm their name. Wrong patient–wrong procedure had a high occurrence because of the lack of identification. During the study, it was difficult to change the culture where wristbands were not used and also difficult to implement policy changes. It was also demonstrated that 11% of diagnostic errors were in imaging areas, and these errors resulted from lack of identification and verification at first contact with the patient.

RFID
New technology aids in proper patient identification. RFID is a patient traceability system that minimizes the occurrence of adverse events by the unequivocal identification of the patient. RFID has been used in different specialty areas since its development in the 1940s to track allied planes. Currently, it is used in the medical setting to track personnel, supplies, and patients. The areas of improvement by using RFID include identification of medications, validation of medications, verification of right patient–right medication, and documentation of medication given. If RFID systems were allowed to communicate with hospital wide EMRs, wrong patient–wrong medication errors would be reduced drastically.

Bar Code Identification
One study described bar code identification to track blood transfusions and its effect on safety. During the implementation of this bar code identification system, it was found that near misses on blood transfusions increased while blood products administered to the wrong patient did not change. Another study also demonstrated increased reporting of near misses after the implementation of barcode usage, but they demonstrated a dramatic decrease in misidentification of lab specimens. Portable label printers and mobile carts were used so identification of blood specimens could be done bedside and labeled immediately after the lab draw. In the former study, an increase of incidents from one near miss transfusion to 34 near miss transfusions was reported after the implementation of the bar coding system. Of the 34 near misses, six would have caused an acute hemolytic transfusion reaction. The indication for increased identification of near misses was attributed to the bar coding system identifying mislabeled blood specimens automatically and did not rely on personnel reporting the incidents. There are many distractions that can occur to keep healthcare personnel from properly identifying a patient, and the use of a barcoding system helped to decrease these distractions and increase proper patient identification.

Adequate Medication/Contrast Media Administration
The two main types of contrast media used in imaging departments are iodinated and gadolinium-based contrast. Each type of contrast has its own safety hazards that imaging technologists must be aware. Iodinated media is commonly used in radiography, fluoroscopy, and CT. Gadolinium is used as an MRI contrast agent. Safety precautions prevent potential life threatening contrast reactions.

Contrast Induced Nephropathy (CIN)
Contrast induced nephropathy (CIN) or contrast induced acute kidney injury (CI-AKI) are results of kidney damage by contrast administration. CIN is associated with cardiovascular complications, extended hospital stays, and stages 4–5 renal disease. One study further characterized risk factors of CIN including diabetes mellitus, dehydration, age, contrast administration, choice of contrast, and number of studies conducted on patients in a designated amount of time. CIN was diagnosed in patients who had a rise in creatinine level by more than 25% within three days after their procedure with no other known pathology or etiology for the creatinine spike. The process to prevent CI-AKI varied from facility to facility, and the top facilities had a standardized treatment method before and after contrast agents were administered. Estimated glomerular filtration rate (eGFR) was used to determine kidney function prior to exams. One researcher studied two separate facilities’ pre- and post-procedure hydration. At one center, eGFR less than 60/ml/min/m² had a specific medication regime prior to the contrasted procedure. Normal saline was administered until sodium bicarbonate could be started one hour prior to exam. The sodium bicarbonate was continued after the exam for approximately six hours, and a 1200mg dose of N-acetylcysteine was administered before and after the procedure. The patient was also kept NPO for only four hours prior to the exam to prevent dehydration. The second center had a few differences in protocol for pre-medicating patients prior to contrasted studies than the first center. The patient was NPO for approximately two hours prior to the study, and only normal saline was administered prior to and after the exam. All other factors remained the same at both facilities. Both of these centers ranked below the national average in CI-AKI incidences. Administering sodium bicarbonate prior to contrasted studies diminished the occurrence of CI-AKI.

Nephrogenic Systemic Fibrosis (NSF)
Gadolinium-based contrast agents (gdbca) are used in MRI imaging. These contrast agents were initially deemed safe for patients in end stage 4–5 kidney failure. In 2006, the FDA issued warnings regarding gdbca and the associated development of nephrogenic systemic fibrosis (NSF). The FDA mandated warnings be issued on all gdbcas. NSF affects the
joints, skin, internal organs, but has not affected the face. There is no treatment for NSF. However, research demonstrated NSF conditions improved with renal transplant. Dialysis did not decrease the risk of developing NSF. In one study, NSF had yet to be discovered in patients with stages 3 and 4 kidney disease. Several researchers agreed NSF was limited to patients in stage 5 kidney disease or patients with acute kidney injuries.

Consideration for administration of gdbca must be conducted on each patient. Radiologists and technologists must be aware of risk factors that are closely associated with development of NSF. Patients in stage 5 renal disease are most at risk. Researchers also agreed patients with stage 3 kidney disease did not develop NSF after gadolinium administration. Other factors for developing NSF include: patients 60 years and older, diabetes, lupus, history of renal disease, and multiple myeloma. Patient screening must be implemented to ensure at risk patients are identified prior to gadolinium administration, and eGFR clearance is established prior to gdbca administration.

**Conclusion**

Advances in healthcare have vastly improved patient life expectancy, but also put patients at risk during treatment. Updating policies and procedures throughout the entire hospital and healthcare setting is important to keeping patients safe. Imaging services have multiple areas with potential lethality if protocols and procedures are not followed. Effective handoff communication, proper patient identification, and safe contrast media administration are areas that should be addressed by radiology managers to ensure patient safety in the medical imaging department. Considering the recent NPSGs, these areas of concern should be constantly updated to ensure adequate patient care and safety in the medical imaging department.

**References**


Gwen Carrizales, MSRS, RT(R)(CT)(MR) has worked at Hillcrest Medical Center in Waco, Texas for twelve years. She has been a registered MRI technologist for eight years and has four years experience in CT. Her research interests are in patient safety, new MRI imaging technologies, and MRI interventional procedures.

Kevin R. Clark, EdD, RT(R), is an assistant professor in the department of radiologic sciences at Midwestern State University located in Wichita Falls, Texas. He teaches in the graduate and undergraduate programs at MSU. He has a BS in radiologic technology, MS in instructional technology, MA in teaching, and EdD in leadership and management.
Continuing Education

Implementing Protocols to Improve Patient Safety in the Medical Imaging Department

Home-Study Test

1.0 Category A credit • Expiration date 8-31-2017

Carefully read the following multiple choice questions and take the post-test at AHRA’s Online Institute (www.ahraonline.org/onlineinstitute)

QUESTIONS

Instructions: Choose the answer that is most correct.

1. All reimbursement changes are reflected in the:
   a. National Patient Safety Goals (NPSGs)
   b. United States Reimbursement Results (USRR)
   c. Nationwide Healthcare Money Management (NHMM)
   d. Domestic Funding Objectives (DFO)

2. Major patient safety concerns in medical imaging departments is/are:
   a. Effective handoff communication
   b. Proper patient identification
   c. Accurate contrast media administration
   d. All of the above

3. Assisting in the decline in the number of wrong patient-wrong procedure occurrences are the use of bar code identification and:
   a. Wireless Identification Transmission (WIT)
   b. Frequency Modulated Systems (FMS)
   c. Radiofrequency Identification (RFID)
   d. Electronic Wristband Detection (EWD)

4. Communication was listed as one of the top reasons for medical mishaps on The Joint Commissions survey in:
   a. 2011
   b. 2012
   c. 2013
   d. 2014

5. The process of passing complete and accurate patient-specific information from one caregiver to another is defined as:
   a. Direct Communication
   b. Handoff Communication
   c. Deliberate Communication
   d. Effective Communication

6. Errors that occurred in imaging services were estimated to be approximately:
   a. 11%
   b. 7%
   c. 23%
   d. 15%
7. For identifying and relaying important patient information there is/are:
   a. One protocol
   b. Different protocols
   c. No protocols
   d. Protocols yet to be released

8. A digital version of a patient’s chart that contains the medical and treatment history and supports hospital wide patient care communication is the:
   a. JEB
   b. SIS
   c. EMR
   d. LANE

9. In one study, during the implementation phase, it was discovered that having too many features in an EMR did not ease the use of the system, but rather increased its difficulty.
   a. True
   b. False

10. Although the use of a CPOE system decreased medical errors approximately 12.5%, the number of responding hospitals reported using CPOE systems for all orders was:
    a. 36.9%
    b. 42.4%
    c. 51.7%
    d. 29.8%

11. When implementing a CPOE system if proper security measures are not in place, the potential for HIPAA violations and external information leaks can:
    a. Remain stable
    b. Decrease
    c. Increase
    d. Has yet to be evaluated

12. External breaches of security include:
    a. Hackers and spies
    b. Terrorists
    c. Co-intruders and professional criminals
    d. All of the above

13. One study involving multiple healthcare facilities found 34% of patients were not arm banded and the number asked to confirm their name was:
    a. Two in five
    b. One in six
    c. Three in eight
    d. One in four

14. RFID is a patient traceability system that has been used in different specialty areas since its development in the:
    a. 1940s
    b. 1960s
    c. 1980s
    d. 2000s

15. There are ___ main types of contrast used in imaging departments.
    a. 5
    b. 4
    c. 3
    d. 2

16. Iodinated media is commonly used in:
    a. Radiography
    b. Fluoroscopy
    c. CT
    d. All of the above

17. Contrast induced nephropathy (CIN) or contrast induced acute kidney injury (CI-AKI) are results of kidney damage by contrast administration.
    a. True
    b. False

18. Administering sodium bicarbonate prior to contrast studies ______ the occurrence of CI-AKI.
    a. Increased
    b. Diminished
    c. Stabilized
    d. Had no consequence on

19. The FDA issued warnings regarding Gadolinium-based contrast agents (gbcas) and the associated development of nephrogenic systemic fibrosis (NSF) in:
    a. 2002
    b. 2004
    c. 2006
    d. 2008

20. Advances in healthcare have vastly improved patient life expectancy, but also put patients at risk:
    a. Post-treatment
    b. Pre-treatment
    c. During treatment
    d. There are no risks