Enhancing Patient Safety: Standardization of CT Contrast Media Practices

Prerna Kahlon, BDS, MPAH, CPHQa, Kathryn McCullough, MSa, G. Scott Gazelle, MD, MPH, PhDab

Large health care systems with varied hospital cultures, environments, and practices are continually challenged to provide safer and higher quality patient care. The authors describe their experience implementing uniform procedures for computed tomographic contrast media administration and the impact that standardization of these practices had on patient safety at a large integrated health care system.

Key Words: CT contrast media, CT contrast reactions, standardization, patient safety, electronic medical record

INTRODUCTION

In radiology departments with high daily volumes of computed tomographic (CT) examinations, a large number of outpatients are injected with intravenous (IV) contrast material. High patient volumes exacerbate the challenge of obtaining outside laboratory results or other information before scanning, which therefore increases the possibility of IV contrast being injected into a patient who is at increased risk for an adverse reaction [1]. The proper management of contrast requires knowledge of patient risk [2,3]. In addition, it requires standards for identifying, recording, and responding to those risks. In this way, variation in CT contrast policies and procedures can lead to variation in CT contrast media administration practices, resulting in decreased patient safety. The inability to track patients’ prior CT contrast reaction information can lead to the reoccurrence of CT contrast reactions, leading to decreased patient satisfaction and safety, in addition to increased costs associated with managing the reactions [4].

In this paper, we describe our experience implementing uniform procedures for CT contrast media administration and the impact of the standardization of these practices on patient safety at a large integrated health care system composed of 6 hospitals. Our systemwide CT contrast team (CCT) began this multiphase initiative in 2003 with the objective of enhancing patient safety by developing uniform policies and procedures for the use of contrast media in computed tomography throughout the network.

METHODS

The CCT began by examining existing practices using surveys, interviews, and site visits. They collected and compared the various screening tools used at each hospital for identifying patients at risk for contrast reactions before their examinations. Information was gathered on contrast media administration guidelines, including premedication regimens, drug interactions, and definitions and classification of contrast reactions. The team then examined how each site was documenting contrast reactions and communicating information about patients with histories of contrast reaction. From there, existing processes were flowcharted and failure points identified.

RESULTS

Analysis and Interpretation

Variation was observed in CT contrast policies and procedures. The majority of the institutions (83%) were using screening forms to identify risk for contrast reactions in patients, but all of these forms were different. No consistent contrast media administration guidelines were being followed. Only 50% of the hospitals were classifying contrast reactions according to the ACR’s classification.

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aDepartment of Radiology, Partners Healthcare System, Boston, Massachusetts.
bDepartment of Radiology and Institute for Technology Assessment, Massachusetts General Hospital, Boston, Massachusetts.

Corresponding author and reprints: G. Scott Gazelle, MD, MPH, PhD, 101 Merrimac Street, 10th Floor, Boston, MA 02114-4724; e-mail: scott@mgh-ita.org.

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There was no centralized repository to monitor and track rates of contrast reactions at any of the hospitals; however, ad hoc manual reports were available when required.

None of the 6 hospitals’ radiology departments were able to record CT contrast reaction information for new patients in our systemwide electronic medical record (EMR) or to successfully obtain historical information about CT contrast reactions from the EMR for returning patients. The inability to electronically track contrast reaction information across the system was a significant patient safety concern. It was felt that failure to achieve this objective was due to the technologists or nurses not having access to the EMR and a lack of a well-defined process to both enter and view prior contrast reaction information in the EMR.

**Strategy for Change**

The results of the assessment led to the formulation of standard CT contrast policies and procedures. The CCT first standardized CT contrast reaction definitions as per the ACR’s classification for contrast reactions [5]. The CT contrast media administration policy was also standardized. The team incorporated best practices from the individual hospitals’ policies, along with the ACR’s CT contrast media administration policy to develop a systemwide standardized CT contrast media administration policy. The policy addressed issues such as screening and classification of reactions, approaches for responding to contrast media–induced nephropathy, and special clinical circumstances, such as metformin therapy, diabetes, sickle-cell anemia, and pheochromocytoma.

Simultaneously, the CCT worked to develop a standard CT contrast IV patient questionnaire and an adverse drug event form. The CT contrast IV patient questionnaire targeted the issue of screening patients for risk for contrast reactions. It was used to screen patients’ histories of allergic and idiosyncratic reactions, premedication regimens, and current medications, especially the use of metformin and interleukin-2 therapy. In addition, the questionnaire asked for information concerning conditions such as kidney disease, diabetes, sickle-cell

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**Fig 1.** Proposed process. CPOE = computerized physician order entry; CT = computed tomographic; EMR = electronic medical record; IV = intravenous; PEAR = Partners Enterprise Allergy Repository; RIS = radiology information system.
anemia, pheochromocytoma, multiple myeloma, cardiac disease, and collagen vascular diseases such as lupus. For female patients, it also included questions related to pregnancy and breastfeeding. In this way, the CT contrast IV patient questionnaire was created as a useful resource to provide easy access to valuable information for assessing a patient’s risk for experiencing a CT contrast reaction.

The adverse drug event form was developed to facilitate consistent and reliable documentation of reactions. If a contrast reaction occurs, the adverse drug event form is used to document contrast reaction information. Details on the contrast agent used are documented, including the type of agent, lot number, concentration, amount of contrast injected, time administered, indication, and protocol. The type and severity of reaction, treatment provided in the radiology department, recommendation for future studies, and communication of this information are also specified in the adverse drug event form. Once drafted, both the CT contrast IV patient questionnaire and the adverse drug event form went through a rigorous review process and were presented to the forms committee at each hospital for final approval.

Concurrently, a CT contrast reaction monitoring dashboard was created and hosted on a password-protected Web site. The dashboard displays reactions by hospital, contrast type, total number of injections given, total number of reactions, and severity of reaction. Please refer to the online appendix to view a sample report from our CT contrast reaction monitoring dashboard.

In November 2005, the CCT started to work with the information technology department to get access to the EMR by outlining a standard process for documenting reactions and future retrieval of the same. Beginning in August 2006, the radiology departments received access to the EMR, which enabled the technologists and nurses to enter and check systemwide patient CT contrast reaction information (see Figure 2). A separate field was created in the allergy repository section of the EMR to document new or prior contrast reactions. Various signs and symptoms could also be checked off in this field, and free text could be entered in the comments section (see Figure 3). Technologists and nurses were trained on how to use this new field in the EMR. Workflow changes were then made in each radiology department to incorporate the new process. This step was especially valuable when a patient went from one hospital in the system to another;
the patient’s reaction information was retrievable via
EMR at any site in the system.

To monitor the efficacy of these process changes, the
CT contrast reaction monitoring dashboard was ex-
panded to track compliance with entering CT contrast
reactions into the EMR and categorizing CT contrast
reactions per the ACR’s CT contrast reaction classifica-
tions.

**Effects of Change**

The CT contrast media administration policy was ap-
proved by a networkwide quality and patient safety com-
mittee and is consistently being used as a guideline for
CT contrast media administration. The CT contrast IV
patient questionnaire and the adverse drug event form
were implemented at each hospital and are being used to
screen patients for risk for contrast reactions and for
documentation of reactions in conjunction with the
EMR. The CT contrast reaction monitoring dashboard
is updated and reviewed regularly to monitor compliance
and to identify opportunities for improvement.

The EMR training was well received. The implemen-
tation of the process was simple and successful, without
any roadblocks. Technologists, nurses, and in some cases
radiologists are able to view patients’ CT contrast reaction
information well before their examinations, thus
giving staff members a chance to contact the patients
about premedication, if required. In addition, if a new
patient has a reaction, hospital staff members are able to
record the information into the EMR, which is then
available for future visits.

**Next Steps**

Next steps are to further enhance the allergy repository
section of the EMR so that relevant contrast reaction
information is captured in a manner that is standardized
and auditable. Currently, much of the relevant contrast
reaction information, including the grade of the reaction,
must be tracked as free text in the comments section of
the EMR’s allergy repository. This approach does not
promote consistent, standardized entry of relevant CT
contrast reaction information. Furthermore, the infor-
mation is not easily auditable or analyzable. The team has
begun preliminary meetings with the information tech-
nology department and various stakeholder groups to
take the steps necessary to enhance the EMR allergy
repository to have more structured fields for consistent,
standardized, and auditable tracking of relevant contrast
reaction information.

Once these EMR enhancements have been made, the
next step is to integrate CT contrast decision support
into our radiology order entry systems to provide notifi-
cation at the time of ordering about patients who have
had previous CT contrast reactions. This information is
particularly important because patients with histories of
reactions to contrast have been shown to be at increased
risk for future reactions to contrast media [2].
CONCLUSION

Patient safety continues to be a key issue in health care. Large health care systems with varied hospital cultures, environments, and practices are continually challenged to provide safer and higher quality patient care. Compliance with standards and regulations from the Joint Commission and other relevant organizations, such as the Massachusetts Coalition for the Prevention of Medical Errors, must also be maintained. We have shown that it is feasible to improve and standardize procedures for CT contrast administration at a large integrated health care system, and we believe that such an approach is broadly applicable.

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REFERENCES


SUPPLEMENTARY DATA