

Event Documentation and Transfer of Care After Severe Contrast Reactions

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Abstract

Purpose: Radiology residencies are increasingly using clinical simulation to teach contrast reaction management. The aim of this study was to evaluate resident documentation of management and transfer of care in severe contrast reactions after a clinical simulation.

Methods: After a high-fidelity mannequin simulation of contrast-induced anaphylactic shock, residents (n = 18) were asked to document the event in a progress note and transfer care to a receiving medical team. A total of 22 prospectively determined criteria were selected, and notes were analyzed by a blinded reviewer.

Results: Notes contained between 12 and 21 of the prospectively determined 22 criteria (54%-95%). The median number of criteria contained in a note was 16. None of the notes fulfilled all 22 criteria. However, consistent deficiencies were found in documenting prior reaction to contrast (28%) and transfer-of-care criteria (22%-44%).

Conclusions: Although standards for the documentation of advanced cardiovascular life support codes and other emergencies have been devised, no such standards exist for documentation in the management of contrast reactions. The results of this study suggest the need to develop a standardized documentation system for severe contrast-induced reactions. Education regarding transfer of care and documentation should be emphasized during clinical simulation.

Key Words: Contrast reaction, simulation, transfer of care

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INTRODUCTION

The proper management of acute contrast reactions is central to the role of the radiologist, and yet, in a recent study, only 41% of radiologists recalled the correct dose and route of epinephrine administration in the treatment of life-threatening anaphylactic contrast reactions [1]. Radiology residency programs are increasingly using clinical simulation-based training to teach contrast reaction management. Sarwani et al [2] demonstrated that management of contrast-induced reactions by radiology residents improved after two simulation sessions. However, there is no literature evaluating the accuracy of documentation or transfer of care in the event of severe contrast reactions as a postsimulation primary end point. Direct documentation in a patient's chart and transfer of care are skills that practicing

radiologists may not exercise for extended periods of time, yet they are essential to patient safety in the rare event of a severe contrast reaction. No national standard for the documentation of contrast reactions exists, and to our knowledge, no studies have been conducted to evaluate radiologists' documentation of contrast reactions. Thus, after conducting a clinical simulation of severe contrast reaction management, we evaluated residents' documentation of the event and transfer of care to a receiving medical team. The intent of this study was to analyze radiology residents' ability to accurately document severe contrast reactions and effectively transfer care to a medical team.

METHODS

Our institution recently established a new educational simulation module to help teach the management of contrast-induced anaphylactic shock. A total of 18 residents were enrolled into the simulation. Before the simulation, the residents were given two hour-long didactic lectures on the nature of the upcoming simulation and the proper management of a variety of acute contrast-induced reactions. The simulated patient, a high-fidelity

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mannequin, initially experienced a mild reaction to iohexol 350 administered for abdominal and pelvic CT, which progressed to anaphylactic shock and loss of consciousness. The residents were to take a focused history, address the patient's symptoms, and take vital signs during the early phase of the reaction. As the symptoms progressed to anaphylaxis, participants were expected to resuscitate and manage the patient with continuous vital sign monitoring, intravenous (IV) fluid resuscitation, supplemental oxygen and airway support, administration of bronchodilators or diphenhydramine, administration of epinephrine, and activation of a rapid-response team. At the conclusion of the simulation, a rapid-response team arrived to assume care of the patient, and residents were asked to transfer care to the receiving medical team. The participants were to give a verbal sign-out and document the event in a progress note for the purposes of transfer of care to the receiving medical team.

After we obtained a waiver from the institutional review board, the residents' notes were systematically analyzed and evaluated for content and completeness. Notes were excluded from the final analysis if they were incomplete, the reviewer deemed them illegible, or the resident writing the note failed to complete the simulation. A blinded independent reviewer read and scored all of the resident notes. Given that there are no national standards for the documentation of acute contrast reactions, we derived a novel set of criteria from the "ACR Practice Parameter for Communication of Diagnostic Imaging Findings" [3], the *ACR Manual on Contrast Media* [4], and the American Heart Association's "Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" [5]. Using the "ACR Practice Parameter for Communication of Diagnostic findings," we used basic elements of a radiologic report (demographics, relevant clinical information, techniques, findings and impression) to serve as a basis for documentation. Using this framework, we consulted the *ACR Manual on Contrast Media* and the American Heart Association's "Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" to develop criteria specific to documenting a life-threatening adverse reaction to contrast. The documentation criteria were broken into five categories including 22 criteria in all:

1. Demographics: a title, label, and header on the note; date of event; time of event; patient's age; and patient's gender (five criteria).
2. Imaging procedure: type of imaging study the patient underwent, type and dose of contrast administered, and route of contrast administration (three criteria).

3. Initial evaluation: presenting symptoms, history of prior contrast reactions, pertinent physical examination findings, and initial vital signs (four criteria).
4. Progression and management: IV fluid resuscitation, bronchodilator or diphenhydramine given, development of hypotensive shock or unresponsiveness, activation of a code team, route and rate of supplemental oxygen given, and dose and route of epinephrine administered (six criteria).
5. Transfer of care: patient's subjective condition upon transfer, vital signs upon transfer, vital support including supplemental oxygen and IV fluid rates, and the need for future premedication if contrast administration cannot be avoided (four criteria).

To reduce ambiguity of the criteria for the reviewer, a number of criteria were further defined. If a criterion contained the word *and*, all elements must be present to receive credit (eg, both type and dose of IV contrast must be documented). Pertinent physical examination findings include any of the following: tachycardia, tachypnea, wheezing, coughing, weak pulses, rapid pulses, skin pallor, rash or hives, and airway swelling. These were the pertinent positive physical examination findings the simulation mannequin was programmed to display. Either hypotensive shock or unresponsiveness may be documented as evidence of life-threatening progression of the reaction as the simulation progressed to either or both of these outcomes. The mention of epinephrine being given without documenting the dose and route was not considered to be sufficient, as giving epinephrine was a basic tenet of the simulation, and it was incumbent upon the participants to determine the appropriate dose and route. If the patient was unconscious at the time of transfer, this was to be documented in lieu of the patient's subjective condition. As all patients were receiving IV fluids and supplemental oxygen at the time of transfer, both must be documented. Any mention of the need for future premedication was considered adequate, even if no further specifics were given.

RESULTS

In the final analysis, all residents who participated in the simulation wrote complete and legible notes, so no notes were excluded by the reviewer ($n = 18$). The final cohort included nine first-year residents, three second-year residents, four third-year residents and two fourth-year residents. Notes contained between 12 and 21 of the 22 prospectively determined criteria (54%–95%). The

median number of criteria contained in a note was 16. None of the notes fulfilled all 22 criteria.

In the demographics category, the five criteria were present in 67% to 100% of the notes. The single criterion fulfilled by all notes was the date, and the least frequently documented criterion was the patient's age. In the imaging procedure category, the three criteria were present in 61% to 78% of the notes. The type and dose of contrast administered, along with the route of administration, were both documented in 61% of the notes, typically by the same individuals within a single statement. In the initial evaluation category, the 4 criteria were contained in 28% to 100% of the notes. A significant deficiency was present in this category, as only 28% of the notes documented the patient's history of a contrast reaction. In the progression and management category, the six criteria were contained in 78% to 100% of the notes. Criteria in this category were among the most frequently documented by the residents, and no significant deficiencies were identified. Although all of the notes contained mention of epinephrine's being given, a lesser percentage documented the dose and route (89%). In the transfer-of-care category, the four criteria were contained in 22% to 44% of the notes. All criteria in this category were considered to be deficient. The least frequently documented criteria in this category were the vital supports the patient was receiving (22%) and the need for counseling on future premedication (22%). In fact, these were the least frequently documented of any criteria across categories. Table 1 shows a breakdown of the criteria in all five categories, along with their rates of documentation. Significant deficiencies have been indicated in the table.

DISCUSSION

Participants performed well in a large number of categories, as at least 17 of 22 criteria were met by 39% of the notes, and at least 15 of 22 criteria were met by 78% of the notes. Although 100% of the notes documented that epinephrine was given, only 89% documented the route and dose. Deficiencies were found in documenting prior reaction to contrast and transfer-of-care criteria. This may reflect the infrequency with which radiology residents and practicing radiologists perform transfer-of-care tasks. Alternatively, these documentation deficiencies may be secondary to gaps in training. Traditional training for radiology residents with regard to contrast agents has been focused on management skills, whereas transfer-of-care and

Table 1. Criteria for resident notes

Criterion	Percentage of Notes Meeting Criterion (n = 18)
Demographic criteria	
Title, label, and header	78
Date	100
Time	89
Age	67
Gender	78
Imaging criteria	
Study performed	78
Type and dose of contrast	61
Route	61
Initial evaluation criteria	
Symptoms	100
History of adverse reactions to contrast*	28
Pertinent physical examination findings	100
Vital signs	100
Management criteria	
IV fluids	100
Bronchodilator or diphenhydramine	83
Shock or unresponsiveness	94
Code team activated	100
Route and volume of oxygen	78
Route and dose of epinephrine given	89
Transfer-of-care criteria	
Subjective condition*	44
Vital signs*	39
Vital support*	22
Counsel on future premedication*	22

Sources: Adapted from the *ACR Manual on Contrast Media* [4], the "ACR Practice Parameter for Communicating Diagnostic Imaging Findings" [3], and the American Heart Association's "Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care" [5].

Note: Each note was evaluated according to these criteria, with percentages reported.

*Deficiencies in documentation.

documentation skills may be overlooked. However, the importance of accurate and complete transfer-of-care information and documentation cannot be overstated in the setting of a critically ill patient, as in this case.

Although standards for documentation of advanced cardiovascular life support codes and other emergencies have been devised, such as the American Heart Association's ACLS Code Timer/Recorder Sheet, no such standards exist in the documentation of acute contrast reaction management. Our results suggest the need to develop a standardized documentation system for severe contrast-induced reactions. One of the most important functions of documenting acute contrast reactions is to facilitate safer transfer of care, and yet this was the main

area of documentation deficiencies in our study. Transfer of care has been a major focus of improvement in many areas of medicine and has been identified as a source of medical errors. We feel that regular practice in clinical simulation may facilitate improved transfer-of-care skills. Documentation and transfer of care are rarely evaluated in clinical simulations in radiology departments, and our data show a need to work toward the improvement of these skills. In later studies, we hope to demonstrate improvement in transfer-of-care skills and documentation after residents have received targeted training in documentation.

Additionally, future studies should be performed to show the effectiveness of standardized documentation templates. If shown to be effective, this approach should be adopted at the institutional level to improve patient safety and thorough reporting. There may be a need for the development of a universal standard, and national oversight bodies should play a role in this development.

Limitations

We recognize a number of limitations to our study. Clinical simulation often fails to approximate real-world situations and may often oversimplify complex interactions. Our participants were radiology residents, who may vary from practicing radiologists in a number of ways, including experience and recent practice in clinical settings. Our sample size consisted of only 18 participants, and both senior and junior residents were included in the same sample population. No subgroup analysis of residents by year could be performed because of the small sample size. We feel that these limitations do not significantly detract from the finding that deficiencies in documentation are frequent and may potentially adversely affect patient care.

CONCLUSIONS

In future clinical simulations, education regarding transfer of care should be emphasized, and providing residents with standardized criteria may result in improved documentation and transfer of care to a medical team. Additionally, we feel that there is a future role for national oversight bodies to help develop standard documentation templates to help facilitate patient care in contrast reactions.

TAKE-HOME POINTS

- No national standard exists for documenting contrast reactions.
- Documentation of clinical events and transfer of care are skills radiologists use infrequently.
- Residents' documentation falls short in transfer-of-care arenas.
- National standards for the documentation of contrast reactions may improve patient safety.

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