

Comprehensive Contrast Reaction Management Training: A Quality Improvement Initiative for Direct Patient Care in Radiology



Huijuan Wang MD¹ | Kaitlin Zaki-Metias MD¹ | Farzad Razi² | Nicholas Mills MD¹ | Bashir Hakim MD^{1,3} |

¹ Department of Radiology, Trinity Health Oakland Hospital/Wayne State University School of Medicine, Pontiac, MI; ² Wayne State University School of Medicine, Detroit, MI; ³ Huron Valley Radiology, Ypsilanti, MI

Background

- Reactions to iodinated contrast agents may have a wide range of signs and symptoms. Although true severe contrast allergy are rare, untreated or mistreated contrast reactions can have potential adverse outcomes.
- Contrast reactions are primarily managed by radiologists. Rapid response team and code blue team comprised of internal medicine residents and nurses may be involved in the advanced management.
- Studies have shown that majority of the radiologists and radiology residents are failing to recognize life-threatening anaphylactic reactions (Gaca et al. 2007), and incorrectly recalling the correct treatment regimen (Lightfoot et al. 2009; Nandwana et al. 2015).
- Studies have shown that simulation training is an effective learning tool (Pfeifer et al. 2016), and especially beneficial for junior residents (Kruse et al. 2022).

Purpose

- To ensure patient safety, improve participants' confidence and accuracy, and better prepare participants for practice in contrast reaction management.

Hypothesis

- Comprehensive, formalized contrast reaction management training improves both confidence and accuracy of contrast reaction management in participants.

Subjects

- Phase 1: Radiology residents
- Phase 2: Radiology residents, internal medicine residents, transitional year residents, and rapid response nurses

Methods

Plan-Do-Study-Act (PDSA) model required by the American Board of Radiology for Practice Quality Improvement projects.

Results

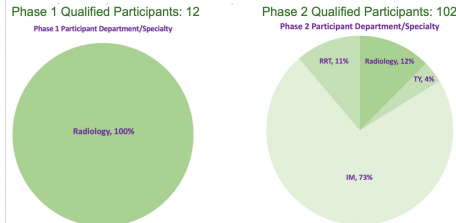


Figure 1. Pie charts representing the percentage of individuals in each department that participated in study phases 1 and 2.

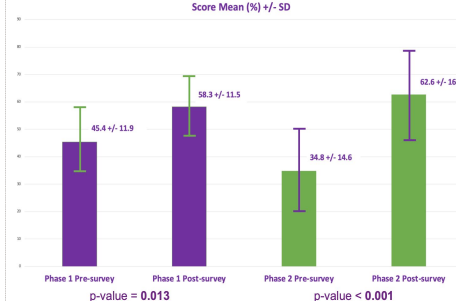


Figure 2. Mean (%) +/- SD of phase 1 and phase 2 participant knowledge scores prior to contrast reaction training (pre-survey) and after training (post-survey). There was a significant increase in knowledge after training in phase 1 (N = 12, p = 0.013) and phase 2 (N = 102, p < 0.001).

Discussion

- Hypothesis is validated.
- Primary outcomes of improving participants' knowledge and confidence in managing contrast reactions have been met.

Participants' Feedback

- Most participants preferred annual repetition of the faculty-led lecture and simulations.
- Majority of participants rated the simulations and the badge buddies being the most helpful components in the training.
- Badge buddies listing the physiologic and allergic-like symptoms are requested for future trainings.

Limitations

- Phase 1:
 - Secondary outcomes need longer observation time.
 - Small number of participants.
 - Recall bias for post-survey due to differing time since the simulation session.
 - Long-term retention is not assessed.
- Phase 2:
 - Limited scheduling for simulation sessions due to instructors' and participants' clinical schedules.
 - Radiology attendings and medical radiation technologists attended a separate but similar training program.

Future

- An annual comprehensive training program with various scenarios tailored to each specialty is available with more availability of simulation slots.
- Solidified institutional protocols related to contrast reaction management.
- Additional physiologic and allergic-like symptoms badge buddies are available for future training.

Subjective Confidence Levels

Questions <i>All questions start with "How confident are you in ...?"</i>	Phase 1 (Standard Deviation)		p-value	Phase 2 (Standard Deviation)		p-value
	Pre-survey	Post-survey		Pre-survey	Post-survey	
1. Oral contrast knowledge	3.08 (1.08)	4.08 (0.67)	0.012	2.84 (1.13)	4.24 (0.81)	<0.001*
2. IV contrast used in CT knowledge	3.00 (1.13)	4.08 (0.79)	0.012	2.69 (1.09)*	4.29 (0.78)*	<0.001*
3. IV contrast used in MRI knowledge	2.67 (1.23)	3.67 (1.16)	0.052	2.53 (1.11)*	4.27 (0.89)*	<0.001*
4. Premedication knowledge	3.00 (1.04)	4.00 (0.74)	0.013	2.82 (1.10)	4.41 (0.66)	<0.001*
5. Managing contrast reactions	2.58 (1.17)	4.00 (0.85)	0.003	See footnotes*	See footnotes*	See footnotes*
6. Managing contrast extravasation	3.50 (1.00)	4.58 (0.67)	0.005	Omitted	Omitted	N/A
7. Logistics for medication and equipment for contrast reaction treatment in the CT rooms	2.00 (1.13)	4.08 (0.67)	0.000			
8. Logistics for medication and equipment for contrast reaction treatment in the MRI rooms	1.75 (0.97)	3.67 (0.99)	0.000	2.24 (1.12) [†]	4.45(0.68) [‡]	<0.001 [†]

Table 1. Mean (SD) of 8 subjective confidence related questions using a numerical scale of 1 to 5, from not confident at all to very confident respectively.

*Confidence levels for both knowledge of IV contrast and management of contrast reactions were assessed simultaneously in questions 2 and 3 in phase 2.

[†]Confidence levels for logistics of medication and equipment for contrast reaction treatment in CT and MRI rooms were assessed as one question in phase 2.

References

- Gaca AM, Frush DP, Hohenhaus SM, et al: Enhancing pediatric safety: using simulation to assess radiology resident preparedness for anaphylaxis from intravenous contrast media. *Radiology* 2007; 245: pp. 236-244
- Kruse DE, Scriber G, Walsh R. High-fidelity simulation training improves resident knowledge of contrast reaction management, especially for junior residents. *Eur J Radiol Open*. 2022;9:100444. Published 2022 Oct 11. doi:10.1016/j.ejro.2022.100444
- Lightfoot C.B., Abraham R.J., Mammen T., Abdolell M., and Kapur S.: Survey of radiologists' knowledge regarding the management of severe contrast material-induced allergic reactions. *Radiology* 2009; 251: pp. 891-896
- Nandwana SB, Walls DG, Torres WE. Radiology Department Preparedness for the Management of Severe Acute Iodinated Contrast Reactions: Do We Need to Change our Approach? *AJR Am J Roentgenol*. 2015;205 (1): 90-94. doi:10.2214/AJR.14.13884
- Pfeifer K, Shah L, Arango J, et al: High-fidelity contrast reaction simulation training: performance comparison of faculty, fellows, and residents. *J Am Coll Radiol* 2016; 13: pp. 81-87