

Radiologic Resident Education

Comparison of High-Fidelity Simulation Versus Didactic Instruction as a Reinforcement Intervention in a Comprehensive Curriculum for Radiology Trainees in Learning Contrast Reaction Management:

Does It Matter How We Refresh?

Melissa Picard, MD, Nancy Curry, MD, Heather Collins, PhD, LaShonda Soma, MD, MS, Jeanne Hill, MD

Rationale and Objectives: Simulation-based training has been shown to be a useful adjunct to standard didactic lecture in teaching residents appropriate management of adverse contrast reactions. In addition, it has been suggested that a biannual refresher is needed; however, the type of refresher education has not been assessed.

Materials and Methods: This was a prospective study involving 31 radiology residents across all years in a university program. All residents underwent standard didactic lecture followed by high-fidelity simulation-based training. At approximately 6 months, residents were randomized into a didactic versus simulation group for a refresher. At approximately 9 months, all residents returned to the simulation center for performance testing. Knowledge and confidence assessments were obtained from all participants before and after each phase. Performance testing was obtained at each simulation session and scored based on predefined critical actions.

Results: There was significant improvement in knowledge ($P < .002$) and confidence ($P < .001$) after baseline education of combined didactic and simulation-based training. There was no statistical difference between the simulation and didactic groups in knowledge or confidence at any phase of the study. There was no significant difference in tested performance between the groups in either performance testing session.

Conclusions: This study suggests that a curriculum consisting of an annual didactic lecture combined with simulation-based training followed by a didactic refresher at 6 months is an effective and efficient (both cost-effective and time-effective) method of educating radiology residents in the management of adverse contrast reactions.

Key Words: Contrast reaction; simulation training; resident education; radiology.

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Acute adverse reactions to contrast administration are rare events, estimated at an incidence of 0.2%–3.1% (1–3). These can range from mild and self-limiting

to life-threatening reactions. Recent surveys of radiologists have shown that there is a deficiency in knowledge of epinephrine for the management of adverse contrast reactions with only 41–43% of radiologists providing the correct dose, route, and concentration of the drug (4,5). These findings have raised concern that standard didactic-based instruction may not be sufficient training in the management of adverse contrast reactions. The addition of simulation-based training has been shown to improve resident management of contrast reactions (6–10). More recent studies have determined that

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From the Department of Radiology and Radiological Sciences, Medical University of South Carolina, 96 Jonathan Lucas St, MSC 323, 210 CSB, Charleston, SC 29425-3230. Received October 8, 2014; accepted January 3, 2015. Address correspondence to: M.P. e-mail: picard@musc.edu

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although there is improvement in knowledge and confidence in the management of adverse contrast reactions when a combined didactic and scenario-based curriculum is used, the effect of this training begins to decline after 6 months. This study suggests that biannual refresher training should be considered (9). What has not been studied to date is the type of training that should be provided at the 6-month refresher mark, didactic or simulation, and what effect the type of reinforcement has on resident performance in the management of adverse contrast reactions. The objective of this prospective randomized study was to determine if there is a difference in knowledge, confidence, and tested performance for managing adverse contrast reactions based on simulation versus didactic refresher courses.

MATERIALS AND METHODS

This prospective study involved all radiology residents of post-graduate years 2–5 at a university program. Participation was voluntary, and written informed consent was obtained from each resident after the nature of the study was explained. Residents were assigned numbers to maintain their anonymity. This study was approved by the institutional review board of the hospital.

Medical knowledge assessments were created on the basis of material covered in the standard didactic lecture and the American College of Radiology contrast manual. Three versions of 15-item quizzes were created which covered similar material (versions A, B, and C). Attending radiologists at our institution were asked to complete these quizzes anonymously to confirm all assessments were of similar difficulty. These knowledge assessments were then administered in a sequential manner at multiple time points throughout the course of the study. Each version was administered a total of two times. All residents took the same version at each time point in the study regardless of their refresher group randomization.

Confidence surveys were also created which assessed the level of training, number of contrast reactions evaluated, and greatest severity of reaction encountered. In addition, there were six questions regarding their confidence in identifying various types of reactions and six questions regarding their confidence in managing these same types of reactions. These questions were answered using a five-point Likert-type scale (1 = no confidence, 2 = not very confident, 3 = neutral, 4 = somewhat confident, and 5 = very confident).

A flowchart illustrating the study design is shown in Figure 1.

Phase 1

In July 2013, baseline knowledge and confidence assessments were completed by all participants before any intervention (Pre1). All radiology residents then attended a standard didactic lecture lasting 90 minutes provided by a senior genitourinary radiology attending with long-term, extensive experience in

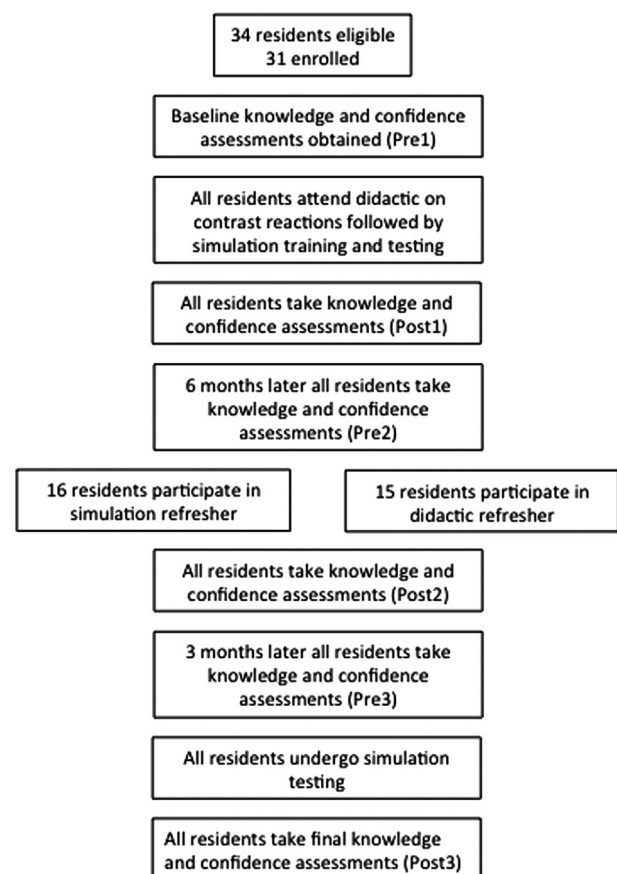


Figure 1. Flowchart showing study process and groups.

adverse contrast reaction management and who is responsible for providing this lecture annually. Within the same month, all residents underwent simulation training with performance testing at our simulation center using a high-fidelity manikin, SimMan (Laerdal Medical, Stavanger, Norway). The facilitator for all of the simulation sessions was an abdominal fellowship-trained attending radiologist from our institution with a special interest in simulation training and genitourinary imaging. This simulator has many features including pulses, heart sounds, and lung sounds. In addition, there are monitors which continuously display vital signs including heart rate, blood pressure, oxygen saturation, and respiratory rate, which update as the scenario progresses. Intravenous lines with fluids, both nasal cannula and mask for oxygen delivery, and a training contrast reaction kit were available for use. Each resident was expected to select and administer the appropriate medication available in the contrast reaction kit. They were also expected to start IV (intravenous) fluids by opening the lock on the tubing connected to the manikin and select an appropriate type and amount of fluids to administer. They were also expected to place supplemental oxygen on the manikin via an appropriate route and rate and raise the manikin's legs as needed. Scenarios were written for five contrast reactions including urticaria, bronchospasm, laryngeal edema, vasovagal, and anaphylaxis-like reaction. Varying degrees of severity for some reactions were created for a total of 13 scenarios. Residents

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