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Not Only for Residents

**NYU Medical Center Department-wide Training
for Contrast Reaction Preparedness:
Initial Results**

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Department-wide Training of
Contrast Reaction Preparedness

We propose a novel model promoting department-wide participation in teaching and training for the management of contrast reactions.

We queried if all radiologists--from trainee to senior attending—have comparable baseline knowledge, experience and confidence levels for managing contrast reactions.

We hypothesize that competence in managing contrast reactions could be enhanced by a real time simulation training environment that acknowledges/addresses the confidence levels of the trainees.

You just stopped by to sign reports, when…

…the technologist runs into the reading room and asks for your help…

Hey doc, we have a patient in the scanner who doesn't look so good…can you come and check?

Contrast reactions

- **Radiologists may go for years without encountering a serious adverse contrast event**

- Over time one could settle into feeling that NO EVENT is the rule

- This can happen to attending radiologists many years in practice, and residents /fellows who have not encountered significant reactions.

Contrast reactions—who is responsible?

<u>All</u> radiologists—residents, fellows and attendings--are expected to manage reactions competently, despite a paucity of practical experience for many.

Many radiologists review management of
contrast reactions while preparing for board exams--learning which may fade if not reinforced.

Complacency in maintaining skills is unwise, as adverse contrast events—although infrequent—are unpredictable and may be severe.

Is a contrast reaction much like a routine code?

- Managing a serious contrast reaction varies from the ICU and ER code setting in which several health care workers work as a team to manage high risk/HIGH frequency events.

- A radiologist called for a contrast reaction often has to function alone, in a potentially high risk/LOW frequency setting-- more akin to sporadic management crises airline pilots may encounter.

Contrast Management Initiative

- To address these issues directly, we have developed an ongoing initiative: department-wide training for management of a range of contrast reactions utilizing our institution's SIMULATION Center.

- 9 attendings have volunteered to be trainers for contrast reaction training sessions. The trainers "trained" each other, based on discussion of our experiences and ACR guidelines (Manual on **Contrast** Media vol 7 available on the web).

Pilots take SIMULATION training for rare adverse events. So can we.
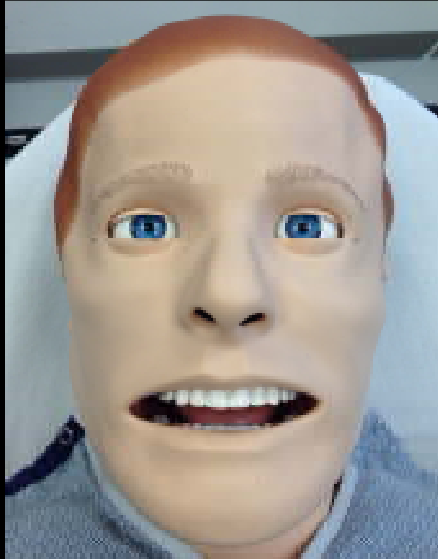
Hands-on training with programmable mannikins for real-time assessment /management of mild to severe reaction scenarios such as anaphylaxis, vasovagal, facial swelling.

Real time response to scenarios is followed by group discussion/*debriefing.*

Scenarios include a range of practical management issues e.g. subjects in the magnet, pediatric management/dosing

Programmable Mannikins

SIMULATION/SIMS training for the management of contrast reactions has been offered at several academic centers to radiology residents (references)

The trainer describes a reaction scenario at onset: "Mrs. Jones is 37 y/o, undergoing an arthrogram. She begins to sweat profusely and slur her speech"

Vital signs (set by a second trainer) are obtained and displayed on a large screen (and depending on intervention, improve or worsen).

Trainers stand by as trainees state their interventions--O2, IV fluids, drug route/ dose and call for back-up, as needed.

Who has undergone training (so far)

- We have expanded the trained groups to include all radiologists

- 4 classes of 10 residents. 10 incoming residents per year –REQUIRED. 60 so far.

- @ 27 fellows, and new fellows every year. Fellows train at the discretion of their fellowship director

- 28 Attendings—training is VOLUNTARY but encouraged. 10 attending trainers have also undergone de facto training.

Query: Are all trainees on a level playing field?

Under the auspices of our department-wide contrast reaction training initiative we asked if radiologist cohorts from trainee to senior attending have different overall levels of knowledge and confidence for managing contrast reactions.

Could understanding differences help us modify how we train the different cohorts?

METHODS: Testing

IRB exemption was obtained. The radiologist trainers conducted small group sessions at our institution's Simulation Center.

An unanticipated quiz assesses baseline KNOWLEDGE of reactions, their MANAGEMENT/ appropriate DRUGS for treatment, and participant CONFIDENCE levels for managing @ 5 reactions graduating in severity.

33 true-false/ multiple choice quiz questions are based on ACR Manual guidelines, and 5 confidence questions are answered subjectively on a scale from 1-5

METHODS: Practical Training

- The test is followed an interactive lecture, and then participation in small group simulation exercises involving 4 or more contrast reaction scenarios with programmable manikins.

- After managing these scenarios, trainee response is discussed in a group "debriefing" session, without grades.

- Residents were the first group trained, and the first group to be re-quizzed, at 1 year

Statistical Analysis

- Analysis of variance compared cohorts in terms of test scores and confidence ratings. Paired sample t-tests assessed whether test scores for residents changed from pre-training to 1 year post-training

- Pearson correlations assessed the association of test scores with confidence ratings.

- All statistical tests were conducted at the 2-sided 5% significance level using SAS 9.3

RESULTS: TEST SCORES

The overall mean test scores were comparable across resident/fellow/attending cohorts.

Senior residents had significantly lower general contrast reaction KNOWLEDGE scores than the junior residents (p=0.019--p=0.001) but significantly higher DRUG ADMINISTRATION scores than juniors (p=0.033).

The mean test score for REACTION MANAGEMENT was significantly lower among Attendings than Residents (p=0.028) or Fellows (p=0.007).

Table 1. The mean and standard deviation (SD) of the scores (percentage of questions correctly answered) achieved by each cohort of doctors for each test module.

Cohort	Overall		Drugs		Knowledge		Management	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Attendings	72.55	8.73	70.63	12.37	72.31	16.90	58.33	25.52
Fellows	72.93	9.12	68.00	14.24	66.15	13.26	80.77	11.15
Residents (All)	71.76	9.07	66.67	14.14	67.48	11.71	75.58	14.02
Level 1	70.37	7.07	60.00	11.18	66.67	6.66	81.43	10.69
Level 2	70.91	8.11	66.00	15.78	76.15	12.27	67.78	17.16
Level 3	72.73	11.95	66.67	16.58	67.31	16.32	76.00	12.65
Level 4	73.33	10.18	67.78	12.02	67.52	6.41	80.00	16.33
Level 5	71.21	8.57	73.75	14.08	57.69	8.22	72.86	7.56

Table 2. P values from ANOVA to compare cohorts in terms of the mean scores for each test module. P values are in red when indicative of a significant difference.

Cohorts Compared		Overall	Drugs	Knowledge	Management
Attendings	Fellows	0.905	0.587	0.271	0.007
Attendings	Residents	0.753	0.294	0.309	0.028
Fellows	Residents	0.667	0.754	0.731	0.172

The mean test score for Management was significantly lower among attendings than among either Residents (p=0.028) or Fellows (p=0.007).

RESULTS: CONFIDENCE

For each of the graduated confidence scores, the FELLOWS had the highest mean confidence rating.

The mean confidence was significantly higher for the FELLOWS than ATTENDINGS and RESIDENTS for the more severe reaction scenarios (p=0.001--0.030).

Table 3 | The mean and standard deviation (SD) of the confidence scores provided by each cohort of doctors for each scenario. (A—E graduating in severity)

Scenario:	A		B		C		D		E	
Cohort	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Attendings	4.12	0.99	2.47	1.12	2.24	1.03	2.06	1.09	2.56	1.46
Fellows	4.17	0.88	3.30	0.96	3.30	0.70	3.37	0.77	3.61	0.63
Residents (All)	3.67	0.93	3.05	0.81	2.86	1.13	2.76	0.95	2.96	0.88
Level 1	3.56	0.73	3.11	0.93	2.89	1.05	2.78	0.97	2.89	0.93
Level 2	3.50	0.71	3.10	0.74	3.10	1.10	3.00	0.82	3.10	0.88
Level 3	3.80	1.14	2.70	0.82	2.60	1.07	2.60	0.97	2.50	0.97
Level 4	3.70	1.34	3.10	0.88	2.45	1.46	2.25	1.18	2.90	0.88
Level 5	3.81	0.65	3.31	0.70	3.38	0.74	3.25	0.46	3.50	0.53

Table 4 | P values from ANOVA to compare cohorts in terms of the confidence for each scenario. P values are in red when indicative of a significant difference.

Cohorts Compared		A	B	C	D	E
Attendings	Fellows	0.988	0.069	0.003	0.001	0.030
Attendings	Residents	0.245	0.129	0.098	0.057	0.566
Fellows	Residents	0.153	0.643	0.179	0.036	0.008

RESULTS: CONFIDENCE

- While there were significant correlations between test scores and confidence ratings, all of these correlations were <0.3 in magnitude, implying weak to modest correlation.

- Between the pre-training and 1 year post training test, all resident classes showed a significant increase in confidence scores for each of the graduated scenarios (p=<0. 001)

Table 5 The mean and standard deviation (SD) of the test scores before (Time 1) and after (Time 2) training and for the increase in score from Time 1 to Time 2 among those Residents that took the test twice. P values are from paired t tests to assess whether the score increased.

	Time 1		Time 2		Increase		P
	Mean	SD	Mean	SD	Mean	SD	Value
Drugs	65.20	13.27	73.85	12.35	8.40	17.95	0.028
Knowledge	70.47	11.25	63.94	15.31	-6.45	16.39	0.036
Management	75.38	16.55	74.14	13.23	-0.38	20.10	0.923
Overall	71.40	8.22	71.69	7.04	0.28	9.28	0.864

If there is no SIMS Center at your institution--

- Although a great resourse for training physiologic response to contrast/ treating medications, the SIMS environment does <u>not</u> replicate the scanner environment.
- In-situ training (with actor-pts and call out of vital signs) can also be used to train.
- We are moving toward utilizing both training environments, depending on the cohort and skills we are training

In conclusion

- Most prior simulation-based training for the management of contrast reactions has addressed the education of residents only.

- We are developing department-wide participation in training for the management of contrast reactions using simulated scenarios, encouraging involvement of residents, fellows and attendings alike.

In conclusion

- Testing reveals many overall similarities between these cohorts within the department, but differences in confidence and baseline knowledge.

- Fellows demonstrated the greatest confidence of the cohorts on the initial exam, possibly related to recent review of contrast reaction management during board preparation.

Going forward

More work is required to determine if considering subjective differences in confidence and testable differences in competence will be useful to tailor training *per* specific cohort—for example:

Attendings may benefit from directed reinforcement of management skills

Fellows may reinforce their skills with more challenging scenarios.

Our overall goal:

To use real-time hands on training—
simulated, or in situ-- to raise the confidence
and competence of all radiologists in the
assessment and management of –

uncommon but possible,
mild to severe
adverse contrast reactions

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- Sandy Moore (chair)
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Sandy Moore
Ben Cohen

4 RESIDENT trainers are joining our trainer group: Leonid Drozhnin, Marissa Albert, Evan Johnson, Alexander Merkle

Photography: Tony Jalandoni and Leonid Drozhinin MD

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