

University of Colorado Radiologist Adult Contrast Reaction Smartcard

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THE PROBLEM

At the University of Colorado, we have designed the Radiologist Adult Contrast Reaction Smartcard[®] to facilitate rapid and accurate radiologist response to contrast reactions. In the radiology suite, there are myriad potential patient-related reactions radiologists are expected to treat, including nausea, vasovagal events, hives, bronchospasm, angioedema, and cardiovascular collapse. As these events are rare, radiologists are often suboptimally prepared to diagnose and treat these patients [1]. Additionally, anaphylactoid reactions can progress rapidly, and early intervention is critical.

Since the introduction of low osmolar, nonionic iodinated contrast, the individual risk of adverse reactions following intravenous administration of iodinated contrast has dramatically decreased [1-3]. However, the absolute number of contrast reactions encountered in the radiology department has increased, and this is directly related to increases in imaging volume [4]. Although severe, anaphylactoid reactions to nonionic intravenous contrast remain rare, at an incidence of approximately 1:2,500, less severe, moderate events are not infrequent and occur with approximately 1 in 250 injections [5].

The overall infrequency of life-threatening reactions to intravenous iodinated contrast presents a serious clinical issue as radiologists lack practice-based expertise in management of severe contrast-related complications. However, a radiologist is usually the first physi-

cian contacted for evaluation and treatment of the patient and also, is often the only available physician on site. In fact, the majority of contrast reactions occur in the outpatient setting [6] rather than the hospital setting, where multidisciplinary resuscitation teams are usually readily available for assistance.

Both practicing radiologists and trainees demonstrate knowledge and skills deficits in the identification and management of severe contrast reactions. In a recent survey, only 41% of the practicing radiologists provided both the correct route and medication dose in the management of anaphylactoid reactions [7]. A second survey revealed that 47% of residents and attending radiologists incorrectly answered knowledge-based and skills-based questions on adverse events to contrast reactions [8].

Underscoring the current lack of skills among radiologists in the management of severe contrast reactions is suboptimal resident education and training in this area. Specifically, most radiology programs educate residents in the treatment of contrast reactions primarily through didactic lectures, which increase knowledge but do not focus on skills development [9]. In fact, initial studies of high-fidelity simulation training showed that only 68% of residents appropriately called the code team for assistance [10].

Contributing to the problem is a limited formal assessment of resident knowledge in this area. From 2007 to 2010, there were no related questions included on the ACR in-

service examinations [9]. Although educational strategies and competency assessment related to contrast reaction management are suboptimal, there are also systems issues that can be addressed to improve radiologist performance when responding to contrast reactions.

OUR RESPONSE AND SOLUTION

At the University of Colorado, we developed the Radiologist Adult Contrast Reaction Smartcard (shown in Fig. 1), with the 3-fold purpose of providing (1) an algorithm for the clinical assessment and evaluation of the patient, (ACCE), (2) a quick reference source to management algorithms adapted directly from the *ACR Manual on Contrast Media* [11] consolidated into an easily accessible and transportable format, and (3) a quick checklist that can be reviewed en route to evaluate a patient with a potential reaction, which reviews common "Pearls and Pitfalls" in patient management that have been previously documented in the literature [12].

Radiologists are prone to common errors in management, such as incorrect epinephrine dose and route administration, mistaking a vasovagal reaction for anaphylactoid-related cardiovascular collapse, and inappropriately administering diphenhydramine for the treatment of hypotension, angioedema, and bronchospasm [12]. These potential errors are addressed in both the "Pearls and Pitfalls" and "Management" algorithms sections of the Smartcard.

Segal et al performed a literature review and developed a list of 12

PEARLS

1. Call for help when needed- Use closed loop communication at all times
2. Administer O₂ early
3. Do not delay administration of epinephrine in a patient with bronchospasm unresponsive to beta agonist inhaler
4. If patient is obese and reaction moderate consider IV rather than IM epinephrine
5. If administering IM EPI (1:1,000) from a vial rather than EPIPEN[®], dose is 0.3cc and use of a TB syringe recommended
6. If patient has no pulse and is unresponsive, initiate BCLS/ACLS - intravenous EPI dose 10cc (1mg) 1:10,000
7. BCLS 30 compressions to 2 breaths

PITFALLS

1. If the patient is bradycardic atropine NOT epinephrine is the appropriate first line drug
2. Do not hesitate to administer IM epinephrine early for the treatment of a moderate contrast reaction
3. Before administering the EPIPEN[®], revisit instructions on the device to avoid common errors
4. EPIPEN[®] must be held in place for 10 seconds for full dose delivery. Preferred site of injection is the thigh
5. Reserve Benadryl for the treatment of hives as it thickens secretions (contraindicated in bronchospasm and angioedema) and can exacerbate hypotension
6. Do not confuse the IM and IV dose/route of epinephrine administration- **DOUBLE CHECK VIAL CONCENTRATION**
7. The EPIPEN[®] is for IM and ADULT use only

References

1. Manual on Contrast Media V8-American College of Radiology. www.acr.org/Quality-Safety/Resources/Contrast-Manual. Accessed on 10/5/2012
2. Segal AJ, Bush WH. "Avoidable Errors in Dealing with Anaphylactoid Reactions to Iodinated Contrast Media" Investigative Radiology, vol 46, number 3, March 2011.p
3. EPIPEN[®] 0.3mg epinephrine auto-injector Dey Pharma, LP., Napa, CA 94558



**Radiologist
ADULT CONTRAST REACTION SMART CARD[®]**

Approach to Evaluating and Managing Patient Contrast Reactions

Pocket Treatment Algorithms Based on ACR[®] Manual on Contrast Media v8

Pearls and Pitfalls



ACCE Response

Assess the Patient

- See the Patient Immediately DO NOT diagnose over the phone
- Introduce yourself to the nurse, tech and patient
- Obtain a brief history and **COLLECT VITALS** with focused physical exam as appropriate
 - Is the patient in distress?
 - Check mental status
 - Is the patient hoarse or having difficulty speaking?
 - Evaluate for bronchospasm
 - Evaluate mucous membranes
- Classify the level of severity (mild, moderate, severe) Call for help if needed

Construct a "Working" Diagnosis

- Allergic Contrast Reaction
- Anxiety
- Adverse Reaction
- Vasovagal
- Seizure
- Cardiac

Communicate Assessment and Treatment Plan to Patient and Staff

Execute Management

- Use closed loop communication

Management of Acute Reactions in Adults ACR Manual on Contrast v8

Urticaria

1. No treatment needed in most cases
2. Benadryl PO/IM/IV 25-50mg
3. If severe or widely disseminated: **EPIPEN[®] IM (1:1,000) 0.3cc**

Bronchospasm

1. Give O₂ 10 liters/min via mask
2. Give **beta-agonist inhalers 2 to 3 puffs**; repeat as necessary. If unresponsive to inhalers, use SC, IM, or IV epinephrine.
3. Give epinephrine **SC or IM (1:1,000) 0.1-0.3 ml (= 0.1-0.3 mg)** or, especially if hypotension evident, epinephrine **(1:10,000) slowly IV 1-3 ml (= 0.1-0.3 mg)**
4. Call for assistance for severe bronchospasm or if O₂ saturation <88% persists

Pulmonary Edema

1. 10 L O₂ via mask
2. Elevate Torso
3. Give **furosemide (Lasix) 20-40mg IV, slow push**
4. Consider morphine 1-3mg IV
5. Transfer to ICU or ED

Angioedema

1. 10 L O₂ via mask
2. **EPI SC (1:1,000) 0.3cc or IF hypotensive EPI (1:10,000) slow IV 3cc, may repeat up to maximum of 1mg**
3. If unresponsive to therapy, seek appropriate assistance

Severe Hypertension

1. 10 L O₂ via mask
2. **Nitroglycerine 0.4mg tablet sublingual (may repeat X3)**
3. If unresponsive to therapy, **labetalol 20 mg IV**
4. Transfer to ICU or ED

Seizure

1. 10 L O₂ via mask
2. **Diazapan (Valium) 5mg IV or midazolam (Versed) 0.5mg - 1mg IV**
3. Monitor vitals
4. Call CODE, Transfer to ICU or ED

Hypotension with Tachycardia (Anaphylactoid)

1. 10 L O₂ via mask
2. Rapid IV fluid/elevate legs 60°
3. IF Poorly Responsive: **EPI IM (1:1,000) 0.3cc or IF hypotensive EPI (1:10,000) slow IV 3cc, may repeat up to maximum of 1mg**
4. If unresponsive to therapy, seek appropriate assistance

Hypotension with Bradycardia

1. 10 L O₂ via mask
2. Rapid IV fluid/elevate legs 60°
3. Give **atropine 0.6 - 1mg slowly if patient does not respond to step 1 and 2. Can repeat atropine to total dose of 2-3mg**
4. If unresponsive to therapy, seek appropriate assistance

Fig 1. The University of Colorado Adult Contrast Reaction Smartcard[®]. This can be distributed to residents and faculty, and folded into a pocket-sized reference for the identification and management of contrast reactions.

common but significant errors to be avoided in the management of adverse reactions to radiologic contrast [12]. The University of Colorado Radiologist Adult Contrast Reaction Smartcard addresses these significant issues, which range from

physician response time to misdiagnosis [12]. Additionally, the Smartcard promotes advanced preparation and provides a space for inserting the appropriate phone number and procedure for requesting help from the hospital resuscitation team.

The card serves as both an educational tool and quick reference intended to increase the accuracy and speed with which radiologists assess and treat patients with contrast-related and potentially life-threatening events.

OUTCOMES AND FUTURE DIRECTIONS

The Smartcard offers a systems-based approach attempting to help bridge the gap between radiologist education and the clinical skills required for the effective management of contrast reactions. The Smartcard will be distributed to residents and faculty after focused simulation training and utilized in the poststimulation debriefing to reinforce learning goals and objectives. Additionally, the Smartcard will be placed in the radiology suite adjacent to the code cart and contrast reaction medication box to facilitate availability. Future directions include validating the efficacy of the card in simulation scenarios. Additionally, conversion of the Smartcard into an electronic mobile device application would broaden accessibility and utilization. Currently, the card and treatment algorithms are limited to adult populations and do not address sedation and reversal agents. Expansion of the card into an electronic format with inclusion of these clinical scenarios

would result in a more comprehensive resource.

In the era of low-osmolar, non-ionic iodinated contrast, serious contrast reactions are infrequently encountered and radiologists lack experience in management. The University of Colorado Radiologist Adult Contrast Reaction Smartcard was developed to promote early and accurate diagnosis and administration of critical medications in the setting of severe contrast reactions.

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