

The use of order-based clinical decision support alerting to increase the homogeneity of premedication regimens in patients with known contrast allergies

John Benson MD^{1,2}, Paul Hines^{3,4}, Zeke J. McKinney MD MHI MPH^{5,6}, Alexander McKinney MD^{1,2}

INTRODUCTION

Iodinated Contrast Utilization

- 62 million CT scans completed annually in the US
- **0.7-3.2%**: Prevalence of adverse reactions to non-ionic iodinated contrast
- Symptoms range from mild (e.g. urticaria) to life-threatening (e.g. anaphylactic shock)

Premedication

- ACR recommends **corticosteroids** with or without an anti-histamine
- Ideally, premedication begins 12-13 hours prior to study
- Less effective regimens can be used in emergent settings
- IV steroids may have no effect when given <4-6 hours prior to study

Objectives

1. Increase homogeneity of premedication use
2. Assess efficacy of CDS alerting intervention

METHODS

Electronic Health Record (EHR) Changes

- Clinical decision support (CDS) alert installed into Epic 4/7/2014
- Providers alerted of patient allergies to intravenous iodinated contrast
- CDS prompts providers to order a recommended premedication regimen
- Alert discontinued if patient has adequate premedications ordered

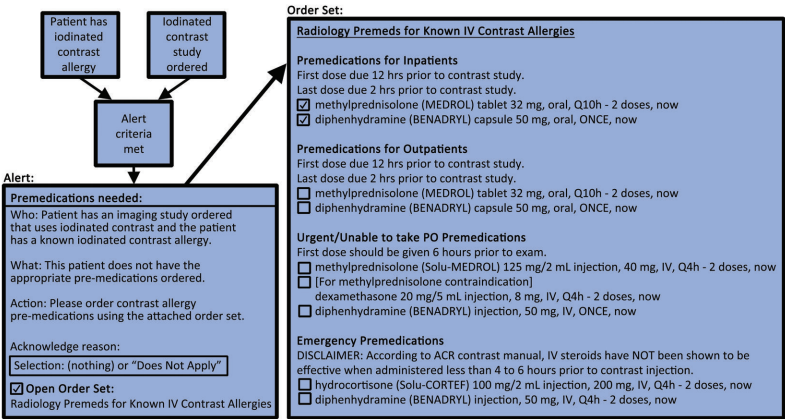
Premedication Analysis

- Patients classified by premedication regimen received:
 1. Preferred premedication regimen, based on ACR recommendations
 2. Corticosteroids <24 hours prior to study (i.e. not following recommendations)
 3. No premedication with corticosteroid

Data Collection and Analysis

- Retrospective analysis; 11 months pre- and post-implementation
- Pre- and post-CDS patients compared
 1. Type of premedication regimen
 2. Documented allergic reactions

Alert Logic and Order Set Content



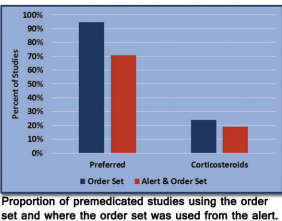
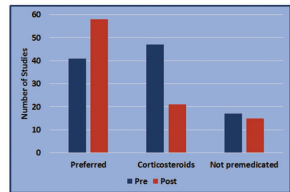
RESULTS

Patient Population & Alert Firing

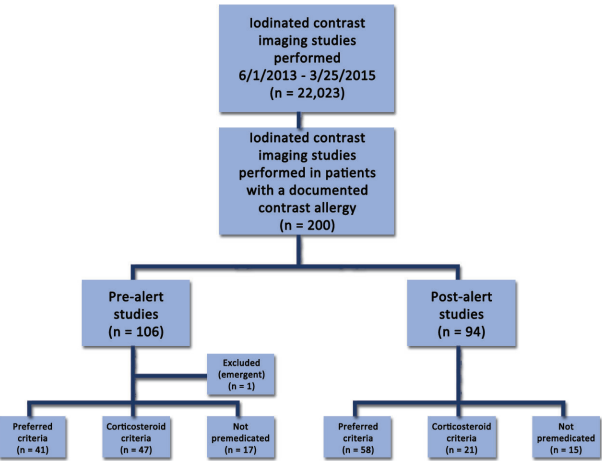
- 200 patients with documented allergy received IV contrast for a radiologic exam
- Alert fired appropriately for all premedication patients, only 2/3 of non-premedicated patients
- Alert did not fire inappropriately for any patients (**100% specificity**)
- Non-premedicated patients where alert did not fire had premedications not meeting criteria
- Overall alert sensitivity: **94.68%**

Statistical Analysis

- Proportion of patients who received preferred regimen increased (Z-score=3.25, p=0.001)
- No difference in proportion of patients who were not premedicated (Z-score= -0.02, p=0.98)
- One patient had allergic reaction; occurred post-CDS in patient given preferred premedication



Patient Population by Study Period and Premedication Criteria



DISCUSSION

Conclusion

- Homogeneity of premedication regimens significantly improved using CDS in Epic
- Alert firing is primarily associated with increased orderset usage
- Order set usage led to increased homogeneity
- Sample size not sufficient to analyze number of contrast reactions
- Alert sensitivity suboptimal as premedications have other clinical indications, thus may cause alert to not fire inappropriately

Future Direction

- Additional analysis needed to see if CDS has lead to increased patient safety
- Further steps to ensure patient compliance with premedication
- Implement similar CDS designed for allergies to gadolinium
- Further optimize alert firing for all relevant studies

References

1. Mortele KJ, Oliva MR, Ondategui S, Ros PR, Silverman SG. Universal use of nonionic contrast medium for CT: evaluation of safety in a large urban teaching hospital. *AJR Am J Roentgenol.* 2005;184(1):31-4.
2. Schopp JG, Iyer RS, Wang CL, et al. Allergic reactions to iodinated contrast media: premedication considerations for patients at risk. *Emerg Radiol.* 2013;20:299-306.
3. Rose T, Choi J. Intravenous imaging contrast media complications: the basics that every clinician needs to know. *Am J Med.* 2015 Sep;128(9):943-9.
4. American College of Radiology (ACR). ACR Manual on Contrast Media, Version 9, 2013. Available from: <http://www.acr.org/quality-safety/resources/contrast-manual/>. Accessed April 12, 2015.

Author Affiliations

- ¹University of Minnesota Medical Centers, Department of Radiology, Minneapolis, MN USA.
- ²Hennepin County Medical Center, Department of Radiology, Minneapolis, MN USA.
- ³University of Minnesota Medical School, Minneapolis, MN, USA.
- ⁴University of Minnesota Institute for Health Informatics, Minneapolis, MN, USA.
- ⁵HealthPartners/University of Minnesota, Occupational and Environmental Medicine Residency, St. Paul, MN USA.
- ⁶Hennepin County Medical Center, Clinical Informatics, Minneapolis, MN USA.