ORIGINAL ARTICLE

Use of Clinical Decision Support to Increase Premedication Regimen Homogeneity

John C. Benson, MD[a], *Alexander M. McKinney, MD*[a], *Paul Hines, MD, MHI*[b], *Zeke McKinney, MD, MHI, MPH*[c,d]

Abstract

Purpose: Patients with prior allergic reactions to iodinated contrast require premedication. This study aimed to increase the homogeneity of premedication orders in such patients.

Methods: A point-of-care (POC) clinical decision support (CDS) alert accompanied by an order set was implemented in the electronic health record (EHR) to notify providers of a prior allergic reaction upon ordering an examination involving iodinated contrast. Premedication regimens were retrospectively compared 11 months pre– and 11 months post–alert implementation, with the different regimens being classified as follows: (1) "preferred" (per ACR recommendations), (2) "nonpreferred" (corticosteroid administered <24 hours before examination, but not per ACR recommendations), or (3) "no premedication."

Results: Over 22 months, 22,023 iodinated contrast examinations were performed, 200 (186 intravascular, 12 gastrointestinal/genitourinary, 1 intraarticular, 1 intrathecal) being in patients with a documented iodinated contrast allergy (106 pre–, 94 post–alert deployment). Prealert, 41 of 106 patients (38.7%) received a preferred regimen, 47 (44.3%) received nonpreferred regimens, and 18 (17.0%) received no premedication. Postalert, 58 of 94 patients (61.7%) received a preferred regimen, 21 (22.3%) nonpreferred regimens, and 15 (16.0%) no premedication. After alert initiation, the patients prescribed a preferred regimen significantly increased (Z-score = 3.25, $P = .001$), but there was no significant difference in the proportion of patients with no premedication (Z-score = -0.02, $P = .85$). In 2 of 200 patients (1.0%), an allergic reaction occurred, both after POC-CDS alert implementation with a preferred regimen administered.

Conclusions: The homogeneity of premedication regimens significantly increased after the alert's launch. However, the proportion of patients with no premedication did not significantly change.

Key Words: Clinical decision support, premedication, allergy, iodinated contrast

J Am Coll Radiol 2016;■:■-■. Copyright © 2016 American College of Radiology

INTRODUCTION

Over the past decades, the number of CT scans using iodinated contrast performed annually in the United States has significantly increased [1-3]. The proportion of patients who have an acute allergic reaction to nonionic intravenous (IV) contrast is relatively low; one large-scale study noted a reaction rate of 3.13%, whereas more recent studies report more conservative rates of 0.2% to 0.7% [2-7]. Nevertheless, acute allergic reactions continue to pose a risk to patients, with symptoms ranging from mild urticaria to anaphylaxis [6,7].

The ACR Manual on Contrast Media (2013 version) recommended that patients with a documented iodinated contrast allergy be premedicated by corticosteroids, with or without the addition of antihistamines [7]. However, the timing of premedication is crucial; the prophylactic effects significantly lessen without a 4- to 6-hour delay before contrast administration [7]. As such, ensuring provider compliance in ordering nationally recognized premedication regimens is critical to ensure treatment efficacy.

[a]University of Minnesota Medical Centers, Department of Radiology, Minneapolis, Minnesota.

[b]Abbott Northwestern Hospital, Minneapolis, Minnesota.

[c]HealthPartners Occupational and Environmental Medicine, St. Paul, Minnesota.

[d]HealthPartners Institute, Bloomington, Minnesota.

Corresponding author and reprints: John C. Benson, Hennepin County Medical Center, University of Minnesota Medical Center, MMC 292; B-212 Mayo; 420 Delaware Street SE, Minneapolis, MN 55455; e-mail: benso905@umn.edu.

The authors have no conflicts of interest related to the material discussed in this article.

1546-1440/16/$36.00 ■ http://dx.doi.org/10.1016/j.jacr.2016.10.023

Prior studies have demonstrated that physicians can prevent up to 28% of adverse drug events with optimized computerized provider order entry (CPOE), and that clinical decision support (CDS) alerts can positively impact providers' future treatment decisions [8-14]. At the participating institution, a point-of-care (POC) CDS alert with an accompanying premedication regimen order set was designed into the electronic health record (EHR) to assist providers in ordering pretreatment regimens. This study compared the administered premedication regimens before and after the alert's implementation. The purpose of this study was to determine if the alert improved the homogeneity of premedication regimens ordered for iodinated contrast-based radiologic examinations. The hypothesis was that an alert that is appropriately triggered by POC-CDS with an accompanying ACR recommendations-based order set would lead to greater homogeneity of iodinated contrast premedication in those with a history of allergies.

METHODS

Background and Design

Institutional review board approval was obtained for the purposes of this study. This study was performed at a county safety-net hospital and level 1 trauma center (455 beds, with a radiology department internally within the emergency department). Before the implementation of the POC-CDS alert into the hospital's EHR (Epic Systems Corporation, Verona, WI), clinicians could only choose a standardized, preexisting order set based on ACR recommendations for patients with contrast allergies. At that time, in patients with a documented history of iodinated contrast allergy, there was no "hard stop" type of alert in the EHR that would direct workflow toward the standardized order set; providers were expected to search for the order set after noting a patient's documented allergy.

An interdisciplinary team composed of clinicians (including radiologists), pharmacists, clinical informaticists, and EHR analysts designed a POC-CDS alert that accounted for all uses of iodinated contrast at the participating institution; the type and route (eg, intravenous, intraarterial, oral, intrathecal, rectal) were specified. The POC-CDS alert (1) informed providers of a documented allergy to contrast media when ordering examinations that utilized intravenous iodinated contrast and (2) offered providers an order set to select an ACR-recommended premedication regimen. The implementation of the POC-CDS alert in tandem with the order set created a maximum of four extra "clicks" to order premedication, when necessary (alert/confirmation → order set choosing → confirmation of order → signing premedication order). The alert intervention was initiated within the EHR in April 2014. This retrospective study consisted of a 22-month period from May 2013 to March 2015. At the times of implementation and analysis, the EHR versions were Epic 2012 and Epic 2014, respectively.

Radiology Examination Selection

A set of radiologic examinations that utilized any iodinated contrast was manually constructed from the EHR by two clinical informaticist physicians: a staff radiologist (A.M.M.) and a hospital-based informaticist (Z.J.M.). The list of examinations was thereafter grouped according to one of three possible "modalities" and one of four possible "routes." The three modalities were CT or PET/CT, fluoroscopic, and interventional; these modalities are commonly known to potentially utilize iodinated contrast. MRI was excluded, as it does not utilize iodinated contrast. The four routes were intravascular (IV; including both intraarterial and intravenous), gastrointestinal/genitourinary, intraarticular, and intrathecal.

Alert Design and Triggering

The POC-CDS alert was triggered at the time of order entry if two inclusion criteria were met: (1) the patient's electronic orders contained a radiologic examination with a modality that utilized iodinated contrast, and (2) the patient had an EHR-documented iodinated contrast allergy. The alert was designed to *not* trigger if one of the four specified "preferred" premedication regimens had already been ordered for the patients, ie, if prescriptions already existed that matched the correct medication and frequency for each medication recommended in a particular regimen (Fig. 1). Patients' documented allergies exist in the EHR as "*Allergies/Contraindications*," which is composed of six fields that allow a provider to specify the "agent," "reactions," "reaction type," "severity," "date reaction noted," and "comments." Of these, the only two fields that triggered the alert were the agent being iodinated contrast, along with the reaction type being specified as an allergy (as opposed to another type of adverse drug event or contraindication, such as intolerance, nausea/vomiting, headache, etc.); the other four fields were not considered for the purposes of triggering the alert.