

# Reducing IV contrast extravasation in contrast enhanced CT scans using power injected saline bolus

Rodulfa J, Sun JY, Lee RK, Hall R, Griffin L

Department of Diagnostic Radiology, Einstein Medical Center, Philadelphia, PA 19141



Figure 1: MedRad Stellant Dual Syringe injector injecting a small volume of saline (blue column) at the same rate as the IV contrast (green column) prior to contrast injection.

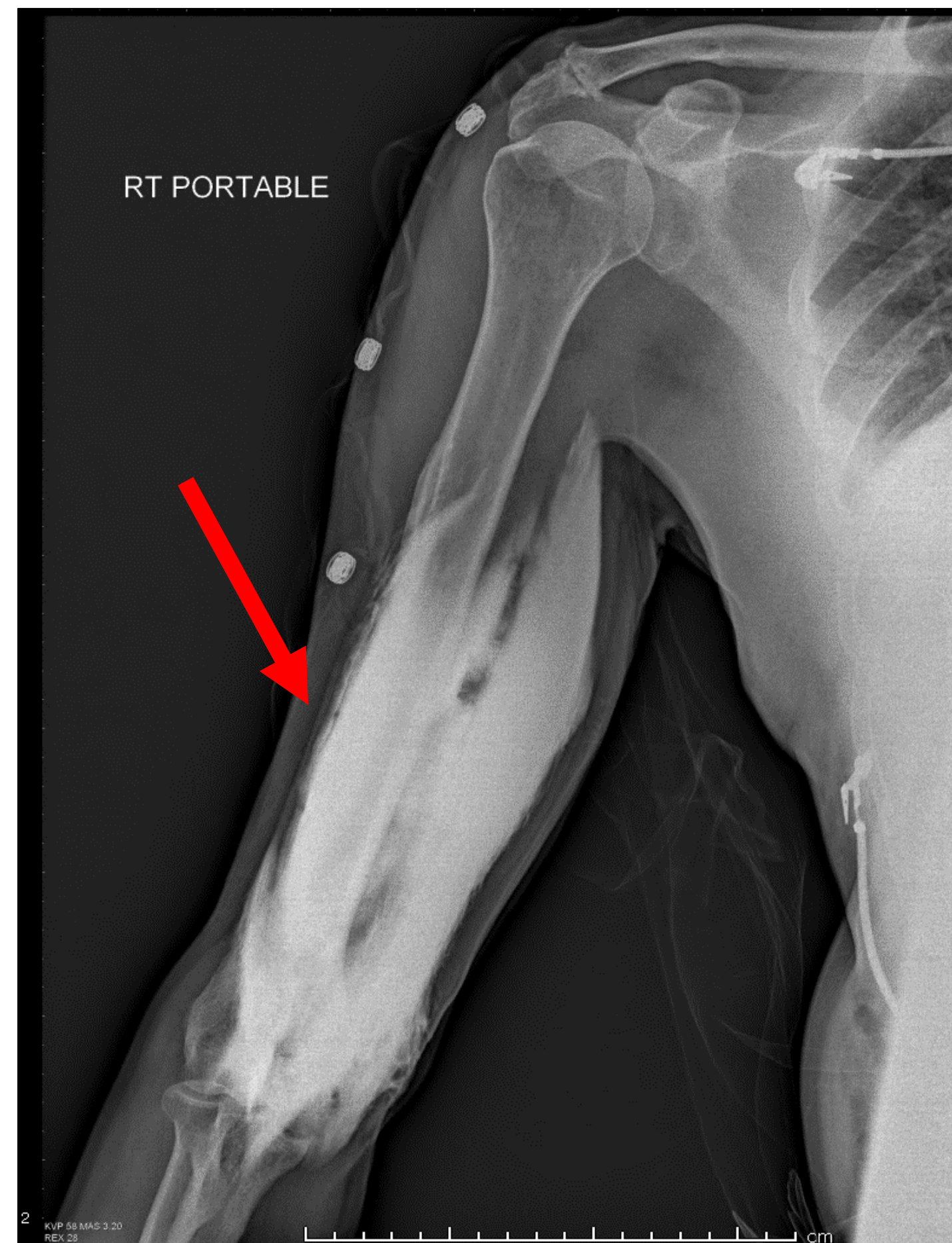


Figure 2: Example of contrast extravasation from a CT pulmonary embolism study. IV contrast is seen in the muscle fascial planes of the right biceps (red arrow).

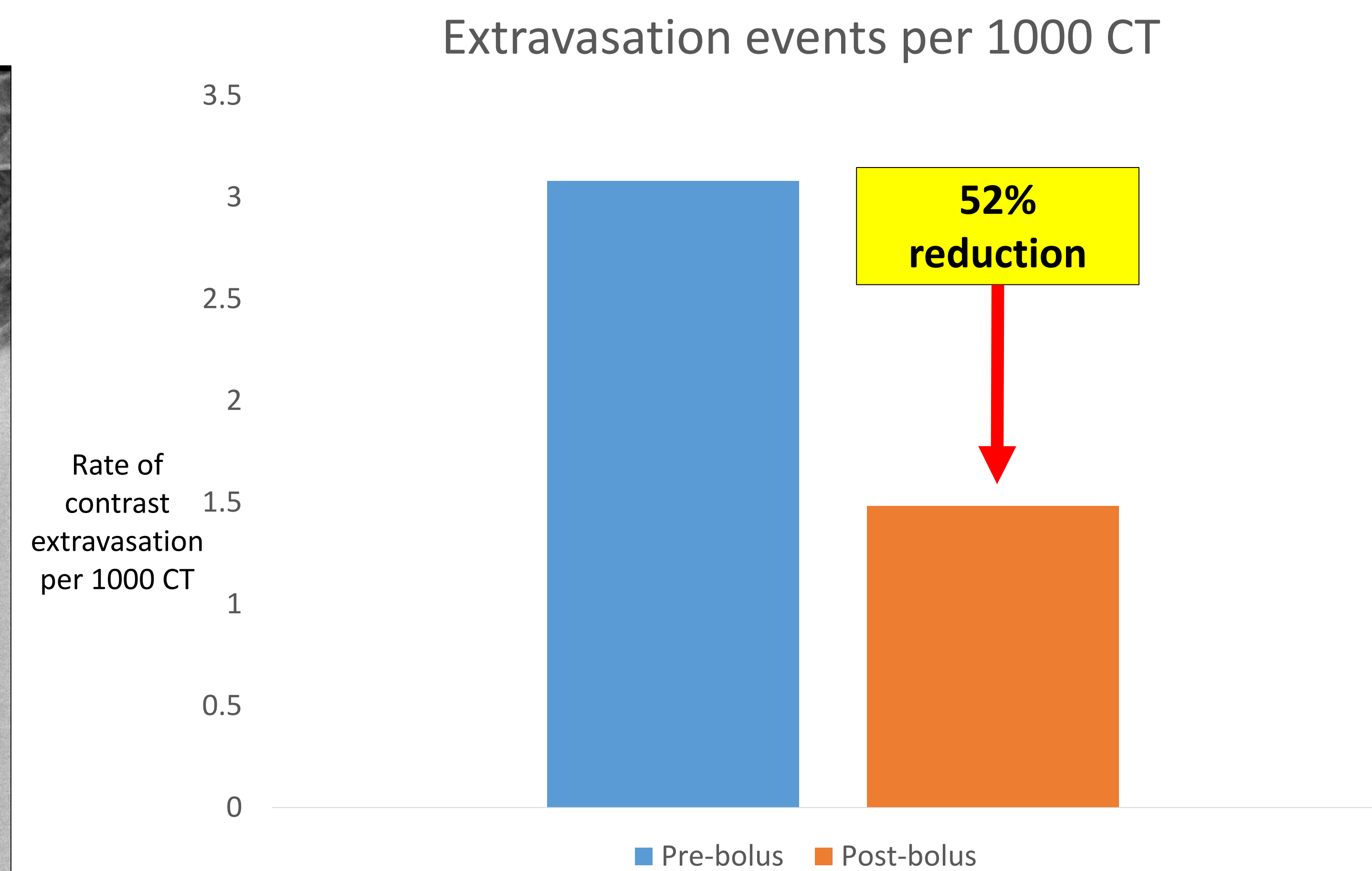


Figure 3: A total of 113 events occurred from November 1, 2013 to April 30, 2016 (blue) in relation to 36,682 CT, giving a rate of 3.08/1000 CT. Saline test bolus utilization started on May 1, 2016. There were a total of 32 events from May 1, 2016 to July 31, 2017 (orange) in relation to the 14,447 contrast enhanced CT, resulting in an extravasation rate of 1.48/1000 CT. This corresponds to a 52% reduction in the extravasation rate when using the saline test bolus compared to conventional methods ( $p = 0.0002$ ).

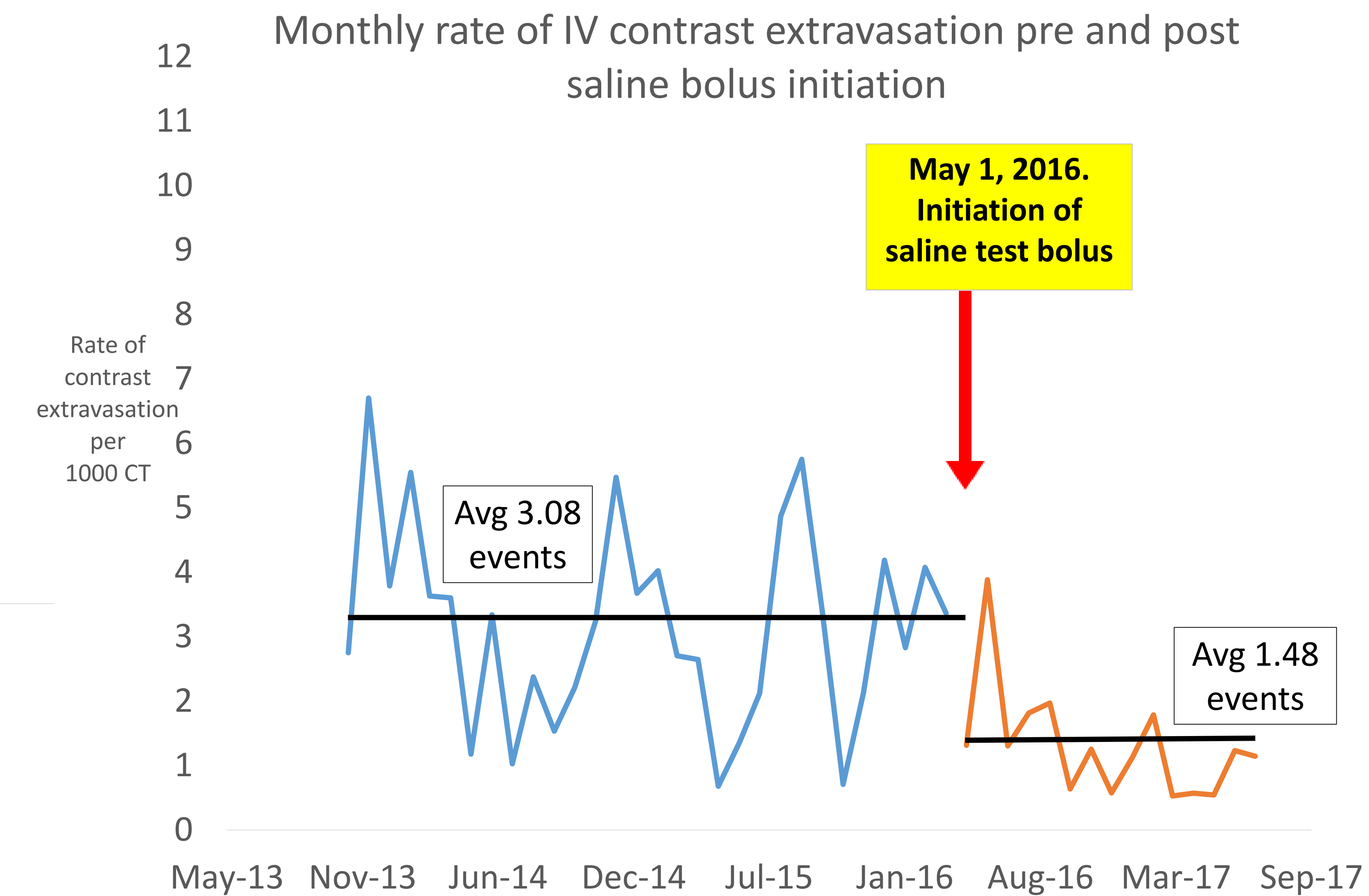


Figure 4: Monthly rate of IV contrast extravasation in relation to total contrast enhanced CT per month from November 1, 2013 to January 31, 2017 (blue). Saline test bolus utilization started on May 1, 2016 with monthly rates until July 31, 2017 (orange).

**Background:** Extravasation of IV contrast during a CT scan is not an uncommon event that harms patient safety, with rare instances of severe complications. Besides the possible complications of contrast extravasation as well as patient inconvenience, these events also disrupt workflow of the health care team since assessment of the patient is needed with observation required after the event. In most instances, extravasated IV contrast causes only temporary pain and swelling, however in severe cases, long term pain and impairment requiring surgery have been reported. The purpose of this study is to assess whether reduction of IV contrast extravasation can be achieved using pre-injection of saline through a power injector to assess the viability of the IV prior to contrast injection. The rationale is that extravasation of small volume of normal saline is preferable to extravasated contrast, with the latter resulting in more severe complications.

**Methods:** A MedRad Stellant Dual Syringe CT injection system was utilized. Baseline number of contrast extravasations data was collected from November 1, 2013 to April 30, 2016. Beginning May 1, 2016, we implemented a protocol of pre-injecting 30cc saline through the IV using a power injector prior to administering the IV iodinated contrast at the same rate as contrast. If this test injection was successful, IV contrast was then administered. If the injected saline extravasated, the IV site was not used, and a new site of access attempted. Total number of contrast enhanced CT scans were obtained using retrospective search of our institution's radiology EMR with keyword "Isovue-370" as the search phrase. P-value calculated using Chi-Square test of independence.

**Results:** Data was acquired from 4 hospitals across the Einstein network in Philadelphia. A total of 36,682 contrast enhanced CT examinations were performed from November 1, 2013 to April 31, 2016 utilizing Isovue-370. The total number of extravasations during this baseline period is 113, which represents an average of 3.77 extravasations/month, and corresponds to extravasation rate of 3.08/1000 CT. Following the initiation of the protocol using the pre-injected saline with a power injector, a total of 14,447 contrast enhanced CT examinations were performed from May 1, 2016 to July 31, 2017. The total number of extravasations during this intervention period is 32, which represents an average of 2.46 extravasation/month, and corresponds to an extravasation rate of 1.48/1000 CT. This represents a 52% reduction in extravasation rate compared to the baseline period before the initiation of the pre-injected saline protocol ( $p = 0.0002$ ).

**Conclusion:** Pre-injection of saline bolus with a power injector is a safe and effective method to reduce IV contrast extravasation. This technique is generalizable and can further improve patient safety at other centers if continued education and training of this method is undertaken.

**References:**

- ACR Manual on Contrast Media, Version 10.2, 2016
- Al-Benna S, O'Boyle C, Holley J. Extravasation injuries in adults. *ISRN Dermatology* 2013.
- Wang C, Cohan R, Ellis J, Adusumilli S, Dunnick N. Frequency, management, and outcome of extravasation of nonionic iodinated contrast medium in 69 657 intravenous injections. *Radiology* 2007;243:80-87.