Development of a CT Contrast Program: A Model for Community Hospitals

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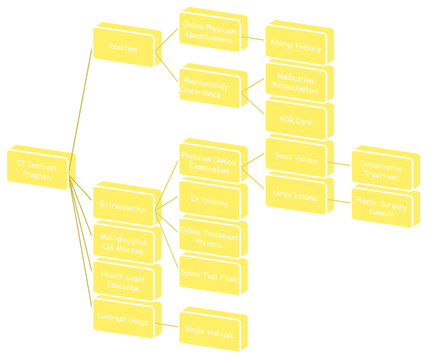
Purpose:

We review the development and achievements of our CT IV contrast program, emphasizing the diligence and consistency required to attain significant reductions in contrast extravasations and reactions. The importance of staff education and training is highlighted. We also discuss ways to maximize efficiency and cost effectiveness while maintaining patient safety.

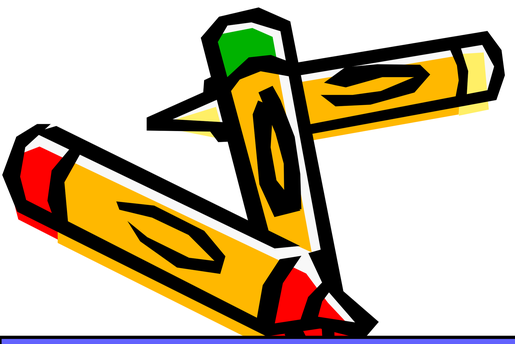


Materials and Methods:

Our research was conducted in a large community hospital with 135,000 total exams per year. We performed a retrospective review of incidents of contrast extravasations and adverse reactions that occurred from July 2005 through March 2010. Data sources included patient records and incident reports that were completed by both a technologist or nurse and a supervising radiologist. Information gathered included patient demographics; type and description of incident; subsequent management; and volume, rate and severity of contrast extravasations. All incidents were presented at monthly multidisciplinary QA meetings, and we introduced several measures in response to our data and existing literature. Notably, we introduced instrumental safety initiatives in April 2008 including universal use of nonionic contrast in single use vials (with low-osmolar contrast agents used for patients with impaired renal function); on-line placement of protocols/screening forms; strict documentation of contrast type and volume usage; and close collaboration with Pharmacy in order to assist our understanding and tracking of incidents. We compare the quarterly incidence of extravasations and contrast reactions before and after these changes.

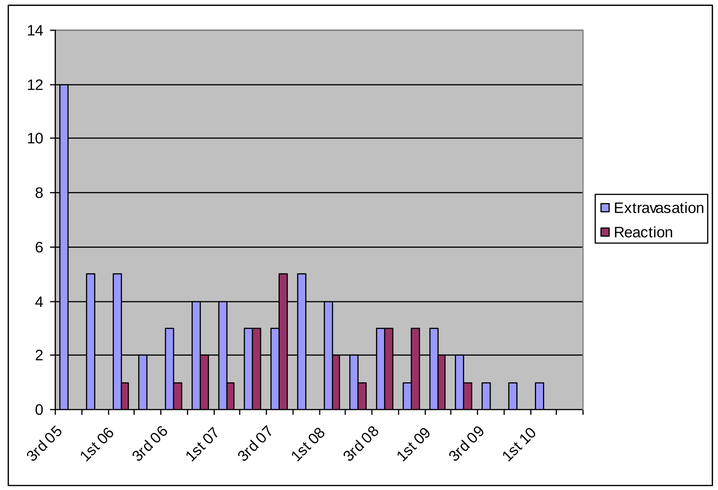
Policy Initiatives (April 2008):

- Universal use of nonionic contrast in single use vials
- Low-osmolar contrast agents used for patients with impaired renal function
- On-line placement of protocols/screening forms
- Strict documentation of contrast type and volume usage
- Close collaboration with Pharmacy (ADR cards)
- Workshops to teach proper injection technique
- Administration of saline test flushes before all contrast injections



Results:

The development of an educational program, enhanced staff monitoring, and universal use of test flushes were critical to injection safety and the reduction of extravasations. A specially trained interventional nurse conducted workshops to teach proper injection technique and IV line testing/installation. Residents and nurses were formally certified after having performed 10 successful injections and passing a competency test. Administration of saline test flushes before all contrast injections has helped reduce unwanted extravasations. Real-time monitoring of the patient's injection site by residents and technicians for up to 20 seconds following contrast injections ensures that errant injections can be promptly halted if necessary.



- During the 39 months preceding our department-wide intervention in April 2008 there were 56 extravasations (quarterly mean 4.31).
- In the 18 months following, there were 11 extravasations (quarterly mean 1.83), a 58% reduction.
- In 2005, the highest quarterly extravasation rate was 0.9%, as opposed to the recent quarterly incidence of 0.06%. No patients needed surgical intervention and none had severe long-term sequelae.

Premedication Regimen

"At-risk" patients include, but are not limited to, patients who have had a prior reaction to intravenous CT contrast media. Ultimately, the decision of who is "at-risk" will be made by the radiologist in conjunction with the ordering physician.
Premedication regimen is as follows:

Adult:
Prednisone 50 mg PO 12 and 1 hour pre-injection
Diphenhydramine 50 mg PO 1 hour pre-injection
Cimetidine 300 mg PO 1 hour pre-injection

Pediatric:
Prednisone 1 mg/kg PO 12 and 1 hour pre-injection
Diphenhydramine 1 mg/kg 1 hour pre-injection
Cimetidine 5 mg/kg 1 hour pre-injection

Measures undertaken to minimize allergic reactions included development of policies defining appropriateness use of IV contrast (nonionic and low-osmolar) for a variety of clinical scenarios. For example, in a patient with elevated creatinine it is our policy that a renal consult should be obtained for nonemergent cases if an alternative study (MRI or Ultrasound) is not appropriate. For emergent cases, the ordering physician must document that delay of diagnosis by waiting for a renal consult is too great compared to a risk of renal failure.

To minimize pyogenic reactions associated with multiple piercing of large volume bottles we have universally adopted the use of single-use 100 ml vials. Residual contrast totals were calculated on a monthly basis from calculating the difference of filled and injected volumes. Residual contrast totals were calculated on a monthly basis from calculating the difference of filled and injected volumes. We have achieved monthly contrast utilization efficiencies of 95%-99%.

Online screening questionnaires for referring physicians were also installed to help detect contrast risk. CT technologists act as an additional safeguard by reassessing patients prior to injection, noting discrepancies or incomplete allergic histories. Standardized protocols were developed for premedication and to provide assistance for management of contrast related emergencies.

Indications for Visipaque (Iso-osmolar)

- Creatinine level between 1.6 to 1.9 or GFR under 60.
  - Consider non-contrast or alternative test (US or MRI).
- Creatinine ≥ 2 or GFR <30:
  - Consider non-contrast or alternative test.
  - Administer iodinated contrast only for emergent cases with informed consent and documented medical necessity
  - For non-emergent cases, a renal consult should be obtained
- Patients with a history of congestive heart failure (CHF)
- Age > 80
- In emergent situations where patient is elderly and age is unknown.
- Renal failure patients not required to receive Visipaque if dialysis following the study.

Together with Pharmacy we have developed adverse drug interaction (ADR) cards that permit improved differentiation of genuine contrast reactions from those due to polypharmacy.

From a quarterly high of five allergic reactions in the latter part of 2007 we have witnessed a gradual decline, with no reported allergic reactions in the past three quarters.

Conclusion:

Diligent monitoring of contrast usage can improve efficiency, reduce operating costs and promote patient safety, without sacrificing diagnostic quality. Our CT IV Contrast Program is equipped with multiple checkpoints and safeguards to reduce reactions and extravasations. Key elements include staff education and regular drill-downs to identify problems and implement solutions.