Children's Health Orange County (CHOC)
Best Evidence and Recommendations (BEaR)

Epinephrine Administration for Contrast Anaphylaxis in Radiology

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Abstract

Contrast media is administered in a significant percentage of radiology exams to help delineate structures within the body. Allergic-like reactions to contrast media are low-frequency, high-risk events that can lead to significant patient harm if not treated quickly and appropriately. Radiology departments are often underprepared and uncomfortable managing these events (Asch et al., 2023). The goal of this evidence-based practice project was to identify best practices related to contrast anaphylaxis in the radiology department, ensuring our institution provides optimal care for our pediatric patients.

The review process highlighted several key findings: contrast reactions are infrequent; typically occurring 20-30 minutes after contrast administration, and radiology department personnel may be underprepared to manage a serious reaction. Effective strategies to enhance outcomes in these high-risk situations include conducting contrast reaction-specific simulations with all members of the radiology team and implementing strategies to reduce epinephrine administration errors. Epinephrine autoinjectors can help reduce these errors.

In addition to staff education and simulation exercises, other evidence-based practices include enforcing a post-injection waiting period for each child, posting emergency response treatment algorithms, utilizing standardized contrast reaction kits, and using epinephrine autoinjectors. Implementing these practice recommendations will strengthen the unit's emergency response plan, provide clear guidance for staff and physicians, and reduce the likelihood of serious adverse events.

Keywords

Contrast; contrast media; anaphylaxis; epinephrine; adrenaline; adverse reactions; radiology; pediatrics; treatment

PICOT

What are the best practices for the safe and effective administration of epinephrine for the treatment of contrast-related anaphylaxis in the radiology department?

Background and Significance

Anaphylactic contrast reactions are low-frequency, high-risk events that can result in life-threatening injury to the patient if not treated appropriately. 0.01-0.6% of contrast injections result in a reaction among radiology patients (American College of Radiology [ACR], 2024). At our institution, the contrast reaction rate was 0.06% in 2023. While this represents a low occurrence, the current process for managing contrast reactions in radiology is not clearly defined and lacks a standardized policy or treatment guideline, increasing the risk of adverse events. The evidence highlights opportunities for improvement that can help reduce adverse events and optimize patient safety when a contrast reaction occurs.

In 2024, contrast was administered in 53.4% of radiology exams. This represents a large percentage of exams utilizing contrast, and as the hospital and department continue to expand, that number will increase each year. With the opening of new facilities in 2025, an additional outpatient radiology area will be operational with different emergency response protocols. A code team is activated in the hospital and the current radiology department during serious medical emergencies. However, 911 will be called in the new facility for medical emergencies, potentially increasing the time before help arrives. In the case of an anaphylactic response to contrast, this delay could be fatal if appropriate treatment is not rendered quickly. Currently, the radiology department at our organization does not have a standardized policy or treatment algorithm for managing contrast reaction emergencies, including the administration of epinephrine in these events. Implementing strategic resources like care guidelines, allergic reaction kits and posted treatment algorithms to provide visual aid in managing contrast reactions can help standardize treatment, mitigate errors and improve patient outcomes.

The findings from this project have contributed to the knowledge base for creating a contrast reaction care guideline and implementing clinical practice improvements that will help implement a standardized response and improve patient outcomes. Additionally, there is ongoing development of educational materials to help increase staff comfort and confidence in managing contrast reactions, reducing epinephrine administration errors, and reduce time to administration.

This project aligns with our organization's goals and priorities by utilizing evidence-based practice to provide the safest and most effective care for all patients in the pursuit of our mission to nurture, advance, and protect the health and well-being of children.

Framework

This EBP project utilized the "Translating Evidence into Practice: CHOC's Approach to EBP" model, adapted from the EBPI Model © 2007 Brown & Ecoff (Ecoff, Stichler & Davidson, 2020).

Search for the Evidence

Databases searched for this review included CINAHL, Google Scholar, PubMed, and Wiley Online Library. Key search words: contrast; contrast media; anaphylaxis; epinephrine; adrenaline; adverse reactions; radiology; pediatrics; treatment. This search yielded 40 articles including systematic reviews, retrospective reviews, case reports, and expert opinion. Of these articles, 15 were found to have applicable information.

Anaphylaxis clinical care guidelines were also reviewed from seven children's hospitals nationwide to gain insight into current best practices. These institutions include Children's Hospital of Colorado, Children's Hospital of Philadelphia, Children's Wisconsin, Connecticut Children's, Johns Hopkins All Children's Hospital, Nationwide Children's Hospital and University of Texas MD Anderson Cancer Center. Personal correspondence was made with Children's Hospital of Los Angeles (CHLA), Rady Children's Hospital, and Phoenix Children's Hospital.

Critical Appraisal and Synthesis of the Evidence

- Contrast reactions are infrequent and typically occur 20-30 minutes after contrast administration (ACR, 2024; Fukushima et al., 2023).
- The low incidence of reaction events highlights that radiology departments may be underprepared to manage serious contrast reactions. Reasons for this include a lack of posted treatment algorithms, inadequate equipment and medications, and infrequent application of epinephrine knowledge in practice (Asch et al., 2023; Gardner et al., 2018; Nandwana et al., 2015).
- Due to the limited nature of studying a high-risk event, most literature on pediatric contrast reaction management consists of expert opinions or retrospective analyses. There is a lack of well-designed pediatric-specific clinical studies.
- Several anaphylaxis clinical practice guidelines are available from children's hospitals nationwide, though few specifically address pediatric contrast reactions.
- Emergency response simulations for contrast reactions involving all radiology clinical staff help address knowledge gaps, increase comfort, and build a cohesive team, leading to improved practice translation (Coupal et al., 2018; Tofil et al., 2010; Wang et al., 2020)
- Key methods to standardize emergency responses to contrast reactions include:
    - Posting treatment algorithms (Nandwana et al., 2015).
    - Using standardized contrast reaction kits (Asch et al., 2023; CHLA, personal communication, 2024).
    - Utilizing epinephrine autoinjectors (Asch et al., 2023).

- Epinephrine administration errors involving dose, delivery method, and concentration are common in radiology.
    - Epinephrine autoinjectors reduce dose, delivery method, and concentration errors, and demonstrate faster administration times (Asch et al., 2017).
    - Epinephrine autoinjectors are associated with increased provider comfort (Asch et al., 2017; Fukushima et al., 2023; Masch et al., 2016).
- Implementing innovative practices such as visual aids for staff, standardized contrast reaction kits, and epinephrine autoinjector use, reduced epinephrine administration errors and improved staff comfort in managing contrast reactions (Asch et al., 2017; Asch et al., 2023; Coupal, et al., 2018).
- Best practices include screening for high-risk patients (CHLA, personal communication, 2024; Maloney et al., 2019).
    - Our institution already conducts thorough screening to determine if a patient is considered high risk before contrast administration.
    - Screening for a history of asthma with active wheezing was noted in the literature and by other institutions as a contraindication to the administration of contrast, including MRI contrast (CHLA, personal communication, 2024; Maloney et al., 2019). Currently, our institution only screens for asthma and active wheezing with CT contrast.
- Best practices and policies from other pediatric healthcare facilities included:
    - Utilizing contrast reaction kits in all areas that administer contrast (CHLA, personal communication, 2024).
    - A contrast reaction treatment algorithm should be included in the policy (CHLA, personal communication, 2024).
    - Using epinephrine autoinjectors (Children's Hospital of Philadelphia, 2023; Children's Wisconsin, 2020; Johns Hopkins All Children's Hospital, 2023; Nationwide Children's Hospital, n.d.).

Practice Recommendations

- Conduct contrast-reaction specific simulations involving all staff: radiologists, nurses, and technologists.
- Monitor patients for 20-30 minutes after contrast is administered.
- Post treatment algorithms in all areas where contrast is administered.
- Implement standardized contrast reaction kits in radiology.
- Utilize epinephrine autoinjectors in all radiology areas.

Outcome Measures

The proposed outcomes to be measured include:

- Staff comfort and confidence in managing contrast reactions.
- Frequency of epinephrine administration errors
- Epinephrine administration times: comparing manual administration vs. autoinjector use.

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