**Pediatric Management of Contrast Media Reactions**

Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.

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Any signs or symptoms of hypersensitivity reaction/allergic reaction, notify Responding Provider¹ and activate the appropriate emergency response process for your area. *If available, notify Pediatric Intensive Care Unit (PICU): 713-745-0570*

**Note:** Page 2 of this algorithm is intended for Providers; subsequent pages (3-9) are for both Providers and Nurses

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**PREVIOUS HISTORY OF REACTIONS²**

- Yes
  - Previous anaphylactic or severe reaction to any contrast media?
    - Yes
      - Consider non-contrast/alternate study or follow with management below as clinically indicated:
        - **Regimen 1:**
          - Prednisone ⁴ 0.5-0.7 mg/kg (maximum 50 mg/dose) PO – Give 13 hours, 7 hours, and 1 hour prior to procedure and
          - Diphenhydramine 1 mg/kg (maximum 50 mg/dose) PO – Give 1 hour prior to procedure
        - **Regimen 2:** (for patients unable to tolerate oral or for urgent cases)
          - Hydrocortisone² 2 mg/kg (maximum 100 mg/dose) IV – Give 5 hours and 1 hours prior to procedure and
          - Diphenhydramine 1 mg/kg (maximum 50 mg/dose) IM – Give 1 hour prior to procedure
    - No
      - If emergency procedure³ required and patient has previous history of mild to moderate reaction:
        - Consider non-contrast/alternate study or
        - Hydrocortisone² 0.5-1 mg/kg (maximum 100 mg/dose) IV every 4 hours until procedure is completed and
        - Diphenhydramine 0.5-1 mg/kg (maximum 50 mg/dose) IV, 1 hour prior to procedure
  - No
    - Continue with scheduled procedure

- No IV contrast and consider non-contrast/alternate study

**PROPHYLACTIC TREATMENT**

**Note:** See Appendix B on Page 8 for Reaction Rebound Prevention

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1. Applicable provider may include: local provider in the area where the reaction occurs, anesthesiologist, radiation oncology team, diagnostic imaging team/radiologist, etc.
2. See Appendix A for Categories of Acute Reactions to Contrast Media
3. High risk factors include patients with previous anaphylactic reactions to food or medication
4. Caution use of steroids in patients receiving Chimeric Antigen Receptor (CAR)-T cell therapy, uncontrolled hypertension, diabetes, tuberculosis, systemic fungal infections, peptic ulcer disease, neutropenic colitis or diverticulitis.
5. If allergic, contact primary physician. If patient has received CAR-T cell therapy (as denoted in the patient banner in the EHR), contact Pediatric Stem Cell Transplant service.

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Any signs or symptoms of hypersensitivity reaction/allergic reaction, notify Responding Provider¹ and activate the appropriate emergency response process for your area. *If available, notify Pediatric Intensive Care Unit (PICU): 713-745-0570*  

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### PRESENTING SYMPTOMS

- Urticaria (hives), rash, itching, facial flushing
- Severe or widely disseminated ²

### TREATMENT

- **Stop infusion** of contrast and hold procedure until symptoms have improved
- Ensure IV access
- For mild to moderate itching, consider:
  - Diphenhydramine 1 mg/kg (maximum 50 mg/dose) IV push over 5 minutes

**Patient symptoms resolved or stable within 5 minutes?**

- Yes
- No

- **Stop infusion** of contrast and hold procedure
- Stay with patient to monitor symptoms, check SpO₂ continuously, and obtain vital signs
- If associated with hypotension ³ or respiratory distress then considered anaphylaxis:
  - Initiate oxygen via non-rebreather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%
  - Ensure IV access. Give sodium chloride 0.9% (NS) 10 mL/kg (maximum 1000 mL) IV via rapid infusion (push-pull technique).
  - Elevate legs > 60°
  - Epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.5 mg/dose) IM ⁴
- If moderate or severe skin findings ONLY, give diphenhydramine 1 mg/kg (maximum 50 mg/dose) IV push over 5 minutes

**Note:** See Appendix B on Page 8 for Reaction Rebound Prevention

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¹ Applicable provider may include: local provider in the area where the reaction occurs, anesthesiologist, radiation oncology team, diagnostic imaging team/radiologist, etc.

² See Appendix A for Categories of Acute Reactions to Contrast Media

³ Communicate the contrast media reaction event to the Primary Care Team so that precautionary measures are considered for future scans

⁴ Hypotension is defined as: Age 0 – 28 days: SBP < 60 mmHg; Age 1 – 12 months: SBP < 70 mmHg; Age 1 – 10 years: SBP < [70 mmHg + (age in years x 2)]; Age > 10 years: SBP < 90 mmHg

⁵ Administer epinephrine IM into the antero-lateral mid-third portion of the thigh. Administration via IM route is preferred regardless of platelet count.

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Pediatric Management of Contrast Media Reactions

**Presenting Symptoms**

**Hypotension** with bradycardia / vasovagal reaction (responsive patient)

- Airway positioning to ensure patency and suction as needed.
- Initiate oxygen via non-rebreather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%.
- Ensure IV access
- Monitor vital signs
- Elevate legs > 60º
- Give sodium chloride 0.9% (NS) 10 mL/kg IV (maximum 1000 mL) via rapid infusion (push-pull technique)

**Hypotension** with tachycardia

- Airway positioning to ensure patency and suction as needed.
- Initiate oxygen via non-rebreather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%.
- Ensure IV access
- Monitor vital signs
- Elevate legs > 60º
- Give sodium chloride 0.9% (NS) 10 mL/kg IV (maximum 1000 mL) via rapid infusion (push-pull technique)
- Give epinephrine (1 mg/mL) 0.01 mg/kg IM (maximum 0.5 mg/dose)

**Treatment**

- Activate appropriate emergency response process
- Continue monitoring
- Responding Provider:
  - Evaluate and consider:
    - Atropine 0.02 mg/kg (maximum 1 mg for infants/children and 2 mg for adolescent) IV push over 1 minute for vasovagal reaction
    - Ensure proper hand-off to the emergency response team and inform the Primary Care Team

- Disposition per emergency response team
- Document allergy and enter safety event

**Responding Provider**:

- Evaluate and consider:
  - Repeating epinephrine every 5 minutes if symptoms persist/progress
  - Ensure proper hand-off to the emergency response team and inform the Primary Care Team

**Note:** See Appendix B on Page 8 for Reaction Rebound Prevention

Any signs or symptoms of hypersensitivity reaction/allergic reaction, notify Responding Provider and activate the appropriate emergency response process for your area.

*If available, notify Pediatric Intensive Care Unit (PICU): 713-745-0570*

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**CPR** = cardiopulmonary resuscitation

1 Applicable provider may include: local provider in the area where the reaction occurs, anesthesiologist, radiation oncology team, diagnostic imaging team/radiologist, etc.

2 Hypotension is defined as:
   - Age 0 – 28 days: SBP < 60 mmHg; Age 1 – 12 months: SBP < 70 mmHg; Age 13 – 17 years: HR < 60 bpm
   - Age 5 – 12 years: HR < 70 bpm; Age 13 – 17 years: HR < 60 bpm

3 Bradycardia is defined as:
   - Age 0 – 1 year: HR < 100 bpm; Age 2 – 4 years: HR < 80 bpm; Age 5 – 12 years: HR < 70 bpm; Age 13 – 17 years: HR < 60 bpm

4 Tachycardia is defined as:
   - Age 0 – 28 days: HR > 160 bpm; Age 1 – 12 months: HR > 140 bpm; Age 1 – 10 years: HR > 120 bpm; Age > 10 years: HR > 110 bpm

5 Administer epinephrine IM into the antero-lateral mid-third portion of the thigh. Administration via IM route is preferred regardless of platelet count.

6 In patients with myocardial dysfunction or history of dysfunction, provider to consider normal saline 5-10 mL/kg while continuously monitoring for signs of fluid overload

7 Communicate the contrast media reaction event to the Primary Care Team so that precautionary measures are considered for future scans

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Any signs or symptoms of hypersensitivity reaction/allergic reaction, notify Responding Provider and activate the appropriate emergency response process for your area.

*If available, notify Pediatric Intensive Care Unit (PICU): 713-745-0570*

**PRESENTING SYMPTOMS**

- Respiratory distress (responsive patient)
  - Activate appropriate emergency response process
  - Airway positioning to ensure patency and suction as needed. Initiate oxygen via non-breather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%.
  - Ensure IV access
  - Monitor vital signs
  - Call Responding Provider to bedside to evaluate

**TREATMENT**

- Pulmonary edema as diagnosed by provider
  - Responding Provider to place order for furosemide 1 mg/kg (maximum 40 mg/dose) IV push over 2 minutes

- Bronchospasm (expiratory wheeze) as diagnosed by provider
  - Responding Provider to evaluate and place orders for:
    - Albuterol 2.5 mg nebulized; may repeat every 20 minutes for up to 3 doses
    - Epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.5 mg/dose) IM; may repeat once in 5 minutes if no improvement

- Continue monitoring
  - Responding Provider to ensure proper hand-off to the emergency response team and inform the Primary Care Team
  - Disposition per emergency response team
  - Document allergy and enter safety event

**Note:** See Appendix B on Page 8 for Reaction Rebound Prevention

1 Applicable provider may include: local provider in the area where the reaction occurs, anesthesiologist, radiation oncology team, diagnostic imaging team/radiologist, etc.
2 Administer epinephrine IM into the antero-lateral mid-third portion of the thigh. Administration via IM route is preferred regardless of platelet count.
3 Communicate the contrast media reaction event to the Primary Care Team so that precautionary measures are considered for future scans.
Any signs or symptoms of hypersensitivity reaction/allergic reaction, notify Responding Provider¹ and activate the appropriate emergency response process for your area. *Pediatric Intensive Care Unit (PICU) (713-745-0570)*

**PRESENTING SYMPTOMS**

**Laryngeal edema (inspiratory stridor)**
- Activate appropriate emergency response process
- Airway positioning to ensure patency and suction as needed
- Initiate oxygen via non-rebreather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%
- Ensure IV access
- Monitor vital signs
- Give epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.5 mg/dose) IM²

**Seizures/convulsions**
- Activate appropriate emergency response process
- Airway positioning to ensure patency, turn patient on side to avoid aspiration and suction as needed. If available, consider calling STAT Airway Team if airway is compromised.
- Initiate oxygen via non-rebreather mask at 10 L/minute and titrate up to 15 L/minute to maintain oxygen saturation ≥ 92%
- Ensure IV access
- Monitor vital signs

**TREATMENT**

Responding Provider¹ to evaluate and consider:
- Repeating epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.5 mg/dose) IM² once in 5 minutes if no improvement

Responding Provider¹ to evaluate and order if available:
- If seizure activity > 1 minute, order lorazepam 0.05-0.1 mg/kg (maximum 4 mg/dose) IV; may repeat in 10 minutes
- If no IV access, order diazepam gel rectally (note: round dose to nearest 2.5 mg, not to exceed 20 mg/dose)
  - 2-5 years: 0.5 mg/kg
  - 6-11 years: 0.3 mg/kg
  - 12 years and older: 0.2 mg/kg

- Continue monitoring
- Responding Provider¹ to ensure proper hand-off to the emergency response team and inform the Primary Care Team²
- Disposition per emergency response team
- Document allergy and enter safety event

Note: See Appendix B on Page 8 for Reaction Rebound Prevention

¹ Applicable provider may include: local provider in the area where the reaction occurs, anesthesiologist, radiation oncology team, diagnostic imaging team/radiologist, etc.
² Administer epinephrine IM into the antero-lateral mid-third portion of the thigh. Administration via IM route is preferred regardless of platelet count.
³ Communicate the contrast media reaction event to the Primary Care Team so that precautionary measures are considered for future scans

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### APPENDIX A: Categories of Acute Reactions

#### Mild Reactions
Signs and symptoms appear self-limited without evidence of progression (e.g., limited urticaria with mild pruritis, transient nausea, one episode of emesis) and include:

<table>
<thead>
<tr>
<th>Allergic-like</th>
<th>Physiologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited urticaria/pruritus</td>
<td>Limited nausea/vomiting</td>
</tr>
<tr>
<td>Limited cutaneous edema</td>
<td>Transient flushing/warmth/chills</td>
</tr>
<tr>
<td>Limited “itchy”/“scratchy” throat</td>
<td>Headache/dizziness/anxiety/altered taste</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>Mild hypertension</td>
</tr>
<tr>
<td>Sneezing/conjunctivitis/rhinorrhea</td>
<td>Vasovagal reaction that resolves spontaneously</td>
</tr>
</tbody>
</table>

#### Moderate Reactions
Signs and symptoms are more pronounced. Some of these reactions have the potential to become severe if not treated and include:

<table>
<thead>
<tr>
<th>Allergic-like</th>
<th>Physiologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse urticaria/pruritus</td>
<td>Protracted nausea/vomiting</td>
</tr>
<tr>
<td>Diffuse erythema, stable vital signs</td>
<td>Hypertensive urgency</td>
</tr>
<tr>
<td>Facial edema without dyspnea</td>
<td>Isolated chest pain</td>
</tr>
<tr>
<td>Throat tightness or hoarseness without dyspnea</td>
<td>Vasovagal reaction that requires and is responsive to treatment</td>
</tr>
<tr>
<td>Wheezing/bronchospasm without hypoxia</td>
<td></td>
</tr>
</tbody>
</table>

#### Severe Reactions
Signs and symptoms are often life-threatening and can result in permanent morbidity of death if not managed appropriately and severe reactions include:

<table>
<thead>
<tr>
<th>Allergic-like</th>
<th>Physiologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse edema, or facial edema with dyspnea</td>
<td>Vasovagal reaction resistant to treatment</td>
</tr>
<tr>
<td>Diffuse erythema with hypotension</td>
<td>Arrhythmia</td>
</tr>
<tr>
<td>Laryngeal edema with stridor and/or hypoxia</td>
<td>Convulsions, seizures</td>
</tr>
<tr>
<td>Wheezing/bronchospasm with hypoxia</td>
<td>Hypertensive emergency</td>
</tr>
<tr>
<td>Anaphylactic shock (hypotension plus tachycardia)</td>
<td></td>
</tr>
</tbody>
</table>

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1 Cardiopulmonary arrest is a nonspecific end-stage result that can be caused by a variety of the following severe reactions, both allergic-like and physiologic; if it is unclear what etiology caused the cardiopulmonary arrest, it may be judicious to assume the reaction is/was an allergic-like one. Pulmonary edema is a rare severe reaction that can occur in patients with tenuous cardiac reserve (cardiogenic pulmonary edema) or in patients with normal cardiac function (noncardiogenic pulmonary edema). Noncardiogenic pulmonary edema can be allergic-like or physiologic; if the etiology is unclear, it may be judicious to assume that the reaction is/was an allergic-like one.
## APPENDIX B: Rebound Reaction Prevention

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<th>Drug</th>
<th>Recommended Dose</th>
<th>Daily Maximum Dose</th>
</tr>
</thead>
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<tr>
<td>Dexamethasone</td>
<td>0.5 mg/kg IV; administer over 1-4 minutes</td>
<td>10 mg per day</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>5 mg/kg IV; administer over 30 seconds</td>
<td>200 mg per day</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>1 mg/kg IV; administer over 5 minutes</td>
<td>40 mg per day</td>
</tr>
</tbody>
</table>

**Note:** While IV corticosteroids may help prevent a short-term recurrence of an allergic-like reaction, they are not useful in the acute treatment of any reaction. However, these may be considered for patients having severe allergic-like manifestations prior to transportation to the Acute Cancer Care Center, local emergency center, or inpatient unit.
SUGGESTED READINGS


This practice consensus statement is based on majority opinion of the Contrast Media Reaction Work Group at the University of Texas MD Anderson Cancer Center. These experts included:

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