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 Provider[1] and activate the appropriate emergency response process for your area.**
If available, notify MERIT: 713-792-7090

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

PREVIOUS HISTORY OF REACTIONS[2]

Previous history of contrast allergy or high-risk[3] of contrast allergy?

- No → Continue with scheduled procedure
- Yes → Previous anaphylactic or severe reaction to any contrast media?
  - No → **PROPHYLACTIC TREATMENT**
  - Yes → No IV contrast **and** consider non-contrast/alternate study

PROPHYLACTIC TREATMENT

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)
  - Hydrocortisone[4] 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

If emergency procedure[5] required and patient has previous history of mild to moderate reaction:

- Consider non-contrast/alternate study **or**
- Hydrocortisone[4] 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

If allergy or contraindications to steroids or in an emergency, premedicate with diphenhydramine 1.25 mg/kg (maximum 50 mg/dose) PO or 0.5-1 mg/kg IV (maximum 50 mg/dose), 30 to 60 minutes prior to procedure

Note: See Appendix B for Rebound Reaction 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] 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. 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.
[5] If the patient has an allergy to steroids and/or requires an emergency procedure, discussion between the radiologist and Primary Care Team is indicated, if feasible

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PRESENTING SYMPTOMS	TREATMENT	DISPOSITION
Urticaria (hives), rash, itching, facial flushing		
Mild-moderate[2]	• **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 → • If the study has not been completed earlier, provider to consider completing the imaging study if symptoms resolved and patient stable • Disposition per Responding Provider[1,3] • Document allergy and enter safety event
Severe or widely disseminated[2]	• **Stop infusion** of contrast and hold procedure • Stay with patient to monitor symptoms, check SpO_2 continuously, and obtain vital signs • If associated with hypotension[4] 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 1,000 mL) IV via rapid infusion (push-pull technique). ◦ Elevate legs > 60° ◦ Epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.3 mg/dose) IM[5] • If moderate or severe skin findings ONLY, give diphenhydramine 1 mg/kg (maximum 50 mg/dose) IV push over 5 minutes	• Activate appropriate emergency response process • Continue monitoring • Responding Provider[1] to ensure proper hand-off to the emergency response team and inform the Primary Care Team[3] • Disposition per emergency response team • Document reaction and enter safety event

Note: See Appendix B for Rebound Reaction 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] 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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PRESENTING SYMPTOMS	TREATMENT			DISPOSITION
Hypotension[2] with bradycardia[3]/ 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[4] IV (maximum 1,000 mL) via rapid infusion (push-pull technique)	• Activate appropriate emergency response process • Continue monitoring • Initiate CPR if HR < 60 bpm with poor perfusion	Responding Provider[1]: • 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[5]	• Disposition per emergency response team • Document allergy and enter safety event
Hypotension[2] with tachycardia[6] (anaphylaxis)	• 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[2] IV (maximum 1,000 mL) via rapid infusion (push-pull technique) • Give epinephrine (1 mg/mL) 0.01 mg/kg IM[7](maximum 0.3 mg/dose)	• Activate appropriate emergency response process • Continue monitoring	Responding Provider[1]: • 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[5]	

Note: See Appendix B for Rebound Reaction Prevention

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 1 – 10 years: SBP < [70 mmHg + (age in years x 2)]; Age > 10 years: SBP < 90 mmHg

[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] 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

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

[6] 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

[7] 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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PRESENTING SYMPTOMS	TREATMENT	DISPOSITION
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[1] to bedside to evaluate	
Pulmonary edema as diagnosed by provider	• Responding Provider[1] to place order for furosemide 1 mg/kg (maximum 40 mg/dose) IV push over 2 minutes • Elevate head of bed	
Bronchospasm (expiratory wheeze) as diagnosed by provider	Responding Provider[1] to evaluate and place orders for: • Albuterol 2.5 mg nebulization; may repeat every 20 minutes for up to 3 doses • Epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.3 mg/dose) IM[2]; may repeat once in 5 minutes if no improvement	
		• Continue monitoring • Responding Provider[1] to ensure proper hand-off to the emergency response team and inform the Primary Care Team[3] • Disposition per emergency response team • Document allergy and enter safety event

Note: See Appendix B for Rebound Reaction 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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PRESENTING SYMPTOMS	TREATMENT		DISPOSITION
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 0.3 mg/dose) IM[2]	Responding Provider[1] to evaluate and consider: • Repeating epinephrine (1 mg/mL) 0.01 mg/kg (maximum 0.3 mg/dose) IM[2] once in 5 minutes if no improvement	• Continue monitoring • Responding Provider[1] to ensure proper hand-off to the emergency response team and inform the Primary Care Team[3] • Disposition per emergency response team • Document allergy and enter safety event
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	Responding Provider[1] 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	

Note: See Appendix B for Rebound Reaction 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 To Contrast Media

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:

Allergic-like	Physiologic
Limited urticaria/pruritus	Limited nausea/vomiting
Limited cutaneous edema	Transient flushing/warmth/chills
Limited "itchy"/ "scratchy" throat	Headache/dizziness/anxiety/altered taste
Nasal congestion	Mild hypertension
Sneezing/conjunctivitis/rhinorrhea	Vasovagal reaction that resolves spontaneously

Moderate Reactions

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

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

Severe Reactions[1]

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

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

[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 patents 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

Drug	Recommended Dose	Daily Maximum Dose
Hydrocortisone	5 mg/kg IV; administer over 1-2 minutes	200 mg per day
Methylprednisolone	1 mg/kg IV; administer over 1-2 minutes	40 mg per day

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

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