

Patient Safety & Technique
General Postgraduate Course - May 15, 2018
SAM References

Post-Contrast Acute Kidney Disorder

Matthew Davenport, MD

1. A 5-year-old hospitalized female with congenital megaureter, appendicitis (post-operative day 3), sepsis, and eGFR of 70 undergoes contrast-enhanced CT that confirms an abdominal abscess. One day later, her serum creatinine doubles. A diagnosis of contrast-induced nephropathy is made. What is the percent likelihood that her acute kidney injury is secondary to the contrast material?

- A. 100%
- B. 50%
- C. 25%
- D. <5%

Correct Answer: D

Rationale: Contrast-induced nephropathy is usually a misnomer. Acute kidney injury occurring around the time of contrast-enhanced CT often is a correlative diagnosis related to other comorbidities, and better termed post-contrast acute kidney injury—a term that is agnostic to cause. If a threshold is used to demarcate risk of true CIN, the ACR suggests that eGFR <30 be used.

References:

- McDonald RJ, McDonald JS, Newhouse JH, Davenport MS. Controversies in Contrast Material-induced Acute Kidney Injury: Closing in on the Truth? *Radiology*. 2015 Dec;277(3):627-32
- Davenport MS, Khalatbari S, Cohan RH, et al. Contrast material-induced nephrotoxicity and intravenous low-osmolality iodinated contrast material: risk stratification by using estimated glomerular filtration rate. *Radiology*. 2013 Sep;268(3):719-28
- McDonald RJ, McDonald JS, Bida JP, et al. Intravenous Contrast Material-induced Nephropathy: Causal or Coincident Phenomenon? *Radiology*. 2016 Jan;278(1):306

2. Circa 2006, how many of the >3,000 published studies on CIN both 1) evaluated intravenous contrast material and 2) included a control group?

- A. 2
- B. 20
- C. 100
- D. 1000

Correct Answer: A

Rationale: Nearly all of the world's literature evaluating and diagnosing contrast-induced nephropathy has done so without a control group and by analyzing AKI following coronary catheterization. In 2006, the glaring deficits in the literature were recognized, which led to a revolution in thought about CIN as a diagnosis.

References:

- Rao QA, Newhouse JH. Risk of nephropathy after intravenous administration of contrast material: a critical literature analysis. *Radiology*. 2006 May;239(2):392-7.
- Katzberg RW, Newhouse JH. Intravenous contrast medium-induced nephrotoxicity: is the medical risk really as great as we have come to believe? *Radiology*. 2010 Jul;256(1):21-8.

Gadolinium Update

Daniel J. Podberesky, MD

3. Which of the following Gadolinium Based Contrast Agents (GBCA) is not a macrocyclic agent?

- A. Gadoterate meglumine (Dotarem)
- B. Gadoteridol (Prohance)
- C. Gadopentetate dimeglumine (Magnevist)
- D. Gadobutrol (Gadavist)

Correct Answer: C

Rationale: Gadopentetate dimeglumine (Magnevist) is a linear GBCA, not macrocyclic. Answer A is incorrect: Gadoterate meglumine (Dotarem) is a macrocyclic agent. Answer B is incorrect: Gadoteridol (Prohance) is a macrocyclic agent. Answer D is incorrect: Gadobutrol (Gadavist) is a macrocyclic agent

Reference: Fraum TJ, et al. JMRI 2017;46:338-353

Sedation/Anesthesia Update

Joshua Nickerson, MD

4. Animal studies have demonstrated that repeated exposures to general anesthetic agents during brain development may result in:

- A. Decrease in neuronal cell apoptosis
- B. Long-term decrease in working memory
- C. Increase in gray matter volume
- D. Increase in ventricular caliber

Correct Answer: B

Rationale: Studies in rats have shown long-term decrease in learning and memory capacity in pups exposed to anesthetic agents. Answer A is incorrect: Anesthetic exposures have been shown to cause increased cell death/ Answer C is incorrect: No conclusive volumetric data at clinical anesthetic agent exposure levels has been proven. Answer D is incorrect: No conclusive volumetric data at clinical anesthetic agent exposure levels has been proven.

Reference:

- Barton K, Nickerson JP, Higgins T, Williams RK. Pediatric Anesthesia and Neurotoxicity: What the Radiologist Needs to Know. *Pediatr Radiol.* 2018 Jan; 48(1):31-36.

What kVp Should I Use?

Samuel L. Brady, MS, PhD

5. How does CT x-ray tube output vary with kV?

- A. Exposure \propto kV/2
- B. Exposure \propto kV
- C. Exposure \propto kV²
- D. Exposure \propto kV³

Correct Answer: C

Rationale: The efficiency of photon production has been measured as the square of the tube potential. Answers A, B and D are incorrect: Output efficiency (i.e., bremsstrahlung) increases due to more energetic electrons accelerated across higher kV potentials.

Reference:

- Khan, The physics of radiation therapy, 3ed. Lippincott Williams & Wilkins; page 37

6. What is a common reason to decrease kV for a particular patient?

- A. Dose reduction
- B. Faster imaging
- C. Enhance soft tissue contrast
- D. The patient is large

Correct Answer: A

Rationale: The photon number decreases with decreasing kV allowing for patient dose reduction. Answer B is incorrect: To image faster, you would need higher mA which is usually only available at higher kVs. Answer C is incorrect: Lower kV best enhances iodine/bone. Answer D is incorrect: Larger patients require higher penetrating photons (i.e., more energetic photons) from high kVs.

Reference:

- Seyal, et al. RadioGraphics, 35(7) 2015; 1922-1939

Contrast Reaction Management

Jonathan R. Dillman, MD, MSc

7. In a child who is having acute difficulty breathing and inspiratory stridor immediately after intravenous iodinated contrast material and, what is the most appropriate management?

- A. Reassurance
- B. Diphenhydramine by mouth
- C. Intravenous corticosteroid
- D. Intramuscular epinephrine

Correct Answer: D

Rationale: This child is having a moderate to severe contrast reaction with clinical evidence of laryngeal edema. This is a life-threatening situation. Consequently, immediate administration of intramuscular epinephrine is the most appropriate treatment option.

Reference:

- <https://www.acr.org/Clinical-Resources/Contrast-Manual>. Accessed on January 24, 2018.

8. In a child with three hives following intravenous gadolinium-based contrast material injection and no other symptoms, what is the most appropriate management?

- A. Reassurance and observation
- B. Diphenhydramine by mouth
- C. Intravenous corticosteroid
- D. Intramuscular epinephrine

Correct Answer: A

Rationale: This child is having a very mild contrast reaction based on the development of a few urticaria following gadolinium-based contrast material exposure. In the patient who is otherwise asymptomatic, reassurance and observation are next most appropriate management steps.

Reference:

- <https://www.acr.org/Clinical-Resources/Contrast-Manual>. Accessed on January 24, 2018

MRI Device Safety Update

Suraj D. Serai, PhD

9. Can a cardiac MRI scan be performed on a patient with MRI conditional pacemakers ?

- A. Yes on 1.5T only
- B. Yes on 3.0T only
- C. Yes on Both 1.5T and 3.0T
- D. Cardiac MRI scans are forbidden and cannot be performed on patients with pacemakers; Neither 1.5T nor 3.0T

Correct Answer: C

Rationale: 1.5T MRI scanning is MRI conditional for all 5 approved models. 3T MRI scanning is MRI conditional for certain select models – such as Advisa MRI pacemaker.

Reference:

- <http://www.medtronic.com/us-en/healthcare-professionals/mri-surescan/implantable-cardiac-devices/sure-scan-pacing-system.html>