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:

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:
- 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.
Gandolinium 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.

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:

What kVp Should I Use?
Samuel L. Brady, MS, PhD

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

A. Exposure ∝ kV/2
B. Exposure ∝ kV
C. Exposure ∝ kV^2
D. Exposure ∝ kV^3

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:

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:
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: