Safety of Ultrasound Contrast Agents
Jamie L. Coleman, MD

1. **Ultrasound contrast agents:**
   A. Consist of particles that are much smaller than those in CT and MRI contrast agents.
   B. Pose a risk of nephrotoxicity.
   C. Are for intravascular use only.
   D. May be used to characterize focal masses in the liver.

**Correct Answer: D**

**Rationale:** Ultrasound contrast agents are larger than the iodinated contrast agents used in CT and the gadolinium based agents used in MRI, and remain in the vascular space. Ultrasound contrast agents are comprised of microspheres of gas surrounded by a biocompatible thin outer shell such as a lipid or protein, depending on the agent. The particles are much larger than the agents used for CT and MRI, and remain in the vascular space. These agents pose no risk of nephrotoxicity, and have a lower reported rate of adverse reactions than CT and MRI contrast agents. Ultrasound contrast agents may be administered intravenously for many indications; the most widely studied application is in the characterization of focal liver lesions. Following catheterization, an ultrasound contrast agent may be placed in the urinary bladder for performance of voiding cystourethrography. Other indications for pediatric use are emerging.

**References:**

2. **Reported applications of ultrasound contrast agents include:**
   A. Assessment of active synovial inflammation in subclinical cases of juvenile rheumatoid arthritis
   B. Diagnosis of solid organ injury in blunt abdominal trauma
   C. Evaluation of revascularization of the capital femoral epiphysis in Legg-Calve-Perthes’ disease
   D. All of the above

**Correct Answer: D**

**References:**


**Contrast Enhanced Ultrasound in Pediatric Oncology**
*M. Beth McCarville, MD*

3. **On CEUS the most important feature to distinguish a benign from malignant liver lesion is?**
   A. Early arterial flow
   B. The size of the lesion
   C. The location within the liver
   D. Whether or not the lesion washes out on delayed phase imaging

Correct Answer: D

Reference:
   i. Chiorean L et al., World J Gastroenterol (2015);21(28):8541-8561
   2. Jang et al., Clinical and Molecular Hepatology (2013);19:1-16

4. **The most common focal liver lesion in children previously treated for cancer is?**
   A. Adenoma
   B. Metastasis
   C. Focal nodular hyperplasia
   D. Granuloma

Correct Answer: C

Reference:
   i. Smith E. et al., Am J Roentgen (2012); 199:186-191
   3. Icher-De Bouyn C, Cancer (2003):97(12);3107-3113

**Contrast Enhanced Ultrasound of Blunt Abdominal Trauma**
*Harriet J. Paltiel, MD*

5. **Which of the following statements regarding the application of contrast-enhanced US (CEUS) in the evaluation of traumatic solid organ lesions is correct?**
   A. CEUS was recently approved in the U.S.A. for the evaluation of solid organ injury after abdominal trauma in children and adults
   B. CEUS is almost as sensitive as computed tomography (CT) in the initial identification and characterization of solid organ lesions in blunt abdominal trauma
   C. CEUS is as sensitive as CT in the identification of urinoma
   D. CEUS is almost as sensitive as MRI in the follow up of solid organ lesions in blunt abdominal trauma

Correct Answer: B
**Rationale:** Answer is B. A number of published studies have shown that in both adults and children, the sensitivity of CEUS approaches that of CT in the initial diagnosis of blunt solid organ trauma. Option A is not correct. The US contrast agent Lumason® was recently approved in the USA for the characterization of focal liver lesions in adults and children, not for the diagnosis of solid organ injury after abdominal trauma. Option C is not correct. Since the conventional US contrast agents currently available in the U.S.A. are not filtered or excreted by the kidney, they cannot be used to diagnose a urinoma. Option D is not correct. Based on the recent study by Miele et al, CEUS does not appear to detect residual or persistent solid organ injuries as well as MRI.

**References:**


6. **You are shown images from a CEUS examination (see Figure 1A-D).**
Which one of the following is the LEAST likely diagnosis?

A. Liver laceration  
B. Splenic contusion  
C. Normal left kidney  
D. Normal pancreas

**Correct Answer: A**

**Rationale:** The liver is normal in appearance with homogenous parenchymal uptake of contrast material. Option B is not correct. The spleen contains an irregular, hypoechoic focus of diminished contrast enhancement that corresponded to a focal contusion depicted by CT. Option C is not correct. The left kidney is indeed normal with homogenous parenchymal uptake of contrast material. Option D is not correct. The pancreas is indeed normal with homogenous parenchymal uptake of contrast material.
References:


Contrast Enhanced Voiding Urosonography: How I do It
Susan J. Back, MD, FAAP

7. Which of the following causes increased microbubble destruction?
   A. Injecting contrast slowly through a large bone needle (20 gauge) or catheter
   B. Decreasing the mechanical index (MI)
   C. Injecting/infusing contrast through the 90 degree position of a 3-way stopcock
   D. Gently agitating contrast vial/syringe to resuspend microbubbles in solution prior to administration

Correct Answer: C

Rationale: Contrast should be gently agitated to resuspend the microbubbles (white) into solution (clear) until there is a homogeneous milky white appearance of the contrast agent. Using larger gauge needles and catheters decrease sheering forces which can destroy microbubbles. When microbubbles are injected at the 90 degree position of a 3 way stop cock, sheering forces can destroy bubbles. Increasing the MI will destroy bubbles.

Reference:


8. Upon administration of US contrast and saline into the urinary bladder for ceVUS, contrast agent is visible in the non-dependent portion of the bladder however the remainder of the image is black. What is the next step?
   A. Increase the contrast concentration in the urinary bladder as there is not enough contrast to fill the bladder
   B. Inject saline to facilitate mixing of the contrast already in the bladder to create a homogeneous distribution of contrast and enable visualization of the retrovesicular space
   C. Decrease the mechanical index (MI)
   D. Ultrasound the kidneys to look for reflux

Correct Answer: B
Rationale: The appearance in the bladder is due to a strong acoustic shadow created by the high concentration of the contrast agent. No more contrast is needed at this time. Injecting or infusing saline will help to mix the bladder contents and create a homogeneous distribution of the contrast agent in the bladder. Decreasing the MI will not help. If the exam proceeds with imaging of the kidneys, reflux may be missed as the distal ureters cannot be directly visualized. If the contrast agent is not mixed throughout the urinary bladder early reflux may be missed.

Reference:

Contrast Enhanced Voiding Urosonography: Comparison with VCUG
Carol E. Barnewolt, MD

9. Which of the below situations may lead to a false negative contrast enhanced Voiding Urosonogram (ceVUS)?
   A. The contrast to saline ratio is too high, leading to posterior acoustic shadows.
   B. There is a volume of dense, pre-existing iodinated contrast in the bladder lumen, which layers posteriorly over the area of the ureterovesical junction.
   C. A lengthy waiting period, with a high bladder volume, prior to voiding, may lead to premature bubble destruction.
   D. All of the above.

Correct Answer: D

Reference:

10. Which statement below is true?
   A. Diagnostic views of the urethra cannot be obtained.
   B. "Practice" scanning of the kidneys, before instillation of bladder contrast, helps to optimize visualization of the kidneys, particularly if bowel is distended with air and/or stool.
   C. ceVUS does not provide information regarding diagnostic details such as intra-renal reflux or the presence of lower pole reflux.
   D. ceVUS is a complicated technique, requiring years of practice to be proficient.

Correct Answer: B
References:

