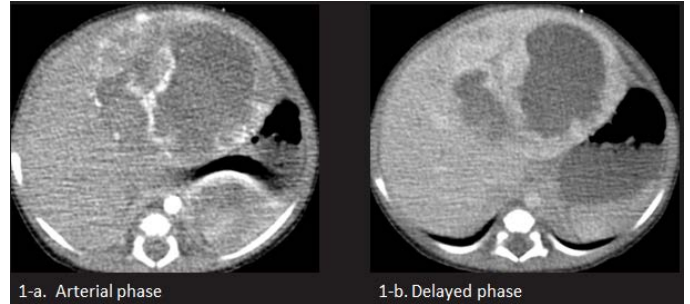


SPR 2015 IR Session
May 1, 2015
SAM Questionnaire

Block 'Em: Hepatic, Splenic, and Gastrointestinal Embolization

Carrie M. Schaefer, MD

1. You are shown 2 images from an abdominal CT on a 5 day old female with abdominal distention and a normal AFP (Figures 1-a and 1-b). What is the most likely diagnosis?
- A. Infantile hemangioma of the liver
 - B. Congenital hemangioma of the liver
 - C. Hepatoblastoma
 - D. Mesenchymal hamartoma



Correct Answer: B

References

1. Roebuck D. Focal Liver Lesion in Children. *Pediatr Radiol* (2008) 38 (Suppl 3):S518-S522.
2. Burrows PE, Dubois J, Kassarian A. Pediatric Hepatic Vascular Anomalies. *Pediatr Radiol* (2001) 31:533-545.
3. Restrepo R, Palani R, Cervantes LF, et al. Hemangiomas Revisited: The Useful, the Unusual, and the New, Part 1: Overview and Clinical and Imaging Characteristics. *Pediatr Radiol* (2011) 41:895-904.
4. Duigenan S, Anupindi SA, Nimkin K. Imaging of Multifocal Hepatic Lesions in Pediatric Patients. *Pediatr Radiol* (2012) 42:1155-1168.
5. Ferguson M, Chapman T, Dighe M. Fetal Tumors: Imaging Features. *Pediatr Radiol* (2010) 40:1263-1273.

Rationale

Option A is not correct. Infantile hepatic hemangiomas are typically small at birth and proliferate shortly after birth. Additionally, they are more often multifocal compared to congenital hemangiomas. Additionally, they have centripetal enhancement.

Option B is correct. Congenital hemangiomas are present at birth and are typically solitary. Additionally, they have centripetal enhancement. The old terminology is hemangioendothelioma.

Option C is not correct. The AFP is elevated with hepatoblastoma. Additionally, hepatoblastoma enhances less than the normal liver parenchyma. Hepatoblastomas may contain areas of necrosis or hemorrhage.

Option D is not correct. Mesenchymal hamartomas are typically cystic or mixed solid and cystic.

2. Regarding partial splenic embolization (PSE), which of the following statements is correct?

- A. Portal vein thrombosis following PSE is associated with extensive splenic embolization.
- B. The pneumococcal and meningococcal vaccines should be given prior to PSE.
- C. Postembolization syndrome is rare following PSE.
- D. The working catheter tip is in the main splenic artery for selective PSE.

Correct Answer: A

References

1. Madoff D, Denys A, Wallace M, et. al. Splenic Arterial Interventions: Anatomy, Indications, Technical Considerations, and Potential Complications. *RadioGraphics* 2005; 25:S191-S211.
2. Mingyue C, Kangshun Z, Huang W, et. al. Portal Vein Thrombosis after Partial Splenic Embolization in Liver Cirrhosis: Efficacy of Anticoagulation and Long-term Follow-Up. *J Vasc Interv Radiology* 2013; 24:1808-1816.
3. Gowda N, D'Souza D, Golzarian J. Partial Splenic Artery Embolization. *Endovascular Today* 2012, April :74-76.

Rationale

Option A is correct. Portal vein thrombosis may occur following PSE due to decreased splenic blood flow and/or a rise in the platelet count. The more extensive the embolization, the less splenic blood flow there will be.

Option B is not correct. It is controversial whether the pneumococcal and meningococcal vaccines need to be given prior to PSE, whereas they are routinely given for splenectomy or splenic arterial embolization.

Option C is not correct. Postembolization syndrome, which consists of abdominal pain, fever, and leukocytosis, occurs frequently after PSE. Patients require hospitalization following PSE for pain management.

Option D is not correct. There are 2 techniques for PSE, selective and nonselective. The working catheter tip is in the main splenic artery beyond the pancreatic branches for nonselective PSE, and in the middle or lower pole splenic branches for selective PSE.

3. Regarding congenital hepatic vascular malformations, which of the following statements is correct?

- A. Hepatic arteriovenous malformations can present with congestive heart failure and portal hypertension.
- B. Hepatic arteriportal fistulas do not cause portal hypertension.
- C. Hepatic portosystemic venous fistula do not cause pulmonary hypertension.
- D. Hepatic arteriportal fistulas with a patent ductus venosus do not cause high-output cardiac failure.

Correct Answer: A

References

1. Burrows P, Dubois J, Kassarian A. Pediatric Hepatic Vascular Anomalies. *Pediatr Radiol* 2001; 31:533-545.
2. Jin Chae E, Woo Goo H, Hyun Yoon C. Congenital Intrahepatic Arterioportal and Portosystemic Venous Fistulae with Jejunal Arteriovenous Malformation Depicted on Multislice Spiral Ct. *Pediatr Radiol* 2004; 34:428-431.

Rationale

Option A is correct. A hepatic arteriovenous malformation is an abnormal connection(s) between the hepatic artery and hepatic vein, with shunting of blood from the artery to the vein. This can lead to congestive heart failure, hepatic ischemia, and portal hypertension.

Option B is not correct. Hepatic arterioportal fistula shunt blood from the hepatic artery to portal vein, resulting in portal hypertension.

Option C is not correct. Hepatic portosystemic venous fistula shunt blood from the portal vein to a systemic hepatic vein (hepatic vein or inferior vena cava), which can cause portal hypertension.

Option D is not correct. Hepatic arterioportal fistulas with a patent ductus venosus can cause high-output cardiac failure because of shunting of blood to the systemic veins and then to the right heart.

Embolization of Renal Angiomyolipomas

John M. Racadio, MD

4. **Re: renal AMLs in Tuberous Sclerosis (TS). Which of the following is NOT true?**
 - A. 40-80% of pts with TS develop AMLs.
 - B. Without intervention, 35% of TS patients with renal AMLs will require hospitalization for hemorrhage.
 - C. AMLs > 4cm have increased risk of hemorrhage
 - D. Renal failure is the leading cause of death among adults with tuberous sclerosis.
 - E. Laproscopic nephron sparing surgery is the treatment of choice for AML intervention.

Correct Answer: E

References

1. Igarashi A, Masuyama T, Watanabe K, Higaki Y, Kuramoto N, Suzuki K, Yoshida H. [Long-term result of the transcatheter arterial embolization for ruptured renal angiomyolipoma]. *Nippon Hinyokika Gakkai Zasshi*. 2002 Sep;93(6):702-6. Review. Japanese. PubMed PMID: 12385095.
2. Yamaguchi Y, Yamanaka M, Nishimura K, Ichikawa Y, Nagano S, Toki K. [Ruptured renal angiomyolipoma treated by transcatheter arterial embolization: report of two cases]. *Hinyokika Kyo*. 2004 Oct;50(10):695-8. Review. Japanese.
3. Msezane L, Chang A, Shikanov S, Deklaj T, Katz MH, Shalhav AL, Lifshitz DA. Laparoscopic nephron-sparing surgery in the management of angiomyolipoma: a

single center experience. J Endourol. 2010 Apr;24(4):583-7. PubMed PMID: 20423289.

Rationale

Option A is true. AMLs are common renal manifestations in pts with Tuberous Sclerosis.

Option B is true. Renal hemorrhage requiring hospitalization is also common over the course of a lifetime in patients with TS.

Option C is true. Renal AML tumor diameter > 4cm is a predictor for hemorrhage.

Option D is true. Although renal AML hemorrhage can be life threatening, the leading cause of death in adults with TS is chronic renal failure.

Option E is not true (the correct answer). Sub-selective trans-arterial embolization is the treatment of choice.

5. All of the following are generally considered indications for renal AML embolization

EXCEPT:

- A. Asymptomatic AMLs with diameter > 4CM
- B. Acute hemorrhage
- C. Rapidly growing AML
- D. Decrease in GFR to 50% baseline
- E. AMLs with associated abdominal pain

Correct Answer: D

References

1. Igarashi A, Masuyama T, Watanabe K, Higaki Y, Kuramoto N, Suzuki K, Yoshida H. [Long-term result of the transcatheter arterial embolization for ruptured renal angiomyolipoma]. Nippon Hinyokika Gakkai Zasshi. 2002 Sep;93(6):702-6. Review. Japanese. PubMed PMID: 12385095.
2. Incedayi M, Turba UC, Arslan B, Sabri SS, Saad WE, Matsumoto AH, Angle JF. Endovascular therapy for patients with renal angiomyolipoma presenting with retroperitoneal haemorrhage. Eur J Vasc Endovasc Surg. 2010 Jun;39(6):739-44. Epub 2010 Jan 21. PubMed PMID: 20096610.
3. Lee SY, Hsu HH, Chen YC, Huang CC, Wong YC, Wang LJ, Chuang CK, Yang CW. Evaluation of renal function of angiomyolipoma patients after selective transcatheter arterial embolization. Am J Med Sci. 2009 Feb;337(2):103-8. PubMed PMID: 19214025

Rationale

Option A true. AMLs > 4cm in diameter are at an increased risk of bleeding regardless of whether or not they are symptomatic.

Option B is true. Acute renal AML hemorrhage can be life threatening.

Option C is true. Rapidly growing renal AMLs have also been associated with an increased risk of hemorrhage.

Option D is false (the correct answer). While renal failure is the leading cause of death in adults with TS, embolization solely because of a decrease in 50% of GFR is not a currently accepted indication.

Option E is true. AMLs associated with abdominal pain may be the result of small hemorrhages, which could herald a larger bleed if not addressed.

6. Re: Post Embolization Syndrome (PES) in renal AML embolization. All of the following are true EXCEPT:

- A. Is an inflammatory response to tissue necrosis involving fever, pain, and leukocytosis.
- B. Is an inevitable untoward consequence of renal AML embolization.
- C. Can be prevented with pre-embolization steroids and post embolization steroid taper.
- D. Occurs in up to 85% of patients without administration of steroid prophylaxis.
- E. Can be severe, including life threatening.

Correct Answer: B

References

1. Reduction of postembolization syndrome after ablation of renal angiomyolipoma. Bissler JJ, Racadio J, Donnelly LF, Johnson ND. Am J Kidney Dis. 2002 May;39(5):966-71. Review. PMID: 11979340
2. Embolization of renal angiomyolipomata in patients with tuberous sclerosis complex. Williams JM, Racadio JM, Johnson ND, Donnelly LF, Bissler JJ. Am J Kidney Dis. 2006 Jan;47(1):95-102. PMID: 16377390

Rationale

Option A is true. These are clinical manifestations of PES.

Option B is false (the correct answer). With steroid prophylaxis, PES can largely be prevented.

Option C is true. Intra-procedure, pre-embolization IV steroids and post embolization oral steroid taper over 2-6 weeks can prevent significant post embolization syndrome.

Option D is true. Without prophylaxis, PES is very common.

Option E is true.

Embolization of Pulmonary AVM & Bronchials

Mark J. Hogan, MD

7. What is the most common etiology for hemoptysis referred for embolization in the US in children and young adults?

- A. Tuberculosis
- B. Pneumonia
- C. Cystic fibrosis
- D. Pulmonary AVM's
- E. Trauma

Correct Answer: C

References

1. Larici AR et al Diagnosis and management of hemoptysis. *Diagn Interv Radiol*. 20(4):299-309. 2014
2. Hurt K et al Cystic fibrosis: management of haemoptysis. *Paediatr Respir Rev*. 13(4):200-5. 2012
3. Lorenz J et al Bronchial artery embolization. *Semin Intervent Radiol*. 29(3): 155-160. 2012

Rationale

Option A is not correct. Tuberculosis is more common in developing countries.

Option B is not correct. While pneumonia may be associated with hemoptysis it rarely is an indication for embolization.

Option C is correct. Cystic fibrosis is the most common cause of hemoptysis requiring embolization in the pediatric and young adult population in the US.

Option D is not correct. Pulmonary AVM's may present with hemoptysis but they are less common than cystic fibrosis.

Option E is not correct. Hemorrhage from trauma rarely requires embolization.

8. Which of the following statements is true in patients with cystic fibrosis?

- A. Massive hemoptysis occurs only in patients with severe lung disease.
- B. The incidence of hemoptysis increases with age.
- C. Most hemoptysis is from the pulmonary arteries.
- D. Mild hemoptysis can be ignored.
- E. Chronic/recurrent hemoptysis is a sign of mild lung disease.

Correct Answer: B

References

1. Barben JU et al Major haemoptysis in children with cystic fibrosis: a 20-year retrospective study. *J Cyst Fibros*. 2003 2(3):105-11.

2. Roebuck DJ, Barnacle AM. Haemoptysis and bronchial artery embolization in children. *Paediatr Respir Rev.* 2008 Jun;9(2):95-104.
3. Antonelli M et al. Bronchial artery embolization for the management of nonmassive hemoptysis in cystic fibrosis. *Chest.* 2002 Mar;121(3):796-801.

Rationale

Option A is not correct. Massive hemoptysis may occur in patients with mild decrease in the FEV1.

Option B is correct. The incidence of hemoptysis increases with age.

Option C is not correct. Most (90%) of hemoptysis in CF patients originates from the bronchial arteries.

Option D is not correct. Mild hemoptysis can progress to massive hemoptysis. Patients often require additional antibiotics, cessation of chest physiotherapy, and Vitamin K.

Option E is not correct. 58% of chronic and recurrent hemoptysis occurs in patients with severe lung disease.

9. What embolization materials have been safely used in the bronchial arteries?

- A. Polyvinyl alcohol particles.
- B. n-butyl cyanoacrylate.
- C. Spherical particles.
- D. Gelfoam.
- E. All of the above.

Correct Answer: E

References

1. Woo S et al. Bronchial artery embolization to control hemoptysis: comparison of N-butyl-2-cyanoacrylate and polyvinyl alcohol particles. *Radiology* 2013 269(2):594-602.
2. Vinaya KN et al. Reassessing bronchial artery embolotherapy with newer spherical embolic materials. *J Vasc Interv Radiol.* 2001 15(3):304-5.

Rationale

Option A is correct. PVA particles are commonly used in bronchial artery embolization. Particle size is usually over 200 microns.

Option B is correct. There are several reports describing n-BCNA use in hemoptysis.

Option C is correct. Spherical particles have been described for this indication.

Option D is correct. Gelfoam slurry has been used for hemoptysis.

Option E is correct. All of these embolization materials have been used in the bronchial arteries.

Embolization for Traumatic Injuries

Gulraiz A. Chaudry, MBChB, MRCP, FRCR

10. When compared to blunt trauma in adults, which of the following statements is true in children?

- A. Clinical assessment of hemodynamic status is easier.
- B. There is decreased likelihood of internal chest injuries.
- C. Conservative management of blunt abdominal trauma is more likely to be successful
- D. There is decreased mortality from sepsis following splenectomy.
- E. Renal injury is less common.

Correct Answer: C

References

1. Vo NJ, Althoen M, Hippe DS, et al. Pediatric abdominal and pelvic trauma: safety and efficacy of arterial embolization. J Vasc Interv Radiol. 2014 Feb;25(2):215-20.
2. Sidhu MK, Hogan MJ, Shaw DW, et al. Interventional radiology for paediatric trauma. Pediatr Radiol. 2009 May;39(5):506-1

Rationale

Option A is not correct. Due to greater physiological reserve, children may not display early signs of hypovolemia.

Option B is not correct. Due to increased elasticity of the rib cage, force is more likely to be transmitted to deeper structures in the chest.

Option C is correct. More than 90% of pediatric cases of blunt abdominal trauma can be managed conservatively.

Option D is not correct. The mortality from sepsis following splenectomy is greater in children.

Option E is not correct. Due to the larger relative size and greater mobility of the kidneys and increased pliability of the abdominal wall, renal injury is more common in children.

11. You are shown an angiographic image from a hemodynamically stable 13-year-old boy with a pseudoaneurysm of a transplant kidney. Which of the following is the most appropriate course of management?

- A. Selective coil embolization of the pseudoaneurysm.
- B. Coil embolization proximal and distal to pseudoaneurysm
- C. Embolization with poly-vinyl alcohol (PVA) particles
- D. Injection of thrombin into the pseudoaneurysm
- E. Urgent nephrectomy



Correct Answer: A

References

1. Watanabe M, Padua HM, Nguyen HT, et al. Renal pseudoaneurysm following laser lithotripsy: endovascular treatment of a rare complication. J Pediatr Urol. 2010 Aug;6(4):420-2.

Rationale

Option A is correct. Although technically challenging, selective coil embolization has the greatest chance of occluding the pseudoaneurysm and preserving renal function.

Option B is not correct. In the absence of symptoms and hemodynamic instability, the aim should be to preserve the renal allograft.

Option C is not correct. PVA particles carry a high risk of non-target embolization in this setting.

Option D is not correct. The wide neck of the pseudoaneurysm increases the risk of thrombosis of the main renal artery if thrombin is injected.

Option E is not correct. Urgent nephrectomy is not indicated unless hemodynamically unstable.

12. Which of the following is most predictive of failure of non-operative management in splenic trauma?

- A. Subcapsular hematoma involving 30% of the surface.
- B. Contrast blush on CT scan
- C. Blood transfusion greater than 10 ml/kg
- D. Injury Severity Score (ISS) of 10
- E. Hemodynamic instability

Correct Answer: E

References

1. Ozturk H, Dokucu AI, Onen A, et al. Non-operative management of isolated solid organ injuries due to blunt abdominal trauma in children: a fifteen-year experience. Eur J Pediatr Surg. 2004 Feb;14(1):29-34.
2. Cloutier DR, Baird TB, Gormley P et al (2004) Pediatric splenic injuries with a contrast blush: successful nonoperative management without angiography and embolization. J Pediatr Surg 39:969-971

Rationale

Option A is not correct. Risk of failure of non-operative management is 44% if grade 3 or higher in the American Association for the Surgery of Trauma Organ Injury scale, where the subcapsular hematoma is > 50% of the surface or expanding.

Option B is not correct. In children, hemodynamic instability and clinical status are better predictors than contrast blush.

Option C is not correct. Blood transfusion greater than 30 ml/kg in 24 hours or 45 ml/kg overall are highly predictive of the need for surgical intervention.

Option D is not correct. An ISS > 15 is predictive of failure of non-operative management.

Option E is correct. Hemodynamic instability is the best predictor of failure of non-operative management in children.

Liver Embolization, TACE/Y90

Kamlesh U. Kukreja, MD

13. Arterial embolotherapies are based on the fact that normal hepatic parenchyma derives its blood supply primarily from portal vein and hepatocellular carcinoma derives blood supply primarily from hepatic artery.

- A. True
- B. False

Correct Answer: True

References

1. Chemoembolization and radioembolization for hepatocellular carcinoma. Salem R & Lendowski R. Clin Gastroenterol Hepatol. 2013 June ; 11(6): 604–e44. doi:10.1016/j.cgh.2012.12.039.
2. Transarterial chemoembolization for treatment of hepatoblastoma in children. Vogl TJ, Scheller A et al. Eur Radiol (2006) 16: 1393–1396. DOI 10.1007/s00330-005-2827-5
3. Yttrium 90 microsphere therapy for hepatic malignancy: Devices, Indications, Technical considerations and Potential complications. Murthy R, Nunex R et al. Radiographics 2005; 25:S41–S55

Rationale

Liver is supplied primarily by portal vein (75-80 %) while liver tumors are supplied primarily by hepatic artery. So selective administration of chemotherapeutic and embolic agent in hepatic artery supplying the tumor does not compromise vascularity of normal liver parenchyma.

14. Potential advantages of transarterial chemoembolisation (TACE) over systemic chemotherapy are:

- A. Higher concentration of antineoplastic drug in tumor
- B. Lower systemic dose and adverse effects of antineoplastic drug
- C. Ischemic injury to the tumor
- D. All of the above
- E. None of the above

Correct Answer: D

References

1. Chemoembolization and radioembolization for hepatocellular carcinoma. Salem R & Lendowski R. Clin Gastroenterol Hepatol. 2013 June ; 11(6): 604–e44. doi:10.1016/j.cgh.2012.12.039.
2. Transarterial chemoembolization for treatment of hepatoblastoma in children. Vogl TJ, Scheller A et al. Eur Radiol (2006) 16: 1393–1396. DOI 10.1007/s00330-005-2827-5
3. Yttrium 90 microsphere therapy for hepatic malignancy: Devices, Indications, Technical considerations and Potential complications. Murthy R, Nunex R et al. Radiographics 2005; 25:S41–S55

15. Two types of radio-embolic agents (Yttrium 90) for liver tumors available today are:

- A. Sir spheres and Madam Spheres
- B. Therasphere and Magic spheres
- C. Sir spheres and Theraspheres
- D. Round spheres and square spheres

Correct Answer: C

References

1. Chemoembolization and radioembolization for hepatocellular carcinoma. Salem R & Lendowski R. Clin Gastroenterol Hepatol. 2013 June ; 11(6): 604–e44. doi:10.1016/j.cgh.2012.12.039.
2. Transarterial chemoembolization for treatment of hepatoblastoma in children. Vogl TJ, Scheller A et al. Eur Radiol (2006) 16: 1393–1396. DOI 10.1007/s00330-005-2827-5
3. Yttrium 90 microsphere therapy for hepatic malignancy: Devices, Indications, Technical considerations and Potential complications. Murthy R, Nunex R et al. Radiographics 2005; 25:S41–S55

Rationale

Sir spheres (SIRTex, USA) & Theraspheres (Nordion, Ca/ BTG) are two products available for administration of Yttrium 90 today.