Update on Interventional Oncology
Matthew P. Lungren, MD, MPH

1. **What percentage of pediatric HCC occurs in children with chronic liver disease?**
   - A. less than 10%
   - B. 20-30%
   - C. 30-40%
   - D. 60-70%

   **Correct Answer: C**

   **Rationale**
   Answer is C. Only 30–40% of pediatric HCC occurs in children with chronic liver diseases, with the most common causes being hereditary metabolic disorders such as tyrosinemia or alpha-1-antitripsin deficiency, chronic viral infections such as hepatitis C (HCV) or hepatitis B (HBV), and cholestatic disorders such as progressive familial intrahepatic cholestasis, congenital biliary atresia, or primary biliary cirrhosis. The remaining 60–70% of pediatric HCC develop within a normal liver with no recognized risk factors, often presenting in advanced stages with regional or distant metastases.

   **References**

2. **Which tumor response imaging guidelines are felt to be best for evaluating HCC after transarterial therapies such as TACE or Y90 and other anticancer drugs, such as molecular targeted therapies?**
   - A. RECIST
   - B. Li-RADS
   - C. mRECIST
   - D. WHO

   **Correct Answer: C**

   **Rationale**
   Answer is C. As acknowledged in the original RECIST publication, assessments based solely on changes in tumor size can be misleading when applied to other anticancer drugs, such as molecular targeted therapies, or other therapeutic interventions. In the case of hepatocellular carcinoma (HCC), recent studies have shown a poor correlation between the clinical benefit provided by new agents such as sorafenib or by loco-regional interventional therapies such as chemoembolization and conventional methods of response assessment. In 2006, a group of experts convened by the AASLD proposed adapting the concept of viable tumor endorsed by the EASL and the AASLD and to RECIST criteria for the determination of tumor response in HCC. These amendments are referred to as modified RECIST (mRECIST).
References

3. Which intervention has the best overall survival data for advanced non-metastatic (stage III) pediatric HCC?
   A. Surgical resection
   B. Systemic chemotherapy
   C. Liver Transplantation
   D. External Beam Radiotherapy

   Correct Answer: C

Rationale
Answer is C. Liver transplantation offers the advantage of treating any concurrent underlying liver disease while eradicating the tumor, and has demonstrated excellent long-term survival and a cure rate of approximately 75-80%

Reference

Update on MR Interventions in Children
Joao Amaral, MD

4. Which is the MR guided non-invasive thermal therapy currently in clinical use?
   A. Cryoablation
   B. HIFU - High Focused Ultrasound Therapy
   C. Radiofrequency ablation
   D. LITT - Laser Interstitial Thermal Therapy

   Correct Answer: B

Rationale
Correct Answer is B. High-intensity focused ultrasound (HIFU) therapy, also known as focused ultrasound surgery (FUS), is a noninvasive technology that delivers ultrasound (US) waves via an extra-corporeal or endocavitary approach to specific targets within the human body. HIFU therapy results in targeted thermal ablation of tissue without injury to the surrounding structures.

Reference
5. What is the best imaging method to identify the iceball created during cryoablation?
   A. Ultrasound
   B. CT
   C. MRI
   D. Cone beam CT

   **Correct Answer: C**

   **Rationale**
   Correct Answer is C. On conventional MRI sequences, frozen tissue appears as a signal void because of short transverse relaxation time, which creates high contrast between frozen and unfrozen tissue that is superior to that of CT or ultrasound.

   **Reference**

6. The artifact caused by needles in MRI helps to identify these needles in the body. Which of the following does not interfere with needle artifact width in the MRI?
   A. Phase encoding direction
   B. Material (e.g. titanium, carbon fiber)
   C. Field strength
   D. Needle orientation to B(0)

   **Correct Answer: A**

   **Rationale**
   Correct Answer is A. Artifact widths depended on needle materials and needle orientation to B(0), with significant differences on tests. No significant influence on artifact character was found for changes in phase encoding direction and slice orientation.

   **Reference**

---

**Spinal Pain Procedures: Role of Nerve Root Blocks, Medial Branch Blocks, Epidural Steroid Injections, Cementoplasty, etc.**

*Manraj Heran, MD*

7. With respect to patients with disc herniation and associated spinal pain, which of the following is a true statement:
   A. The majority get better within 6-8 weeks
   B. Half will have symptoms beyond 3 months
   C. Surgery is usually indicated for those with pure sensory symptoms
   D. Conservative therapy typically does not work

   **Correct Answer: A**
Rationale
Most correct answer is A.

Option A is correct. The vast majority of patients (90%) will be better within 6-8 weeks.

Option B is incorrect. Only a small proportion of patients will have symptoms beyond 3 months.

Option C is incorrect. Surgical intervention is rarely necessary in the pediatric setting, especially in the acute/subacute phase. Pure sensory symptoms are not an indication for surgery. However, motor symptoms, such as root-compression related weakness, often are an indication for urgent surgical intervention.

Option D is incorrect. Conservative therapy remains the mainstay of management, with appropriate restriction of activities, physical and chiropractic therapy, graded rehabilitation, and analgesic/anti-inflammatory medications, as needed.

8. Which of the following ARE NOT examples of percutaneous spinal pain management techniques which can be offered to pediatric patients:
   A. Medial branch block
   B. Cordotomy
   C. Epidural steroid injection
   D. Cementoplasty
   
   Correct Answer: B

Rationale
The incorrect answer is B.

Option A is correct. Medial branch blocks are widely performed for facet-mediated pain, and are one of the most straightforward injection procedures to learn and perform.

Option B is incorrect. Cordotomy is a percutaneous CT-guided procedure where a thermally (typically radiofrequency) induced lesion is created in the spinothalamic tract of the spinal cord. This is performed in the setting of intractable pain, most often in the palliative cancer setting, where the life expectancy of the patient is less than one year. As the performance of this procedure requires a still, cooperative patient who can answer questions appropriately during the procedure, its use in the pediatric setting would be exceedingly rare.

Option C is correct. Epidural steroid injections are widely used for management of non-radicular/polyradicular back pain.

Option D is correct. Although not typically performed in the pediatric setting, cementoplasty has a proven role in managing malignancy-based pain in the appendicular and axial skeleton in adults, and can, in selected settings, be considered an option in children.
9. With respect to steroids typically used in spinal pain procedures, which of the following is incorrect:
   A. No alterations in serum glucose are seen in the immediate post-procedure setting
   B. Particulate steroids should be avoided in cervical and thoracic procedures
   C. Duration of pharmacologic efficacy is typically three months
   D. Emotional lability and insomnia are rare side effects

   **Correct Answer: A**

   **Rationale**
   **Option A is incorrect.** Although the effects are dose-dependent, steroids typically used for spinal pain procedures are potent suppressors of insulin action. This is especially important to consider in patients with diabetes. The maximal serum glucose elevation typically occurs at 48 hours, and normalizes at approximately one week.

   Option B is correct. As a safety precaution, particulate steroids should be avoided where there is a chance for inadvertent vascular (ie, arterial) injection. Rare reports have been published of stroke and spinal cord infarction following cervical and thoracic injection procedures, with one possible mechanism being injection of particulate steroids into the vertebral arteries, or into radiculomedullary branches supplying the spinal cord (ex: artery of Adamkiewitz).

   Option C is correct. Although quite variable, the accepted average duration of pharmacologic efficacy is approximately 12 weeks. However, the primary causative etiology for the patient’s spinal pain may resolve during that period (ex: resolution of acute disc herniation), giving the patient the impression of clinical efficacy well beyond that period.

   Option D is correct. Apart from systemic effects mediated through the hypothalamus-pituitary-adrenal axis, including suppression of insulin action as already discussed, other side effects may include: mood changes; alteration in sleep pattern; effects on menstruation.

   **References for questions 7-9**

   **Role of IR Trauma/Emergency IR Procedures**
   Jared Green, MD and Stanley Kim, MD

10. What is the USA’s leading cause of death in patients aged 1yr – 14 yrs?
    A. Unintentional injury
    B. Homicide
    C. Congenital anomaly
    D. Malignant neoplasm

    **Correct Answer: A**

   **Reference**
11. How many people aged 0-19 yrs were shot and killed in Chicago in 2016?
   A. 15
   B. 58
   C. 155
   D. 220

   Correct Answer: C

Reference
1. Chicago Tribune

12. What is the leading cause of upper gastrointestinal bleeding in children of North and South America?
   A. Varices
   B. Erosive esophagitis
   C. Peptic ulcer disease
   D. Vomiting induced hematemesis

   Correct Answer: C

Reference

Hematologist Aspect of Vascular Malformation: What We Need to Know from a Medical Aspect
Kiersten W. Ricci, MD, FAAP

13. Which vascular anomaly is associated with Kasabach-Merritt phenomenon?
   A. Congenital hemangioma
   B. Infantile hemangioma
   C. Kaposiform hemangioendothelioma
   D. Venous malformation

   Correct Answer: C

Rationale
Occurring in approximately 70% of patients with kaposiform hemangioendothelioma and 10% of patients with tufted angioma, Kasabach-Merritt phenomenon (KMP) is a potentially life-threatening coagulopathy that has a high risk of bleeding. KMP is characterized by platelet trapping, activation of the coagulation cascade, and secondary consumption of coagulation factors within the abnormal vasculature of the KHE/TA tumor, resulting in profound thrombocytopenia, hypofibrinoginemia, elevated D-dimer and fibrin degradation products, and prolonged prothrombin time (PT) and activated partial thromboplastin time (aPTT). Coagulopathy may occur in rapidly involuting congenital hemangiomas and venous malformations but is distinctly different than KMP.

References

14. **Localized intravascular coagulopathy is defined by which of the following?**
   A. Prolonged prothrombin time (PT) and low platelet count only
   B. Prolonged PT and low fibrinogen only
   C. Prolonged partial thromboplastic time (aPTT) and elevated D-dimer
   D. Elevated D-dimer, low platelet count and/or low fibrinogen

   **Correct Answer: D**

   **Rationale**
   Localized intravascular coagulopathy (LIC) is characterized by elevated D-dimer, low fibrinogen, and/or mild thrombocytopenia. LIC may progress to disseminated intravascular coagulopathy following surgical procedures. LIC is not defined by PT and/or PTT measurements but both PT and aPTT may be prolonged if the fibrinogen is low.

   **Reference**
   1. Available at: issva.org/classification

15. **Localized intravascular coagulopathy is associated with what vascular anomaly?**
   A. Venous malformations
   B. Kaposiform hemangioendothelioma
   C. Arteriovenous malformations
   D. Capillary malformations

   **Correct Answer: A**

   **Rationale**

   **Reference**
16. Sirolimus inhibits which step in the growth pathway shown below?
A. PIK3CA  
B. AKT  
C. mTOR  
D. VEGF  

Correct Answer: C  

Rationale
Sirolimus, also known as rapamycin, is a specific and potent inhibitor of mTOR (mammalian target of rapamycin) via mTOR complex 1. The mTORC1 signaling cascade is activated by phosphorylated AKT and results in mRNA translation, ultimately leading to protein synthesis. Rapamycin was first discovered in 1975 in soil sample from Easter Island, also known as Rapa Nui, hence its name is derived. Rapamycin is a macrolide produced by Streptomyces hygroscopius. It has shown both antifungal as well as immunosuppressive properties. Rapamycin was first widely used as an immunosuppressant for solid-organ transplant.

References

17. Sirolimus has shown efficacy in the treatment of which of the following vascular malformations?
A. Capillary Malformations  
B. Lymphatic Malformations  
C. Arteriovenous Malformations  
D. Lymphedema

Correct Answer: B

Rationale
Sirolimus has been shown to be effective for lymphatic malformations, both microcystic and macrocystic, as well as in combined lesions including lymphaticovenous malformations and capillary lymphaticovenous malformations. In a recent Phase II study, patients with lymphatic malformations showed symptomatic improvement in quality of life, clinical status, and often size. In that same study, patients lymphedema and other conduction anomalies of the lymphatic system did not significantly benefit from sirolimus. More recently, sirolimus has been used for pure venous malformations, with improvement in pain and objective improvement in signs of localized intravascular coagulopathy, with lowering of D-dimers and normalization of platelets and fibrinogen.
18. Sirolimus should be held in which of the following situations?

A. Poor wound healing after surgery  
B. Routine sclerotherapy  
C. Fever in an otherwise well-appearing child  
D. Administration of inactivated vaccines

Correct Answer: A

Rationale
Sirolimus has been associated with delayed skin healing after minor trauma and poor wound healing after surgery. However, due to its positive effect on lymphatic malformations, it is no longer being held for long periods after surgery unless they are concerns about wound healing.

Sirolimus should NOT be held for fever alone in otherwise well-appearing patients and does not need to be held for administration of routine killed vaccines. Annual flu shots are strongly encouraged, although LIVE vaccines (including nasal FluMist) are contraindicated during sirolimus therapy due to immunosuppression, and should not be given for several months after discontinuation of sirolimus to allow the immune function to recover. Sirolimus does not need to be held for less invasive procedures such as sclerotherapy or other intravascular procedures.

References