With regard to the FDG uptake in the upper chest shown in the image:

A. Uptake of FDG by this tissue occurs in different locations in pediatric patients than in adult patients
B. Uptake of FDG by this tissue is more common in pediatric patients
C. Uptake of FDG by this tissue can be prevented by warming the FDG dose
D. Uptake of FDG by this tissue cannot be distinguished from pathologic uptake based on imaging alone
E. This tissue has no known physiologic function

The FDG uptake indicated in the figure is uptake in brown (metabolically active) fat.

- Option A is NOT correct – the distribution of brown fat in children and young adults is very similar to the distribution in adult patients
- Option B is CORRECT – the incidence of brown fat uptake is higher in young patients, up to 47%
- Option C is NOT correct – the patient can be warmed, not the dose
- Option D is NOT correct – brown fat uptake localizes to areas of fat on CT and can generally be distinguished from pathologic uptake
- Option E is NOT correct – brown fat functions in thermoregulation

9 year old girl underwent screening MR on day 40 during induction therapy for non-Hodgkin’s lymphoma. Which of the following is true about the findings?

A. Characteristic of lymphoma
B. Should resolve with continued therapy
C. Have been demonstrated only in adolescents who have reached skeletal maturity
D. They herald rapid evolution to extensive osteonecrosis
E. Bilaterality is atypical

Option D is CORRECT. These findings typically herald rapid evolution of extensive osteonecrosis as shown in the follow-up images below.

In contrast to the commonly described MR changes of osteonecrosis (well-defined, geographic lesions that characteristically are of decreased signal on T1- and increased signal on T2-weighted or STIR sequences), these earlier changes are less conspicuous, often poorly defined, and often demarcated by subtle edema.

What is the source of attenuation correction for PET-CT scanners?

A. None
B. X-rays
C. Germanium-68
D. Cesium-137
What is the source of attenuation correction for PET-CT scanners?

• Option A is NOT correct. Attenuation correction is required due to loss of photon counts between 50-95%
• Option B is CORRECT. X-rays from the CT scanner are used for attenuation correction.
• Options C and D are NOT correct. These long lived radioactive sources were used to create transmission scans for attenuation correction in PET-only cameras.

What is the source of attenuation correction for PET-CT scanners?

• Essentials of Nuclear Medicine Imaging, 5th edition, Chapter 13, Mettler and Guiberteau

This patient has a known cancer predisposition syndrome with characteristic tumor shown at the arrow. Which of the following tumors are NOT commonly associated with this syndrome?

A. Clear cell carcinoma of the kidney
B. Pheochromocytoma
C. Endolymphatic sac tumor
D. Choroid plexus carcinoma
E. Hemangioblastoma

Which of the following tumors are not commonly associated with this syndrome?

• Option D is CORRECT. This is an older teenager with a hemangioblastoma, a characteristic tumor seen in von Hippel Lindau disease.
• VHL is commonly associated with all of the answer choices except choroid plexus carcinoma, a tumor which is more characteristically seen in Li-Fraumeni syndrome.
Which of the following tumors are not commonly associated with this syndrome?


In children with neurofibromatosis, FDG PET/CT scan may be helpful to direct biopsy of a specific lesion if the SUVmax is:

A. Above mediastinum but less than liver
B. Above mediastinum and above liver
C. Less than 3.5 on initial and delayed imaging
D. Greater than 3.5 on initial and delayed imaging

Option D is CORRECT.

选项 A 和 B 不是正确的。它们适用于 Deauville 标准，用于淋巴瘤患者，并不适用于神经纤维瘤的病变。

选项 D 不是正确的。SUVmax 大于 3.5 的病变可能具有更恶性的潜在性，并且可能会被活检。

In children with neurofibromatosis, FDG PET/CT scan may be helpful to direct biopsy of a specific lesion:

Which of the following tissues normally show restricted diffusion on DW-MRI?

A. Brain, spinal cord, nerve plexuses
B. Normal lymph nodes
C. Normal red marrow
D. Normal liver
E. A-C

Which of the following tissues normally show restricted diffusion on DW-MRI?

- Option E is **CORRECT**. Brain, spinal cord, nerve plexuses, normal lymph nodes and red marrow all normally show restricted diffusion.
- Option D is **NOT** correct. Normal liver should not restrict diffusion.

Which patient is least likely to have widespread anomalies that would benefit from whole body MRI?

- **A. Infant with 7 cutaneous infantile hemangiomas**
- **B. Neonate with bizarre subcutaneous fatty masses, left leg overgrowth with distended veins and nevi**
- **C. Previously healthy adolescent with an abdominal aortic aneurysm**
- **D. Pre-adolescent with numerous phlebolith-containing soft tissue masses and bubbly lucent bone lesions that show endosteal scalloping**
- **E. Preschooler with new pleural effusions, cystic abdominal mass, expansile lucent bone lesions, and numerous spleen lesions**

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Which patient is least likely to have widespread anomalies that would benefit from whole body MRI?

- Option A is CORRECT. Patients with 5 or more cutaneous infantile hemangiomas are at risk for visceral hemangiomas.
- The liver is the most commonly involved organ in this setting, and can be associated with heart failure, hepatic failure, abdominal compartment syndrome, and hypothyroidism. Abdominal ultrasound is usually a sufficient. Liver MRI is rarely necessary if the sonographic imaging or clinical course is atypical.
- Whole body MRI, however, does not have a role in this particular scenario.

12-year-old with after treatment of stage II Hodgkin disease. Which one of the following is the MOST LIKELY etiology of the abnormalities?

A. Infection
B. Metastasis
C. Granulocyte colony stimulating factor (GCSF) therapy
D. Osteonecrosis

12-year-old with after treatment of stage II Hodgkin disease. Which one of the following is the MOST likely etiology of the abnormalities?

- Option D is CORRECT – osteonecrosis.
- Hodgkin and Non-Hodgkin disease patients are at greater risk to develop osteonecrosis. Although radiographs may reveal serpiginous sclerosis or articular collapse, MRI can detect bone ischemia and necrosis at a much earlier stage.
- The classic MR findings include serpiginous, well defined low T1 and high T2 lines within the medullary cavity.
- Whole-body MRI may detect greater burden of osteonecrosis than clinically suspected.
12-year-old with after treatment of stage II Hodgkin disease. Which one of the following is the MOST likely etiology of the abnormalities?


With regard to the FDG uptake indicated in the images:

- Option A is NOT correct – this is normal thymic uptake of FDG
- Option B is NOT correct – thymic uptake is more commonly observed in pediatric and young adult patients.
- Option C is NOT correct – normal thymic uptake is homogenous. Heterogeneity should raise suspicion for involvement by disease
- Option D is NOT correct – warming has not been shown to influence thymic uptake of FDG. Warming is important to limit brown fat uptake
- Option E is correct – thymic rebound, following elimination of a physiologic or disease stress, appears as an enlarged, more FDG-avid thymus

How can false positive DWI signal of normal spleen, marrow and lymph nodes be suppressed?

A. Inject gadolinium chelate
B. Oral water before scan
C. **Inject iron oxide nanoparticles**
D. Apply fat saturation
E. All of the above

• Option A is **NOT** correct. IV gadolinium does not have a significant effect on DWI signal.
• Option B is **NOT** correct. Oral water would not suppress DWI signal.
• Option C is **CORRECT**. Injection of iron oxide particles leads to signal loss in the normal reticulo-endothelial system.
• Option D is **NOT** correct. DWI images are already fat saturated.

How can false positive DWI signal of normal spleen, marrow and lymph nodes be suppressed?

What is a likely benefit of PET/MR over PET/CT scanners?

A. Superior PET resolution
B. Faster image acquisition
C. Improved anatomic resolution of cortical bone
D. **Decreased patient radiation exposure**
What is a likely benefit of PET/MR over PET/CT scanners?

- Option A is NOT correct. Available PET/MR scanners have equal or lower resolution than their corresponding PET/CT counterparts.
- Option B is NOT correct. Even simple performance of MRAC takes longer than CTAC.
- Option C is NOT correct. CT is superior to MR for imaging of cortical bone. It is hoped that superior MR imaging of bone marrow relative to CT will prove clinically useful in PET/MR.
- Option D is CORRECT. CT can contribute 45% or more of the total effective dose of PET/CT.

What is a likely benefit of PET/MR over PET/CT scanners?

- Jadvar H, Colletti PM. Competitive advantage of PET/MRI. Eur J Radiol 2014; 83: 84-94

11 year old girl 7 months after the initiation of chemotherapy.

- Option A is CORRECT. The lesions in this patient involve nearly the entire articular surface of both femoral heads. Lesions involving > 30% of the articular surface in these patients are at great risk of progressing to collapse.
- Options B and C are NOT correct. Teenagers have repeatedly been shown to be at greater risk for developing glucocorticoid-induced osteonecrosis than preteens.
- Option D is NOT correct. Several polymorphisms have been associated with the development of osteonecrosis and include: PAI-1 (SERPINE1), ACP1
- Option E is NOT correct. Due to the systemic exposure of chemotherapy treatment, all joints are at risk for developing osteonecrosis. Bilateral involvement of joints is typical.
11 year old girl 7 months after the initiation of chemotherapy.


In a child with NF1, the sensitivity for detection of MPNST is BEST described as:

A. FDG PET/CT greater than MRI
B. DOPA PET/CT greater than MRI
C. MRI greater than DOPA PET/CT
D. MRI greater than FDG PET/CT

- The CORRECT answer is option A.
- Both FDG PET/CT and MRI will detect benign and malignant tumors in patients with NF1, but FDG PET/CT has been identified as having greater sensitivity.
  - MRI has been reported to detect 66% lesions but PET/CT has detected greater than 90% lesions.
- Options B, C and D are NOT correct. FDOPA is not used for detection of tumors in NF1 but can be used for neuroendocrine tumors

In a child with NF1, the sensitivity for detection of MPNST is BEST described as:

13 month-old girl with confirmed choroid plexus carcinoma and Li-Fraumeni syndrome. Which one of the following is the MOST likely etiology of the abnormality marked by the arrow?

A. Ectopic pancreas  
B. Neuroblastoma  
C. Adrenal adenoma  
D. Adrenocortical carcinoma  
E. Wilms tumor

Which patient is most likely to benefit from use of a blood pool MR contrast agent?

A. Infant with 7 cutaneous infantile hemangiomas  
B. Neonate with bizarre subcutaneous fatty masses, left leg overgrowth with distended veins and nevi  
C. Previously healthy adolescent with an abdominal aortic aneurysm  
D. Pre-adolescent with numerous phlebolith-containing soft tissue masses and bubbly lucent bone lesions that show endosteal scalloping  
E. Preschooler with new pleural effusions, cystic abdominal mass, expansile lucent bone lesions, and numerous spleen lesions
**Which patient is most likely to benefit from use of a blood pool MR contrast agent?**

- **Option C is CORRECT.** A previously healthy patient with newly discovered abdominal aortic aneurysm should undergo generalized screening for other aneurysms.
- Patient in option A will likely not have any vessel anomalies, while patients in options B, D and E will have slow flow vascular malformations, predominantly in mass form.

**Regarding the administration of intravenous (IV) gadolinium for whole Body MR imaging, which one of the following statements is correct?**

A. Should be administered immediately after the localizing sequences.
B. Should be administered only if diffusion weighted images are obtained.
C. Usually administered to enhance visualization of pathologic lesions.
D. Usually not required for whole body MR imaging. If administered, the STIR sequence should be performed **after** the administration of IV gadolinium.
E. Usually not required for whole body MR imaging. If administered, the STIR sequence should be performed **before** the administration of IV gadolinium.

**Which patient is most likely to benefit from use of a blood pool MR contrast agent?**

Regarding the administration of intravenous (IV) gadolinium for whole Body MR imaging, which one of the following statements is correct?