Pediatric MR imaging I: Oncology imaging

SY02-1

Update on Imaging of Pediatric Brain Tumors

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The purpose of this presentation is to provide a succinct overview of latest update on imaging of pediatric brain tumors. Using 2016 World Health Organization Classification of Tumors of the Central Nervous System as a guide, imaging spectrum of a variety of pediatric brain and spinal cord tumors will be presented including diffuse midline gliomas with H3 K27M mutation, astrocytic tumors with BRAF mutation, medulloblastomas, ependymomas, and embryonal tumors. Implication and importance of molecular genotypes in diagnosis and surveillance of pediatric brain tumors will be discussed.

Imaging presentation will focus on the latest advances and clinical application of structural and physiologic magnetic resonance imaging as well as PET-MR imaging. Using quantitative imaging as both diagnostic and prognostic tool in pediatric brain tumors will be introduced. Potential pitfalls and limitations of advanced imaging techniques will be discussed. Combining histopathology, molecular genotypes and imaging phenotypes to improve diagnosis, assess prognosis and differentiate tumor progression and treatment effect will be presented.

Keywords : Pediatric brain tumors, Advanced MRI, WHO 2016 CNS Tumor Classification

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MR Imaging in Pediatric Musculoskeletal Tumors

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Imaging studies play an important role in the initial diagnosis and follow-up assessment of musculoskeletal neoplasms in infants and children. MRI has become standard imaging modality for evaluating musculoskeletal system in children with primary or secondary bone and soft tissue tumors. MRI is very sensitive for bone marrow or soft tissue signal alterations owing to the excellent tissue contrast and multiplanar capability. MRI is also useful for visualizing the bone marrow status in patients with hematologic malignancy including lymphoma and leukemia. Focal bone lesions or diffuse marrow abnormality are best seen on pre-contrast T1-weighted images and fat-suppressed T2-weighted or other fat-suppressed sequences (STIR, SPIR, or SPAIR). Recently, whole body MRI with or without DWIBS (diffusion-weighted whole-body imaging with background body signal suppression) has been increasingly performed for screening of metastatic lesions in oncologic patients. Langerhans cell histiocytosis involving the skeletal system could be single (monostotic) or multiple (polyostotic), and whole body MRI may play a promising role for identifying multiple bony lesions without radiation in contrast to the skeletal survey or bone scintigraphy.

Osteosarcomas and Ewing sarcomas are the 1st and 2nd most common primary malignancy in the pediatric skeletal system. MRI of the specific bone is mandatory for assessing the intraosseous and extraosseous tumor extent; signal characteristics; relationship with the adjacent soft tissue and neurovascular bundle; epiphyseal involvement; skip lesions; and a guide to biopsy. MR imaging should be performed through the entire involved bone in order not to miss skip metastases. In children with acute leukemia, marrow signal intensity is diffusely abnormal and homogeneously hypointense on T1-weighted images with a variable degree of contrast enhancement. Metastasis to the skeletal system is quite common in patients with neuroblastoma especially in young children.

Conventional MRI along with post-gadolinium imaging is essential for tumor surveillance during and after treatment including chemotherapy and radiotherapy. At least two planes of post contrast T1-weighted images with fat suppression are needed for gadolinium-enhanced sequences. Enhancement after intravenous gadolinium administration is useful to differentiate peritumoral edema from the tumor and to assess tumor necrosis after treatment. Sometimes, it is problematic to differentiate recurrent or metastatic bone tumor from treatment-related osteonecrosis or osteomyelitis. Functional MR sequences including diffusion and perfusion imaging would be helpful for management of oncologic patients involving the musculoskeletal system.

Keywords : Bone and soft tissue tumors, Pediatric

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SY02-3

MR imaging in pediatric abdominal tumor

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MRI has an important role in pediatric body oncologic imaging and it is increasingly replacing or complementing CT in many cases. MRI has several advantages over CT. In addition to the lack of ionizing radiation, MRI provides superior contrast resolution as well as superior tissue characterization with the use of novel pulse sequences and multiphase dynamic post-contrast imaging. Several challenges remain in the performance of MRI in pediatric oncology patients, including frequent need for sedation in young children because of long acquisition time, as well as the suboptimal imaging of the lungs in the evaluation for pulmonary metastatic disease. However, despite these challenges, with continued improvements in MRI image quality and the development of novel sequences and quantitative imaging techniques, MRI is expected to play an increasing role in the imaging of pediatric oncology patients.

The following issues will be discussed in the present lecture.

1) To review MR findings of common pediatric solid tumors, including Wilms tumor, neuroblastoma, hepatoblastoma and lymphoma, focusing on imaging findings which correspond to critical branch points in treatment algorithms and which will change clinical management in pediatric solid tumor patients.

2) To discuss modern MRI techniques (including diffusion-weighted imaging) that are now applied for pediatric body oncologic imaging that allows faster, better or more accurate disease diagnosis.

3) To highlight the motion-resistant techniques for pediatric body MRI.

Keywords : Children, Oncology, Body, Tumor