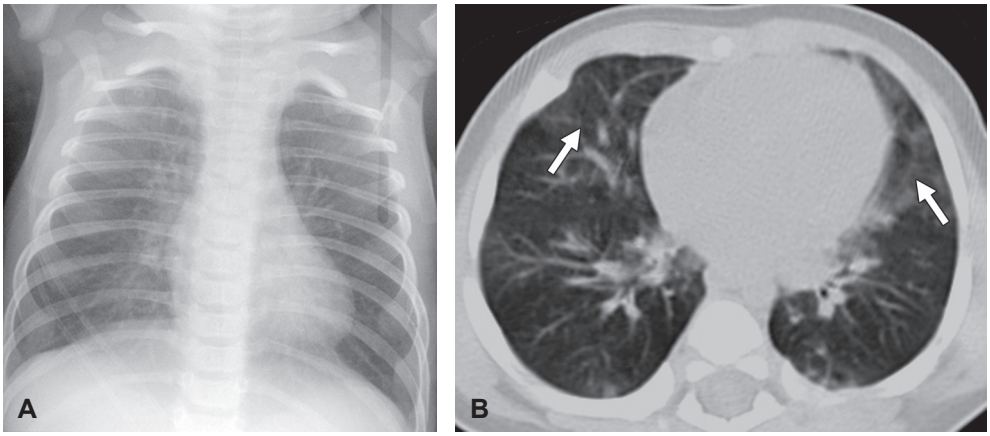
PEDIATRIC IMAGING: Chest Imaging

Case 12 Pediatric interstitial lung disease

History 4-month-old girl with tachypnea and shortness of breath



Imaging Findings

Fig. 12—Frontal chest radiograph (**A**) shows hyperinflation and parahilar peribronchial thickening. Axial contrast-enhanced CT image (**B**) shows subtle ground-glass opacities (*arrows*) within the right middle lobe and lingula with sparing of the lower lobes.

Differential Diagnosis

- Asthma
- Bronchiolitis obliterans
- Neuroendocrine cell hyperplasia of infancy
- Surfactant protein abnormality

Correct Diagnosis _____

Teaching Points

Neuroendocrine cell hyperplasia of infancy (NEHI) is an interstitial lung disease occurring predominantly in term male infants; 50% of cases occur in the neonatal period and present with tachypnea, hypoxemia, retractions, and crackles.

NEHI has distinct CT findings of geographic ground-glass opacities (GGO) within the right middle lobe and lingula and centrally with associated air trapping.

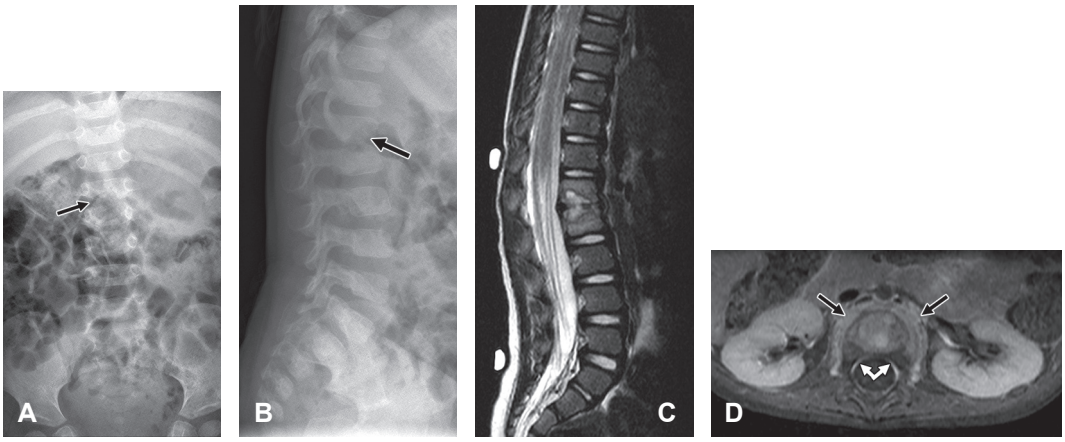
NEHI can be differentiated from bronchiolitis obliterans on the basis of the lack of bronchiectasis and from surfactant protein abnormality and asthma on the basis of the right middle lobe, lingular, and central distribution of the GGO.

Definitive diagnosis of NEHI is made with biopsy; immunostaining with bombesin is necessary for confirmation.

PEDIATRIC IMAGING: Pediatric Musculoskeletal Imaging

Case 13 Diskitis

History 17-month-old boy in rheumatology clinic with abnormal gait worsening over 5 weeks and history of antibiotic-treated mild febrile illness 4 weeks before presentation and no relevant remote medical history; he pulls himself up to a standing position, walks with a swaying gait, and does not have ataxia; findings on radiographs of the abdomen, pelvis, and both lower extremities are reported as normal except for constipation; fever has resolved, and inflammatory laboratory values are reassuring; physical examination shows normal joints and no spinal tenderness; consult to physical therapy and lumbar spine radiographs are ordered



Imaging Findings

Fig. 13—Frontal (**A**) and lateral (**B**) radiographs of the lumbar spine show disk-space narrowing at L1–L2 with irregularity along the inferior endplate of L1 and the superior endplate of L2 with mild focal kyphosis (*arrow*). Sagittal T1-weighted fat-suppressed contrast-enhanced MR image of the lumbar spine (**C**) shows abnormal, increased enhancement of the L1 and L2 vertebral bodies with loss of L1–L2 disk height and abnormal, increased enhancement within the disk. Loss of definition along the affected endplates is evident. Axial T1-weighted fat-suppressed contrast-enhanced MR image of the lumbar spine at the level of L1 (**D**) shows abnormal soft-tissue enhancement within the paravertebral regions (*black arrows*) with mild extension within the epidural space (*white arrows*). There is no effacement of the thecal sac and no abscess.

Differential Diagnosis

- Chronic recurrent multifocal osteomyelitis
- Infectious spondylodiskitis
- Langerhans cell histiocytosis
- Lymphoma

Correct Diagnosis

Teaching Points

Spondylodiskitis is rare in children, typically affecting children 2–8 years old.

The symptoms of spondylodiskitis are variable and often nonspecific, which may delay the diagnosis. Common symptoms include abdominal pain, fever, irritability, and difficulty walking.

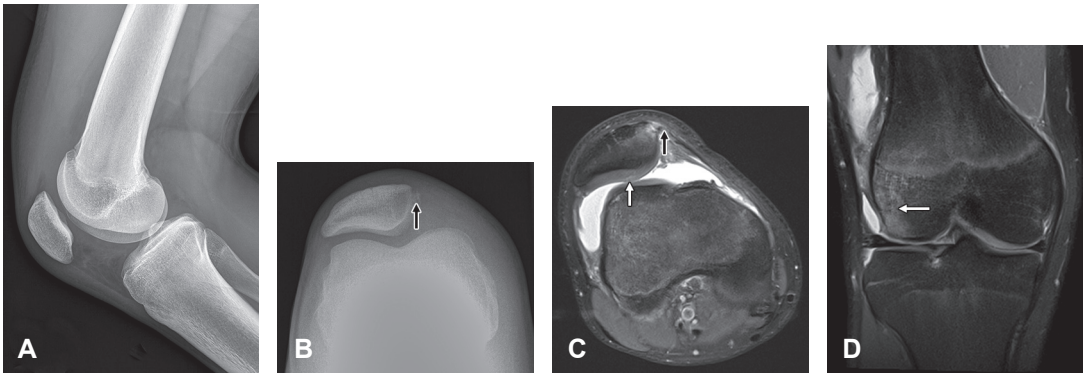
The earliest radiographic sign of spondylodiskitis is loss of definition and irregularity of the vertebral plateau, which can occur within 2–8 weeks after the onset of symptoms.

MRI is the test of choice for evaluating the extent of vertebral involvement, soft-tissue and epidural extension, spinal cord compression, and the presence of abscesses.

PEDIATRIC IMAGING: Pediatric Musculoskeletal Imaging

Case 15 Internal derangement of the knee

History 16-year-old boy with injury to right knee while playing basketball; he jumped for the ball and as he landed felt his knee pop out, and when he stretched his knee, it popped back into place



Imaging Findings

Fig. 15—Lateral radiograph of knee (**A**) shows a small to moderate joint effusion with adjacent soft-tissue swelling. Alignment is normal. Sunrise radiograph (**B**) shows a small avulsion fracture (*arrow*) along the medial aspect of the patella. Axial intermediate-weighted fat-suppressed MR image (**C**) depicts bone marrow edema within the medial aspect of the patella with focal cortical disruption. High signal intensity with partial tearing (*black arrow*) is present within the medial patellar retinaculum at the insertion on the patella. There is a moderate joint effusion with debris. A focal cartilaginous fissure (*white arrow*) is present within the patellar apex. Coronal T2-weighted fat-suppressed MR image (**D**) shows bone marrow edema (*arrow*) within the lateral femoral condyle.

Differential Diagnosis

- Bipartite patella
- Patellar fracture
- Patellar sleeve avulsion
- Transient patellar dislocation

Correct Diagnosis

Teaching Points

Recurrent patellar dislocation usually occurs in individuals with anatomic variants of the patellar stabilizers, such as trochlear dysplasia, patella alta, and lateralization of the tibial tuberosity.

MRI is useful for evaluating for patterns of injury encountered in transient patellar dislocation, such as tearing of the medial patellofemoral ligament, bone bruises of the patella and the lateral femoral condyle, and ligamentous injury. In addition, it helps to identify risk factors for chronic patellar instability.

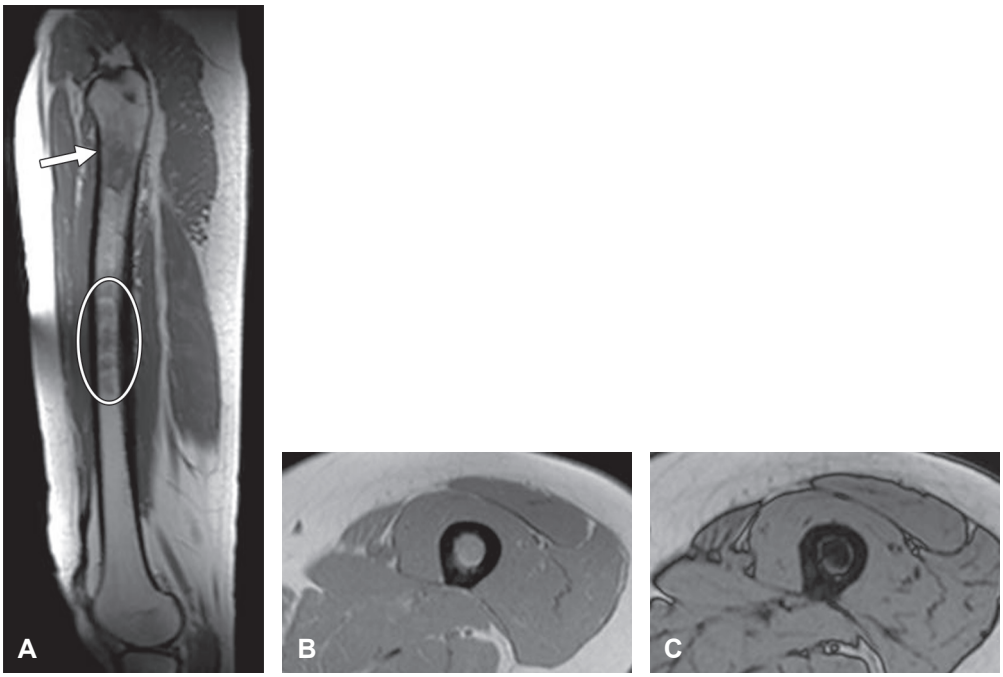
Patients with primary patellar dislocation without severe internal derangement and who lack major risk factors can be treated conservatively.

The most common corrective procedures include medial patellofemoral ligament reconstruction, trochleoplasty, medialization of the tibial tuberosity, and medial capsular plication.

PEDIATRIC IMAGING: Pediatric Musculoskeletal Imaging

Case 16 Chemical shift imaging

History 17-year-old boy with left hip pain and radiographic finding of destructive mass within the proximal left femur; MRI findings are consistent with an aggressive osseous lesion, probably Ewing sarcoma; T1-weighted images show the mass within the proximal femur with foci of decreased signal intensity within the diaphysis that are concerning for metastatic skip lesions; on the basis of the chemical shift imaging findings, it must be determined whether the regions within the diaphysis suggest the presence of a malignant process



Imaging Findings

Fig. 16—Sagittal T1-weighted MR image of the femur (**A**) shows a fairly well-defined mass (*arrow*) within the proximal diaphysis. Because of the appearance on radiographs and images obtained with other sequences (not shown), the findings suggest an aggressive lesion, probably Ewing sarcoma. Foci of decreased signal intensity are evident within the diaphysis (*oval*). Axial in-phase MR image through the mid diaphysis (**B**) shows marrow signal intensity that is isointense to slightly hyperintense to muscle. Axial opposed-phase image obtained at the same level as **B** (**C**) shows marrow signal intensity that is isointense to the bony cortex.

Differential Diagnosis

- They do suggest malignancy, because there is increased signal intensity on in-phase images
- They do suggest malignancy, because there is signal intensity dropout on opposed-phase images
- They do not suggest malignancy, because there is increased signal intensity on in-phase images
- They do not suggest malignancy, because signal intensity dropout is present on opposed-phase images

Correct Diagnosis

Teaching Points

Unenhanced T1-weighted MRI has excellent sensitivity for detecting borders of bone tumor. There is a tendency toward overestimation of tumor extent when fluid-sensitive sequences are used, mainly owing to perilesional edema, which can be challenging to differentiate from tumor.

Chemical shift imaging, consisting of in-phase and opposed-phase gradient-echo sequences, is a potential alternative to T1-weighted imaging for defining the intramedullary extent of a bone tumor.

Chemical shift imaging is based on the principle that protons attached to water precess with slightly different frequencies. When a voxel contains fat and water, there is an additive effect on the signal intensity of the in-phase image with at least a 20% loss of signal intensity on the opposed-phase image. Therefore, marrow that contains fat exhibits signal intensity dropout on opposed-phase images.

Voxels with tumor that replaces normal fat-containing marrow consist of only water within the voxel and thus there will be no substantial signal intensity dropout (< 20%) on opposed-phase compared with in-phase images.