American College of Radiology
ACR Appropriateness Criteria®
Joint Pain: Idiopathic Arthritis-Child

Variant: 1 Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
Radiography area of interest	Usually Appropriate	Varies
US area of interest	May Be Appropriate	O
MRI area of interest without and with IV contrast	May Be Appropriate	O
MRI area of interest without IV contrast	May Be Appropriate	O
US area of interest with IV contrast	Usually Not Appropriate	O
MRI whole body without and with IV contrast	Usually Not Appropriate	O
MRI whole body without IV contrast	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan whole body with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢
CT area of interest with IV contrast	Usually Not Appropriate	Varies
CT area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT area of interest without IV contrast	Usually Not Appropriate	Varies

Variant: 2 Child. Back pain. Suspected idiopathic arthritis. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI complete spine without and with IV contrast	Usually Appropriate	O
MRI spine area of interest without and with IV contrast	Usually Appropriate	O
Radiography complete spine	May Be Appropriate	☢☢☢
Radiography spine area of interest	May Be Appropriate	Varies
MRI complete spine without IV contrast	May Be Appropriate	O
MRI spine area of interest without IV contrast	May Be Appropriate	O
US spine area of interest	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan whole body with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
CT complete spine with IV contrast	Usually Not Appropriate	☢☢☢☢
CT complete spine without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT complete spine without IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢
CT spine area of interest with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without IV contrast	Usually Not Appropriate	Varies

Variant: 3 Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI sacroiliac joints without IV contrast	Usually Appropriate	O
Radiography pelvis	May Be Appropriate (Disagreement)	☢☢
Radiography sacroiliac joints	May Be Appropriate	☢☢
MRI sacroiliac joints and lumbar spine without and with IV contrast	May Be Appropriate	O
MRI sacroiliac joints and lumbar spine without IV contrast	May Be Appropriate	O
US sacroiliac joints	Usually Not Appropriate	O
MRI sacroiliac joints without and with IV contrast	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT sacroiliac joints	Usually Not Appropriate	☢☢☢☢
CT pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢
CT pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
CT pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢

Variant: 4 Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI temporomandibular joint without and with IV contrast	Usually Appropriate	O
Radiography temporomandibular joint	Usually Not Appropriate	☢☢
US head and neck	Usually Not Appropriate	O
MRI temporomandibular joint without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢☢
CT maxillofacial without IV contrast	Usually Not Appropriate	☢☢☢
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT maxillofacial	Usually Not Appropriate	☢☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢

Variant: 5 Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
US area of interest	Usually Appropriate	O
MRI area of interest without and with IV contrast	Usually Appropriate	O
Radiography area of interest	May Be Appropriate (Disagreement)	Varies
MRI area of interest without IV contrast	May Be Appropriate	O
US area of interest with IV contrast	Usually Not Appropriate	O

MRI whole body without and with IV contrast	Usually Not Appropriate	O
MRI whole body without IV contrast	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan whole body with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢
CT area of interest with IV contrast	Usually Not Appropriate	Varies
CT area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT area of interest without IV contrast	Usually Not Appropriate	Varies

Variant: 6 Child. Back pain. Idiopathic arthritis. Follow-up imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI complete spine without and with IV contrast	Usually Appropriate	O
MRI spine area of interest without and with IV contrast	Usually Appropriate	O
MRI complete spine without IV contrast	May Be Appropriate	O
MRI spine area of interest without IV contrast	May Be Appropriate	O
Radiography complete spine	Usually Not Appropriate	☢☢☢
US spine area of interest	Usually Not Appropriate	O
Radiography spine area of interest	Usually Not Appropriate	Varies
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan whole body with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT area of interest	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
CT complete spine with IV contrast	Usually Not Appropriate	☢☢☢☢
CT complete spine without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT complete spine without IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢
CT spine area of interest with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without IV contrast	Usually Not Appropriate	Varies

Variant: 7 Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI sacroiliac joints without IV contrast	Usually Appropriate	O
MRI sacroiliac joints and lumbar spine without and with IV contrast	May Be Appropriate	O
MRI sacroiliac joints and lumbar spine without IV contrast	May Be Appropriate	O
US sacroiliac joints	Usually Not Appropriate	O
Radiography pelvis	Usually Not Appropriate	☢☢
Radiography sacroiliac joints	Usually Not Appropriate	☢☢
MRI sacroiliac joints without and with IV contrast	Usually Not Appropriate	O
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT sacroiliac joints	Usually Not Appropriate	☢☢☢☢
CT pelvis with IV contrast	Usually Not Appropriate	☢☢☢☢

CT pelvis without IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
CT pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢

Variant: 8 Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging.

Procedure	Appropriateness Category	Peds Relative Radiation Level
MRI temporomandibular joint without and with IV contrast	Usually Appropriate	O
CT maxillofacial without IV contrast	May Be Appropriate	☢☢☢
Radiography temporomandibular joint	Usually Not Appropriate	☢☢
US head and neck	Usually Not Appropriate	O
MRI temporomandibular joint without IV contrast	Usually Not Appropriate	O
CT maxillofacial with IV contrast	Usually Not Appropriate	☢☢☢
Bone scan whole body	Usually Not Appropriate	☢☢☢☢
Bone scan with SPECT or SPECT/CT maxillofacial	Usually Not Appropriate	☢☢☢☢
CT maxillofacial without and with IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/MRI whole body	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT whole body	Usually Not Appropriate	☢☢☢☢

Panel Members

Nancy A. Chauvin, MD[a], Anh-Vu H. Ngo, MD[b], Sherwin S. Chan, MD, PhD[c], Brandon P. Brown, MD, MA[d], Scott R. Dorfman, MD[e], Marla Guzman, MD[f], George Koberlein, MD[g], Morgan P. McBee, MD[h], HaiThuy N. Nguyen, MD[i], Karen Brandt Onel, MD[j], Emily S. Orscheln, MD[k], Elizabeth J. Snyder, MD[l], Andrew T. Trout, MD[m], Muhammad Waseem, MD, MS[n], Kirsten L. Weltmer, MD[o], George S. Wu, MD[p], Ramesh S. Iyer, MD, MBA[q]

Summary of Literature Review

Introduction/Background

Juvenile idiopathic arthritis (JIA) is the most common rheumatic disease of childhood, with a prevalence of 0.6 to 1.9 per 1,000 children [1]. JIA is an umbrella term that encompasses all forms of inflammatory arthritis that begin before 16 years of age, persist for >6 weeks, and are of unknown etiology [1,2]. The International League of Associations for Rheumatology (ILAR) defined JIA subtypes based on the number of joints, location of joint inflammation, serologic markers, and other systemic symptoms presenting within the first 6 months of disease [2,3]. The cause of JIA remains unknown, but genetic and environmental factors are likely contributory. Genetic associations with certain human leukocyte antigen (HLA) alleles are recognized in children with a predisposition to JIA, in particular HLA-A2 [2].

The hallmark feature of JIA is inflammation of the synovial lining, the thin layer of soft tissue that lines joint cavities, tendon sheaths, and bursae. If left untreated, synovial inflammation progresses to synovial hyperplasia with hyperemia, resulting in a highly cellular inflammatory pannus. The pannus may eventually erode into the overlying cartilage and bone because of antibody deposition and the release of degradative enzymes, leading to articular destruction [2]. Chronic

inflammation can result in irreversible cartilage damage, joint space narrowing, erosions, and in advanced disease, ankylosis. This is of particular concern in the growing skeleton as growth disturbance and joint malalignment can lead to lifelong disability and decreased quality of life [1]. The disease course is highly unpredictable because some patients have self-limiting disease, whereas others have unremitting inflammation with frequent exacerbations [3]. The clinical treatment goal is early suppression of inflammation to prevent irreversible joint damage. Given that physical examination is limited in its reliability in diagnosing joint inflammation, imaging plays a vital role in diagnosing and managing children with JIA [1,4]. This document discusses eight variants, including both the appendicular and axial skeleton. Given their uniqueness, the temporomandibular and sacroiliac joints are discussed as independent variants.

Special Imaging Considerations

When choosing an imaging study, it is essential to consider the global distribution of skeletal involvement. The timing and usefulness of imaging in JIA must be tailored to the individual patient and regions involved [5]. Ionizing radiation exposure associated with diagnostic imaging is of particular relevance for children with JIA as many patients will require numerous imaging studies throughout their lifetime [6]. Although the diagnosis of JIA remains one of exclusion, based solely on clinical criteria, imaging is increasingly being used to help confirm the diagnosis [7]. Therefore, imaging findings should be correlated with patient symptomatology and serologic markers, particularly given the uncertainty of the significance of depicting subclinical disease on imaging [4].

Imaging of children with inflammatory arthropathy is challenging given the unique features of the growing skeleton and lack of established normative imaging data. To accurately diagnose JIA, one needs to be familiar with the normal age-dependent changes that occur during skeletal development. Developmental changes of recently ossified bones can be misinterpreted as cortical erosions [8]. Imaging atlases to guide interpretation of pediatric MRI are helpful for the sacroiliac joints [9,10] and the temporomandibular joints (TMJs) [11].

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.

The areas of interest for this variant include the shoulder, elbow, wrist, hand, hip, knee, ankle, and foot. Children typically present with joint swelling (with or without pain), causing a restricted range of joint motion [12]. Abnormal gait or refusal to walk may occur with lower limb involvement.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
B. Bone scan whole body with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan whole body with single-photon emission computed tomography (SPECT) or SPECT/CT area of interest as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
C. Bone scan with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone with SPECT or SPECT/CT area of interest as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
D. CT area of interest with IV contrast

There is no relevant literature supporting the use of CT area of interest with intravenous (IV) contrast as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
E. CT area of interest without and with IV contrast

There is no relevant literature supporting the use of CT area of interest without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
F. CT area of interest without IV contrast

There is no relevant literature supporting the use of CT area of interest without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
G. FDG-PET/CT whole body

There is no relevant literature supporting the use of fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET/CT whole body as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
H. FDG-PET/MRI whole body

There is no relevant literature supporting the use of FDG-PET/MRI whole body as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
I. MRI area of interest without and with IV contrast

MRI is an excellent diagnostic modality for assessing features of JIA within the peripheral joints, but MRI is generally not used for initial imaging [13-15]. MRI can demonstrate active inflammatory changes such as effusions, bone marrow edema, synovial thickening, enthesitis, and soft tissue inflammation and chronic structural changes such as cartilage lesions, osseous erosions, and joint derangement. Postcontrast imaging is useful for assessing for active synovitis or tenosynovitis [4,16]. MRI has been shown to be more sensitive and specific when evaluating JIA than clinical examination and radiography [17].

There are no well-accepted MRI joint protocols and experts advocate for a combination of fluid-sensitive and T1-weighted sequences and a sequence to evaluate cartilage [18,19].

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
J. MRI area of interest without IV contrast

To date, no large studies have demonstrated the efficacy and reliability for the use of MRI without IV contrast in depicting active synovial disease. Current recommendations from the European Society of Musculoskeletal Radiology (ESSR)-European Society of Paediatric Radiology (ESPR) include gadolinium contrast to assess for active synovitis and tenosynovitis [4,16]. Early work has shown promise in the use of diffusion-weighted imaging [20] and proton-density images [21] to depict active synovitis in large joints, which has been adopted at some institutions.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
K. MRI whole body without and with IV contrast

There is no relevant literature supporting the use of MRI whole body without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
L. MRI whole body without IV contrast

There is no relevant literature supporting the use of MRI whole body without IV contrast as the initial imaging modality in this clinical scenario.

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
M. Radiography area of interest

Radiography is recommended as an initial imaging for peripheral joints by the ESSR-ESPR [4] and French societies for rheumatology, radiology, and pediatric rheumatology [22]. Radiographs are beneficial as the initial imaging modality in the child with joint pain as they may demonstrate soft tissue edema, periarticular demineralization, periostitis, and presence of a joint effusion, that may support the diagnosis of a nonspecific inflammatory arthritis. Conventional radiographs may help exclude other causes of pain such as trauma or tumors and can serve as a baseline for follow-up imaging. Features of chronic joint damage that may be present at the time of diagnosis, such as

erosions, joint space narrowing, and malignment, can be depicted [4,23,24].

Radiographic joint interpretation can be challenging in children given the variable joint appearance during maturation [8] as well as lack of intrareader agreement [6,25].

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
N. US area of interest

Targeted ultrasound (US) imaging has been shown to confirm suspected peripheral joint arthritis, depict affected anatomical compartments, and can help define JIA subtype [2,26]. Grayscale US imaging can show joint fluid, synovial thickening, entheseal thickening, and cartilage and bone erosions. US imaging supplemented with color or power Doppler that shows increased blood flow or hyperemia within the synovium of joints and bursae, adjacent soft tissues, or the entheses is suggestive of active inflammatory disease [1,2]. The Outcome Measures in Rheumatology and Clinical Trials (OMERACT) has provided consensus-based US definitions of synovitis [27] and tenosynovitis in JIA [28]. The literature consensus supports the use of US to depict enthesitis in JIA, however, strict definitions and US criteria for disease are lacking [29].

US is particularly useful in the smaller joints and has been shown to be superior to clinical examination in the detection of synovitis in JIA [30,31]. Initial US imaging can also serve as a baseline imaging study that can be used as a comparison for follow-up studies [32]. US is limited in assessing children with obesity due to difficulty with transducer penetration as well as deep joint spaces due to acoustic shadowing from overlying bones [21]. As an example, the central recess of the knee, a common location for synovitis, is difficult to evaluate with sonography [4].

Variant 1: Child. Appendicular joint pain or swelling. Suspected idiopathic arthritis. Initial imaging.
O. US area of interest with IV contrast

There is no relevant literature supporting the use of US area of interest with IV contrast as the initial imaging modality in this clinical scenario. The literature is limited to review articles that describe the potential use of evaluating peripheral joint synovitis with US with IV contrast [33].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.

This variant includes assessment of the cervical, thoracic, and lumbar spine.

The cervical spine is most frequently involved in JIA with 65% of all patients with JIA having cervical spine symptoms [4]. Many patients diagnosed with cervical spine involvement are often asymptomatic [34]. Lumbar spine involvement is most common in patients with enthesitis-related arthritis (ERA), a subtype of JIA, and is often asymptomatic [35]. Given that patients often have minor subjective complaints, imagining the entire spine to increase diagnostic accuracy should be considered [4].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
B. Bone scan whole body with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan whole body with SPECT or SPECT/CT area of interest as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
C. Bone scan with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT area of interest as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
D. CT complete spine with IV contrast

There is no relevant literature supporting the use of CT complete spine with IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
E. CT complete spine without and with IV contrast

There is no relevant literature supporting the use of CT complete spine without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
F. CT complete spine without IV contrast

There is no relevant literature supporting the use of CT complete spine without IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
G. CT spine area of interest with IV contrast

There is no relevant literature supporting the use of CT spine area of interest with IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
H. CT spine area of interest without and with IV contrast

There is no relevant literature supporting the use of CT spine area of interest without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
I. CT spine area of interest without IV contrast

There is no relevant literature supporting the use of CT spine area of interest without IV contrast as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
J. FDG-PET/CT whole body

There is no relevant literature supporting the use of FDG-PET/CT whole body as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
K. FDG-PET/MRI whole body

There is no relevant literature supporting the use of FDG-PET/MRI whole body as the initial imaging modality in this clinical scenario.

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
L. MRI complete spine without and with IV contrast

MRI complete spine with IV contrast is useful to evaluate for JIA changes within the spine as it allows for direct visualization of synovial thickening and enhancement, joint effusions, and bone marrow edema. Imaging of the complete spine rather than an area of clinical interest may be helpful because it has been shown that up to 77% of asymptomatic patients with ERA demonstrate positive MRI findings [35]. It shows osseous erosions before they become visible on radiographs [34]. MRI is also useful for the assessment late-stage structural changes such as dens deformation, subluxations, joint ankylosis, and neural compression [4].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
M. MRI complete spine without IV contrast

The literature supports performing an MRI spine with IV contrast. Pathologic enhancement has revealed additional sites of spine inflammation that was not apparent on noncontrast imaging, indicating that it is useful to add IV contrast when performing MR spine imaging in patients with JIA [7,27].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
N. MRI spine area of interest without and with IV contrast

MRI with IV contrast is useful to evaluate for JIA changes within the spine as it allows for direct visualization of synovial thickening and enhancement, joint effusions, and bone marrow edema. It shows osseous erosions before they become visible on radiographs [34]. MRI is also useful for the assessment late-stage structural changes such as dens deformation, subluxations, joint ankylosis, and neural compression [4].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
O. MRI spine area of interest without IV contrast

The literature supports performing an MRI spine with IV contrast. Pathologic enhancement has revealed additional sites of spine inflammation that was not apparent on noncontrast imaging, indicating that it is useful to add IV contrast when performing MR spine imaging in patients with JIA [7,27].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
P. Radiography complete spine

Radiography of the complete spine is not sensitive for detecting early joint changes. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes [4]. Conventional radiographs may help exclude other causes of pain and can serve as a baseline for follow-up imaging [23].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
Q. Radiography spine area of interest

Radiography is not sensitive for detecting early joint changes. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes [4]. Conventional radiographs may help exclude other causes of pain and can serve as a baseline for follow-up imaging [23].

Variant 2: Child. Back pain. Suspected idiopathic arthritis. Initial imaging.
R. US spine area of interest

There is no relevant literature supporting the use of US spine area of interest as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.

Sacroiliitis is most prevalent amongst those with ERA, a subtype of JIA. Patients with ERA are more often male (56%-82.5%) and positive for HLA-B27 (38%-68%) [36]. Anterior uveitis, enthesitis, and a family history of spondyloarthritis are also common with this condition [37]. Clinically, sacroiliitis is defined as tenderness on palpation of the sacroiliac joint(s) and/or inflammatory lumbosacral pain by the ILAR criteria, however, clinical and imaging findings are often discordant [36]. Early depiction of sacroiliac joint inflammation in patients with ERA is crucial because it will typically change clinical management [4]. Unlike other joints affected by JIA, the sacroiliac joint contains only a small amount of synovial tissue and the hallmark feature of active sacroiliitis is bone marrow edema [38].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
B. Bone scan with SPECT or SPECT/CT sacroiliac joints

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT sacroiliac joints as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
C. CT pelvis with IV contrast

There is no relevant literature supporting the use of CT pelvis with IV contrast as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
D. CT pelvis without and with IV contrast

There is no relevant literature supporting the use of CT pelvis without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
E. CT pelvis without IV contrast

CT pelvis without IV contrast can assess erosions, joint space narrowing, and ankylosis of the sacroiliac joint [39]. However, CT is of limited value to detect active changes such as bone marrow edema and capsulitis [37].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
F. FDG-PET/CT whole body

There is no relevant literature supporting the use of FDG-PET/CT whole body as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
G. FDG-PET/MRI whole body

There is no relevant literature supporting the use of FDG-PET/MRI whole body as the initial imaging modality in this clinical scenario.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging.
H. MRI sacroiliac joints and lumbar spine without and with IV contrast

The use of imaging both the sacroiliac joints and the lumbar spine with MRI without and with IV contrast for assessment of inflammatory lesions of the lumbar spine in children with suspected

sacroiliitis remains controversial. In a 2016 study, lumbar spine apophyseal joint arthritis was discordant with imaging findings of active sacroiliitis, suggesting that imaging of the sacroiliac joints alone may not be sufficient for diagnosis in patients with ERA with back pain [40].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. I. MRI sacroiliac joints and lumbar spine without IV contrast

Current MRI recommendations to image the spine include the use of IV contrast, as IV contrast helps monitor disease progression, response to treatment, and evaluation of late changes, including joint ankylosis and spinal cord compression in the lumbar spine [7]. Therefore, when the lumbar spine is being imaged, MRI of the sacroiliac joints and lumbar spine without IV contrast is less useful compared with MRI sacroiliac joints and lumbar spine without and with IV contrast.

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. J. MRI sacroiliac joints without and with IV contrast

MRI of the sacroiliac joints without IV contrast is a useful modality to assess sacroiliitis and studies have shown that IV contrast does not add incremental value when assessing for sacroiliitis [38,41].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. K. MRI sacroiliac joints without IV contrast

MRI of the sacroiliac joints without IV contrast is a useful modality for assessing sacroiliitis and is the reference standard to evaluating early disease. Active inflammatory changes, bone marrow edema, enthesitis, and capsulitis are readily depicted on fluid-sensitive sequences. The addition of T1-weighted sequences are useful to show structural changes, erosions, fatty marrow deposition, sclerosis, and ankylosis. Studies have shown that IV contrast does not add incremental value when assessing for sacroiliitis [38,41]. When imaging for sacroiliitis, a small field-of-view (FOV) dedicated to the sacroiliitis joints, with images tailored to the plane of the sacrum, is helpful over large FOV pelvic imaging [42]. Imaging atlases to guide interpretation of pediatric MRI are helpful for the sacroiliac joints, particularly because bone marrow changes in a typical child may mimic active sacroiliitis [9,10].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. L. Radiography pelvis

Radiography is not sensitive enough to depict early changes of sacroiliitis and marrow edema cannot be assessed [43]. Conventional radiography is limited in assessing sacroiliitis due to high false-positive and false-negative findings as interpretations are often discordant when compared with MRI [43]. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes such as sclerosis, erosions, and ankylosis [4]. Conventional radiographs may also help exclude other causes of pain [23].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. M. Radiography sacroiliac joints

Radiography is not sensitive enough to depict early changes of sacroiliitis and marrow edema cannot be assessed [43]. Conventional radiography is limited in assessing sacroiliitis due to high false-positive and false-negative findings as interpretations are often discordant when compared with MRI [43]. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes such as sclerosis, erosions, and ankylosis [4]. Conventional radiographs may also help exclude other causes of pain [23].

Variant 3: Child. Sacroiliac joint pain. Suspected idiopathic arthritis. Initial imaging. N. US sacroiliac joints

There is no relevant literature supporting the use of US as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

The TMJ is among the most frequently affected joint in patients with JIA, can be involved in all subtypes, and is often asymptomatic. Prolonged inflammation can have severe consequences such as pain, dysfunction, cartilage and bone tissue destruction, and mandibular growth alteration [44]. Patient symptoms include reduced maximal jaw opening capacity, pain during jaw movements, fatigue of the jaws, TMJ crepitus, chewing disabilities, and neck pain [44]. A diagnosis of JIA and the described symptomology will prompt imaging.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
B. Bone scan with SPECT or SPECT/CT maxillofacial

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT maxillofacial as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
C. CT maxillofacial with IV contrast

There is no relevant literature supporting the use of CT maxillofacial with IV contrast as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
D. CT maxillofacial without and with IV contrast

There is no relevant literature supporting the use of CT maxillofacial without and with IV contrast as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
E. CT maxillofacial without IV contrast

There is no relevant literature supporting the use of CT maxillofacial without IV contrast as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.
F. FDG-PET/CT whole body

There is no relevant literature supporting the use of FDG-PET/CT whole body as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

G. FDG-PET/MRI whole body

There is no relevant literature supporting the use of FDG-PET/MRI whole body as the initial imaging modality in this clinical scenario.

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

H. MRI temporomandibular joint without and with IV contrast

MRI TMJ without and with IV contrast is the modality of choice for diagnosing TMJ disease in patients with JIA. MRI can demonstrate soft tissue and osteochondral changes [45]. The administration of contrast is needed for thickening and enhancement of the synovium. Postcontrast images should be obtained immediately after the injection as the contrast diffuses into the joint quickly and can preclude assessment of enhancing synovium from effusion [45]. Members of the Juvenile Idiopathic Arthritis Magnetic Resonance Imaging working group of OMERACT and the EuroTMjoint classifications have published a recommended consensus MRI protocol [46]. Imaging atlases are helpful to guide the interpretation of pediatric MRI for the TMJs [11].

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

I. MRI temporomandibular joint without IV contrast

There is no relevant literature to support the use of MRI without IV contrast to assess for active TMJ synovitis. MRI studies of the TMJs in JIA have employed the use of both without and with IV contrast to assess for active inflammation. Chronic structural changes of the TMJs are readily assessed on noncontrast imaging [4].

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

J. Radiography temporomandibular joint

Radiographs of the TMJs are not useful to diagnose JIA as radiographs are often normal at disease onset [22]. If conventional radiographs are obtained, morphologic mandibular condyle and other osseous joint changes could support the diagnosis of JIA, however, this should be confirmed with MRI [47].

Variant 4: Child. Temporomandibular joint pain. Suspected idiopathic arthritis. Initial imaging.

K. US head and neck

US with power Doppler is not a sensitive modality to diagnose temporomandibular inflammation in JIA. In a recent study comparing US and MRI of the TMJs, US with Doppler demonstrated very poor sensitivity (0%), low specificity (36.4%), and very low positive predictive value (0%) of depicting synovial inflammation when compared with MRI as the reference standard [48].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging.

The areas of interest for this variant include the shoulder, elbow, wrist, hand, hip, knee, ankle, and foot. This variant includes a description for those children with continued or recurrent joint or entheseal pain. In addition, the role of imaging asymptomatic patients is discussed.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging.

A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as a follow-up imaging

modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. B. Bone scan whole body with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan whole body with SPECT or SPECT/CT area of interest as a follow-up imaging modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. C. Bone scan with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone with SPECT or SPECT/CT area of interest as a follow-up imaging modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. D. CT area of interest with IV contrast

There is no relevant literature supporting the use of CT area of interest with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. E. CT area of interest without and with IV contrast

There is no relevant literature supporting the use of CT area of interest without and with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. F. CT area of interest without IV contrast

There is no relevant literature supporting the use of CT area of interest without IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. G. FDG-PET/CT whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the peripheral joints as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. H. FDG-PET/MRI whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the peripheral joints as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. I. MRI area of interest without and with IV contrast

The literature supports the use of MRI with IV contrast to assess for continued or recurrent joint inflammation in children with joint pain and an established diagnosis of JIA [4]. MRI can demonstrate active inflammatory changes such as effusions, bone marrow edema, synovial thickening, enthesitis, and soft tissue inflammation and chronic structural changes such as cartilage lesions, osseous erosions, and joint derangement. Postcontrast imaging is useful for assessing for active synovitis or tenosynovitis [4,16]. It should be noted that MRI-detected subclinical inflammation is present in a large proportion of patients with JIA despite clinical remission. Although there is no accepted consensus regarding the implications of subclinical inflammatory changes depicted on imaging, subclinical synovitis and bone marrow edema have been shown to

play a role in predicting the risk of disease relapse and joint deterioration [50].

There are no well-accepted imaging joint protocols, and centers use a combination of fluid-sensitive, T1-weighted sequences and a sequence to evaluate cartilage [18,19].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. J. MRI area of interest without IV contrast

Current recommendations from ESSR-ESPR include gadolinium contrast to assess for active synovitis and tenosynovitis [4,16]. Early work has shown promise in the use of diffusion-weighted imaging [20] and proton-density images [21] to depict active synovitis. To date, no large studies have shown efficacy and reliability for using noncontrast MRI sequences in depicting active synovial disease.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. K. MRI whole body without and with IV contrast

There is no relevant literature supporting the use of MRI whole body without and with IV contrast as a follow-up imaging modality in this clinical scenario. Given the inherent long scan times in whole body MRI, postcontrast injection delay may result in differential enhancement of structures at varying times after injection, leading to incorrect interpretation of findings [51].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. L. MRI whole body without IV contrast

There are no clear guidelines for the standardized detection, interpretation, and quantification of JIA on whole-body MRI [7]. Preliminary work has been reported by the OMERACT in a JIA working group regarding the use of MRI whole body without IV contrast to determine the total inflammatory burden and assess treatment response in JIA [51]. The authors developed a scoring system based on using coronal short tau inversion recovery images with additional images for specific parts of the body. A note is made that assessment of small joints of the hand and feet are not well assessed on large FOV MRI whole body imaging, and additional sites such as the costovertebral and costotransverse joints are not well assessed in the coronal plane [51]. Future validation studies are needed to assess the usefulness of this modality.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. M. Radiography area of interest

There is no evidence to support the use of routine radiography on all patients to follow up peripheral arthropathy following initial radiographs. Radiographs are not sensitive to evaluating early cartilage damage or bone marrow edema. Follow-up radiography should be tailored to patients, addressing concerns regarding growth abnormalities, progression of erosions, or joint space narrowing [22]. No information exists on the agreement of musculoskeletal pediatric specialists in the assessment of the degree of radiographic joint damage in childhood arthritis [25].

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. N. US area of interest

The literature supports the use of tailored US examination to assess for continued or recurrent peripheral joint inflammation in children with joint pain and an established diagnosis of JIA [26,52]. Grayscale US imaging can show joint fluid, synovial thickening, entheseal thickening, and cartilage and bone erosions. US imaging supplemented with color or power Doppler that shows increased blood flow or hyperemia within the synovium of joints and bursae, adjacent soft tissues, or the entheses is suggestive of active inflammatory disease [1,2]. There is debate and a lack of consensus

regarding the use of US to evaluate joints in asymptomatic patients. For those patients in clinical remission, the detection of subclinical US abnormalities has been suggested to be associated with a significant risk of relapse, especially in the case of positive Doppler signals [52,53]. A recent study that was performed over a 4-year period showed that subclinical disease, demonstrated by both grayscale and power Doppler abnormalities, displayed a higher predictive value of disease relapse [32]. More research is needed to identify the usefulness of US screening in children in clinical remission.

Variant 5: Child. Appendicular joint pain or swelling. Idiopathic arthritis. Follow-up imaging. O. US area of interest with IV contrast

There is no relevant literature supporting the use of US area of interest with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.

This variant discusses the use of imaging the cervical, thoracic, and lumbar spine in children with an established diagnosis of JIA and spine inflammation.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. B. Bone scan whole body with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan whole body with SPECT or SPECT/CT area of interest as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. C. Bone scan with SPECT or SPECT/CT area of interest

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT area of interest as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. D. CT complete spine with IV contrast

There is no relevant literature supporting the use of CT complete spine with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. E. CT complete spine without and with IV contrast

There is no relevant literature supporting the use of CT complete spine without and with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. F. CT complete spine without IV contrast

There is no relevant literature supporting the use of CT complete spine without IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging. G. CT spine area of interest with IV contrast

There is no relevant literature supporting the use of CT spine area of interest with IV contrast as a

follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
H. CT spine area of interest without and with IV contrast

There is no relevant literature supporting the use of CT spine area of interest without and with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
I. CT spine area of interest without IV contrast

There is no relevant literature supporting the use of CT spine area of interest without IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
J. FDG-PET/CT whole body

There is no relevant literature supporting the use of FDG-PET/CT whole body as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
K. FDG-PET/MRI whole body

There is no relevant literature supporting the use of FDG-PET/MRI whole body as a follow-up imaging modality in this clinical scenario.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
L. MRI complete spine without and with IV contrast

MRI of the complete spine without and with IV contrast is usually not useful to monitor for disease progression unless the patient has known multifocal inflammation or inconclusive physical examination findings. In rare cases, complete spine imaging can be useful to evaluate for widespread late changes of inflammation, including atlantoaxial instability, dens deformity, joint ankylosis, and spinal cord compression [7].

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
M. MRI complete spine without IV contrast

Although the literature supports performing an MRI spine with IV contrast [7,27], MRI complete spine without IV contrast may be useful for assessing response to treatment in patients with known multifocal inflammation.

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
N. MRI spine area of interest without and with IV contrast

MRI of the spine without and with IV contrast is helpful for monitoring disease progression, response to treatment, and evaluation of late changes, including atlantoaxial instability, dens deformity, joint ankylosis, and spinal cord compression [7].

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
O. MRI spine area of interest without IV contrast

MRI of the spine without IV contrast is less useful compared with MRI spine without and with IV contrast because IV contrast is useful when assessing for JIA inflammatory changes of the spine. Pathologic enhancement has revealed additional sites of spine inflammation indicating that it is useful to add IV contrast when performing MR spine imaging in patients with JIA [7,27].

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.

P. Radiography complete spine

Conventional complete spine radiography is not routinely indicated to follow-up patients with JIA. Radiography could be considered in select cases and tailored to patients, addressing concerns regarding malalignment, functional impairment, growth disturbances, and morphological bony changes [4,7,22].

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
Q. Radiography spine area of interest

Conventional spine radiography is not routinely indicated to follow patients with JIA. Radiography could be considered in select cases and tailored to patients, addressing concerns regarding malalignment, functional impairment, growth disturbances, and morphological bony changes [4,7,22]. Follow-up cervical spine imaging can be considered in evaluating for anterior atlantoaxial subluxation and atlantoaxial impaction for those children at risk [4]. Atlantoaxial subluxation is more reliably seen on radiographs compared with MRI [54].

Variant 6: Child. Back pain. Idiopathic arthritis. Follow-up imaging.
R. US spine area of interest

There is no relevant literature supporting the use of US spine area of interest as a follow-up imaging modality in this clinical scenario.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.

This variant includes follow-up assessment of the sacroiliac joints in patients with an established diagnosis of sacroiliitis.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.
A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as a follow-up imaging modality in this clinical scenario.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.
B. Bone scan with SPECT or SPECT/CT sacroiliac joints

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT sacroiliac joints as a follow-up imaging modality in this clinical scenario.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.
C. CT pelvis with IV contrast

There is no relevant literature supporting the use of CT pelvis with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.
D. CT pelvis without and with IV contrast

There is no relevant literature supporting the use of CT pelvis without and with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging.
E. CT pelvis without IV contrast

CT pelvis without IV contrast can assess erosions, joint space narrowing, and ankylosis of the sacroiliac joint [39]. However, CT is of limited value to detect active inflammatory changes such as bone marrow edema and capsulitis [37].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. F. FDG-PET/CT whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the sacroiliac joints as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. G. FDG-PET/MRI whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the sacroiliac joints as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. H. MRI sacroiliac joints and lumbar spine without and with IV contrast

The use of MRI without and with IV contrast of the lumbar spine in addition to MRI of the sacroiliac joints to assess for concomitant inflammatory lesions of the lumbar spine in children with known sacroiliitis remains controversial. In a study evaluating patients with ERA, apophyseal joint arthritis or end plate edema was identified in more than half of the participants, most of whom had imaging findings of sacroiliitis [55].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. I. MRI sacroiliac joints and lumbar spine without IV contrast

Current MRI recommendations to image the spine include the use of IV contrast, as IV contrast is helpful for monitoring disease progression, response to treatment, and evaluation of late changes, including joint ankylosis and spinal cord compression in the lumbar spine [7]. Therefore, when the lumbar spine is being imaged, MRI of the sacroiliac joints and lumbar spine without IV contrast is less useful compared with MRI sacroiliac joints and lumbar spine without and with IV contrast.

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. J. MRI sacroiliac joints without and with IV contrast

MRI of the sacroiliac joints without IV contrast is useful to assess sacroiliitis and studies have shown that IV contrast does not add incremental value when assessing for sacroiliitis [38,41].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. K. MRI sacroiliac joints without IV contrast

MRI of the sacroiliac joints without IV contrast is useful to assess response to treatment because it can depict active inflammatory and chronic structural changes. Studies have shown that IV contrast does not add incremental value when assessing for sacroiliitis [38,41]. When imaging for sacroiliitis, a small FOV dedicated to the sacroiliitis joints, with images tailored to the plane of the sacrum, is recommended over large FOV pelvic imaging [42]. Imaging atlases to guide the interpretation of pediatric MRI are useful for the sacroiliac joints [9,10].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. L. Radiography pelvis

Radiography is not sensitive enough to depict incremental changes of sacroiliitis over short periods of time [43]. Conventional radiography is limited in assessing sacroiliitis due to high false-positive and false-negative findings because interpretations are often discordant when compared with MRI [43]. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes such as sclerosis, erosions, and ankylosis [4].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. M. Radiography sacroiliac joints

Radiography is not sensitive enough to depict incremental changes of sacroiliitis over short periods of time [43]. Conventional radiography is limited in assessing sacroiliitis due to high false-positive and false-negative findings because interpretations are often discordant when compared with MRI [43]. Radiographs are useful for assessing malalignment, functional impairment, growth disturbances, and morphological bony changes such as sclerosis, erosions, and ankylosis [4].

Variant 7: Child. Sacroiliac joint pain. Idiopathic arthritis. Follow-up imaging. N. US sacroiliac joints

There is no relevant literature supporting the use of US sacroiliac joints as a follow-up imaging modality in this clinical scenario.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging.

This variant includes follow-up assessment of the TMJ in patients with an established diagnosis of TMJ arthritis.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. A. Bone scan whole body

There is no relevant literature supporting the use of bone scan whole body as a follow-up imaging modality in this clinical scenario.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. B. Bone scan with SPECT or SPECT/CT maxillofacial

There is no relevant literature supporting the use of bone scan with SPECT or SPECT/CT maxillofacial as a follow-up imaging modality in this clinical scenario.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. C. CT maxillofacial with IV contrast

There is no relevant literature supporting the use of CT maxillofacial with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. D. CT maxillofacial without and with IV contrast

There is no relevant literature supporting the use of CT maxillofacial without and with IV contrast as a follow-up imaging modality in this clinical scenario.

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. E. CT maxillofacial without IV contrast

CT and cone-beam CT imaging have been used to assess for chronic bony changes in children with temporomandibular arthritis [56,57]. Given that soft tissue changes and changes related to the disc and capsule cannot be accurately assessed by CT, MRI is the more useful modality to assess for active inflammation of the TMJ [4,57].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. F. FDG-PET/CT whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the TMJs as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. G. FDG-PET/MRI whole body

There is limited relevant literature to support the use of FDG-PET to evaluate the TMJs as a follow-up imaging modality for the assessment of disease activity. One article showed that the degree of FDG activity may be associated with the severity of synovitis [49].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. H. MRI temporomandibular joint without and with IV contrast

MRI TMJ without and with IV contrast is useful for monitoring TMJ disease in patients with JIA [45]. Imaging atlases are helpful to guide the interpretation of pediatric MRI for the TMJs [11].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. I. MRI temporomandibular joint without IV contrast

There is no relevant literature supporting the use of MRI without IV contrast to assess for active TMJ synovitis. MRI studies of the TMJs in JIA have employed the use of both without and with IV contrast to assess for active inflammation. Chronic structural changes of the TMJs are readily assessed on noncontrast imaging [4].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. J. Radiography temporomandibular joint

Conventional radiography is not routinely used to monitor inflammation in the TMJ. In select patients with arthritis, panoramic radiographs can be used to assess for chronic structural osseous changes such as erosions, altered condylar morphology, disproportions between the condylar process and the coronoid process, and accentuated curvature in the antegonial notch [47].

Variant 8: Child. Temporomandibular joint pain. Idiopathic arthritis. Follow-up imaging. K. US head and neck

US with power Doppler is not a sensitive modality to diagnose temporomandibular inflammation in JIA. In a recent study comparing US and MRI of the TMJs, US with Doppler demonstrated very poor sensitivity (0%), low specificity (36.4%), and very low positive predictive value (0%) of depicting synovial inflammation when compared with MRI as the reference standard [48].

Summary of Highlights

This is a summary of the key recommendations from the variant tables. Refer to the complete narrative document for more information.

- **Variants 1 and 5**: For the initial imaging evaluation of suspected idiopathic arthritis in children with appendicular joint pain or swelling, radiographs are usually appropriate to evaluate for soft tissue edema, periarticular demineralization, periostitis, and the presence of a joint effusion. Radiography also helps to exclude other causes of joint pain. For follow-up imaging of joint pain in children with an established diagnosis of JIA, targeted US or MRI without and with IV contrast are usually appropriate to evaluate for joint inflammation. US and MRI with IV contrast are alternate studies as both can depict joint fluid and synovitis. MRI without and with IV contrast is usually appropriate when chronic structural changes such as cartilage lesions, osseous erosions, and joint derangement are suspected.
- **Variants 2 and 6**: For the initial and follow-up imaging evaluation of suspected idiopathic arthritis in children with back pain, MRI without and with IV contrast of either the complete

spine or targeted area of interest is usually appropriate. Based on clinical suspicion, imaging of the complete spine can reveal additional sites of disease in asymptomatic patients.

- **Variants 3 and 7**: For the initial and follow-up imaging evaluation of suspected inflammatory sacroiliitis, MRI of the sacroiliac joints without IV contrast is usually appropriate.
- **Variants 4 and 8**: For the initial and follow-up imaging evaluation of suspected temporomandibular arthritis, MRI without and with IV contrast of the TMJs is usually appropriate.

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria.

Gender Equality and Inclusivity Clause

The ACR acknowledges the limitations in applying inclusive language when citing research studies that predates the use of the current understanding of language inclusive of diversity in sex, intersex, gender, and gender-diverse people. The data variables regarding sex and gender used in the cited literature will not be changed. However, this guideline will use the terminology and definitions as proposed by the National Institutes of Health.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies.”

References

1. Chauvin NA, Doria AS. Ultrasound imaging of synovial inflammation in juvenile idiopathic arthritis. [Review]. Pediatric Radiology. 47(9):1160-1170, 2017 Aug.
2. Basra HAS, Humphries PD. Juvenile idiopathic arthritis: what is the utility of ultrasound?. [Review]. British Journal of Radiology. 90(1073):20160920, 2017 May.
3. Malattia C, Rinaldi M, Martini A. The role of imaging in juvenile idiopathic arthritis. [Review]. Expert Review of Clinical Immunology. 14(8):681-694, 2018 08.
4. Hemke R, Herregods N, Jaremko JL, et al. Imaging assessment of children presenting with suspected or known juvenile idiopathic arthritis: ESSR-ESPR points to consider. [Review]. European Radiology. 30(10):5237-5249, 2020 Oct.
5. Sheybani EF, Khanna G, White AJ, Demertzis JL. Imaging of juvenile idiopathic arthritis: a multimodality approach. Radiographics. 33(5):1253-73, 2013 Sep-Oct.
6. Collado P, Malattia C. Imaging in paediatric rheumatology: Is it time for imaging?. [Review]. Best Practice & Research in Clinical Rheumatology. 30(4):720-735, 2016 08.
7. Tarsia M, Zajc Avramovic M, Gazikalovic A, Kljucevsek D, Avcin T. A clinical perspective on imaging in juvenile idiopathic arthritis. Pediatr Radiol 2023.
8. Ording Muller LS, Boavida P, Avenarius D, et al. MRI of the wrist in juvenile idiopathic arthritis: erosions or normal variants? A prospective case-control study. Pediatric Radiology.

43(7):785-95, 2013 Jul.

9. Herregods N, Maksymowych WP, Jans L, et al. Atlas of MRI findings of sacroiliitis in pediatric sacroiliac joints to accompany the updated preliminary OMERACT pediatric JAMRIS (Juvenile Idiopathic Arthritis MRI Score) scoring system: Part I: Active lesions. Seminars in Arthritis & Rheumatism. 51(5):1089-1098, 2021 10.

10. Herregods N, Maksymowych WP, Jans L, et al. Atlas of MRI findings of sacroiliitis in pediatric sacroiliac joints to accompany the updated preliminary OMERACT pediatric JAMRIS (Juvenile Idiopathic Arthritis MRI Score) scoring system: Part II: Structural damage lesions. Seminars in Arthritis & Rheumatism. 51(5):1099-1107, 2021 10.

11. Kellenberger CJ, Junhasavasdikul T, Tolend M, Doria AS. Temporomandibular joint atlas for detection and grading of juvenile idiopathic arthritis involvement by magnetic resonance imaging. [Review]. Pediatric Radiology. 48(3):411-426, 2018 03.

12. Restrepo R, Lee EY, Babyn PS. Juvenile idiopathic arthritis: current practical imaging assessment with emphasis on magnetic resonance imaging. [Review]. Radiologic Clinics of North America. 51(4):703-19, 2013 Jul.

13. Hemke R, van Rossum MA, van Veenendaal M, et al. Reliability and responsiveness of the Juvenile Arthritis MRI Scoring (JAMRIS) system for the knee. European Radiology. 23(4):1075-83, 2013 Apr.

14. Malattia C, Consolaro A, Pederzoli S, et al. MRI versus conventional measures of disease activity and structural damage in evaluating treatment efficacy in juvenile idiopathic arthritis. Annals of the Rheumatic Diseases. 72(3):363-8, 2013 Mar.

15. Porter-Young FM, Offiah AC, Broadley P, et al. Inter- and intra-observer reliability of contrast-enhanced magnetic resonance imaging parameters in children with suspected juvenile idiopathic arthritis of the hip. Pediatric Radiology. 48(13):1891-1900, 2018 12.

16. Hemke R, Kuijpers TW, van den Berg JM, et al. The diagnostic accuracy of unenhanced MRI in the assessment of joint abnormalities in juvenile idiopathic arthritis. European Radiology. 23(7):1998-2004, 2013 Jul.

17. Nusman CM, Hemke R, Benninga MA, et al. Contrast-enhanced MRI of the knee in children unaffected by clinical arthritis compared to clinically active juvenile idiopathic arthritis patients. European Radiology. 26(4):1141-8, 2016 Apr.

18. Nusman CM, Ording Muller LS, Hemke R, et al. Current Status of Efforts on Standardizing Magnetic Resonance Imaging of Juvenile Idiopathic Arthritis: Report from the OMERACT MRI in JIA Working Group and Health-e-Child. [Review]. Journal of Rheumatology. 43(1):239-44, 2016 Jan.

19. Nusman CM, Rosendahl K, Maas M. MRI Protocol for the Assessment of Juvenile Idiopathic Arthritis of the Wrist: Recommendations from the OMERACT MRI in JIA Working Group and Health-e-Child. J Rheumatol 2016;43:1257-8.

20. Barendregt AM, van Gulik EC, Lavini C, et al. Diffusion-weighted imaging for assessment of synovial inflammation in juvenile idiopathic arthritis: a promising imaging biomarker as an alternative to gadolinium-based contrast agents. European Radiology. 27(11):4889-4899, 2017 Nov.

21. Vo Chieu VD, Vo Chieu V, Dressler F, et al. Juvenile idiopathic arthritis of the knee: is

contrast needed to score disease activity when using an augmented MRI protocol comprising PD-weighted sequences?. European Radiology. 33(5):3775-3784, 2023 May.

22. Marteau P, Adamsbaum C, Rossi-Semerano L, et al. Conventional radiography in juvenile idiopathic arthritis: Joint recommendations from the French societies for rheumatology, radiology and paediatric rheumatology. [Review]. European Radiology. 28(9):3963-3976, 2018 Sep.

23. Pracon G, Aparisi Gomez MP, Simoni P, Gietka P, Sudol-Szopinska I. Conventional Radiography and Ultrasound Imaging of Rheumatic Diseases Affecting the Pediatric Population. Seminars in Musculoskeletal Radiology. 25(1):68-81, 2021 Feb.

24. Onel KB, Horton DB, Lovell DJ, et al. 2021 American College of Rheumatology Guideline for the Treatment of Juvenile Idiopathic Arthritis: Recommendations for Nonpharmacologic Therapies, Medication Monitoring, Immunizations, and Imaging. Arthritis Rheumatol 2022;74:570-85.

25. Rodriguez-Lozano AL, Giancane G, Pignataro R, et al. Agreement among musculoskeletal pediatric specialists in the assessment of radiographic joint damage in juvenile idiopathic arthritis. Arthritis care & research. 66(1):34-9, 2014 Jan.

26. Borocco C, Anselmi F, Rossi-Semerano L. Contribution of Ultrasound in Current Practice for Managing Juvenile Idiopathic Arthritis. J Clin Med 2022;12.

27. Rossi-Semerano L, Breton S, Semerano L, et al. Application of the OMERACT synovitis ultrasound scoring system in juvenile idiopathic arthritis: a multicenter reliability exercise. Rheumatology (Oxford) 2021;60:3579-87.

28. Collado P, Martire MV, Lanni S, et al. OMERACT International Consensus for Ultrasound Definitions of Tenosynovitis in Juvenile Idiopathic Arthritis: Systematic Literature Review and Delphi Process. Arthritis Care Res (Hoboken) 2023;75:2277-84.

29. Rossi-Semerano L, Ravagnani V, Collado P, et al. Validity of ultrasonography in detecting enthesitis in children: A systematic literature review. Joint, Bone, Spine: Revue du Rhumatisme. 90(4):105538, 2023 Jul.

30. Ventura-Rios L, Faugier E, Barzola L, et al. Reliability of ultrasonography to detect inflammatory lesions and structural damage in juvenile idiopathic arthritis. Pediatric Rheumatology Online Journal. 16(1):58, 2018 Sep 17.

31. Vega-Fernandez P, Esteban Y, Oberle E, et al. Reliability of the Pediatric Specific Musculoskeletal Ultrasound Scoring Systems for the Elbow, Wrist, and Finger Joints. Journal of Rheumatology. 50(2):236-239, 2023 02.

32. De Lucia O, Ravagnani V, Pregnolato F, et al. Baseline ultrasound examination as possible predictor of relapse in patients affected by juvenile idiopathic arthritis (JIA). Annals of the Rheumatic Diseases. 77(10):1426-1431, 2018 10.

33. Ntoulia A, Barnewolt CE, Doria AS, et al. Contrast-enhanced ultrasound for musculoskeletal indications in children. [Review]. Pediatric Radiology. 51(12):2303-2323, 2021 Nov.

34. Hospach T, Maier J, Muller-Abt P, Patel A, Horneff G, von Kalle T. Cervical spine involvement in patients with juvenile idiopathic arthritis - MRI follow-up study. Pediatric Rheumatology Online Journal. 12:9, 2014 Mar 04.

35. Demir S, Ergen FB, Taydas O, et al. Spinal involvement in juvenile idiopathic arthritis: what

do we miss without imaging?. Rheumatology International. 42(3):519-527, 2022 03.

36. Srinivasalu H, Sikora KA, Colbert RA. Recent Updates in Juvenile Spondyloarthritis. [Review]. Rheumatic Diseases Clinics of North America. 47(4):565-583, 2021 11.

37. Naveen R, Guleria S, Aggarwal A. Recent updates in enthesitis-related arthritis. Rheumatol Int 2023;43:409-20.

38. Weiss PF, Xiao R, Biko DM, Johnson AM, Chauvin NA. Detection of inflammatory sacroiliitis in children with magnetic resonance imaging: is gadolinium contrast enhancement necessary? Arthritis Rheumatol 2015;67:2250-6.

39. Tsoi C, Griffith JF, Lee RKL, Wong PCH, Tam LS. Imaging of sacroiliitis: Current status, limitations and pitfalls. Quant Imaging Med Surg 2019;9:318-35.

40. Bray TJ, Amies T, Vendhan K, et al. Discordant inflammatory changes in the apophyseal and sacroiliac joints: serial observations in enthesitis-related arthritis. Br J Radiol 2016;89:20160353.

41. Herregods N, Jaremko JL, Baraliakos X, et al. Limited role of gadolinium to detect active sacroiliitis on MRI in juvenile spondyloarthritis. Skeletal Radiology. 44(11):1637-46, 2015 Nov.

42. Wagle S, Gu JT, Courtier JL, Phelps AS, Lin C, MacKenzie JD. Value of dedicated small-field-of-view sacroiliac versus large-field-of-view pelvic magnetic resonance imaging for evaluating pediatric sacroiliitis. Pediatr Radiol 2019;49:933-40.

43. Weiss PF, Xiao R, Brandon TG, et al. Radiographs in screening for sacroiliitis in children: what is the value?. Arthritis Res Ther. 20(1):141, 2018 07 11.

44. Rongo R, Alstergren P, Ammendola L, et al. Temporomandibular joint damage in juvenile idiopathic arthritis: Diagnostic validity of diagnostic criteria for temporomandibular disorders. Journal of Oral Rehabilitation. 46(5):450-459, 2019 May.

45. Inarejos Clemente EJ, Tolend M, Navallas M, Doria AS, Meyers AB. MRI of the temporomandibular joint in children with juvenile idiopathic arthritis: protocol and findings. [Review]. Pediatric Radiology. 53(8):1498-1512, 2023 07.

46. Miller E, Inarejos Clemente EJ, Tzaribachev N, et al. Imaging of temporomandibular joint abnormalities in juvenile idiopathic arthritis with a focus on developing a magnetic resonance imaging protocol. [Review]. Pediatric Radiology. 48(6):792-800, 2018 06.

47. Rosa VLM, Zwir LMF, Dutra MEP, Russo GCS, Rodrigues WDR, Terreri MT. Does the use of panoramic radiography add information in the temporomandibular joint evaluation in Juvenile Idiopathic Arthritis patients? A case control study. Advances in Rheumatology. 63(1):6, 2023 02 13.

48. Zwir LF, Terreri MT, do Amaral E Castro A, Rodrigues WDR, Fernandes ARC. Is power Doppler ultrasound useful to evaluate temporomandibular joint inflammatory activity in juvenile idiopathic arthritis?. Clinical Rheumatology. 39(4):1237-1240, 2020 Apr.

49. Tateishi U, Imagawa T, Kanezawa N, et al. PET assessment of disease activity in children with juvenile idiopathic arthritis. Pediatr Radiol 2010;40:1781-8.

50. Mazzoni M, Pistorio A, Magnaguagno F, et al. Predictive Value of Magnetic Resonance Imaging in Patients With Juvenile Idiopathic Arthritis in Clinical Remission. Arthritis care & research. 75(1):198-205, 2023 01.

51. Panwar J, Tolend M, Redd B, et al. Consensus-driven conceptual development of a standardized whole body-MRI scoring system for assessment of disease activity in juvenile idiopathic arthritis: MRI in JIA OMERACT working group. Seminars in Arthritis & Rheumatism. 51(6):1350-1359, 2021 12.

52. Saoussen M, Yasmine M, Hiba B, Alia F, Kawther BA, Ahmed L. The role of ultrasonography in assessing remission in juvenile idiopathic arthritis: a systematic review. [Review]. European Journal of Pediatrics. 182(7):2989-2997, 2023 Jul.

53. Vega-Fernandez P, Oberle EJ, Henrickson M, et al. Musculoskeletal Ultrasound and the Assessment of Disease Activity in Juvenile Idiopathic Arthritis. Arthritis care & research. 75(8):1815-1820, 2023 08.

54. Kotecki M, Gietka P, Posadzy M, Sudol-Szopinska I. Radiographs and MRI of the Cervical Spine in Juvenile Idiopathic Arthritis: A Cross-Sectional Retrospective Study. J Clin Med 2021;10.

55. Vendhan K, Sen D, Fisher C, Ioannou Y, Hall-Craggs MA. Inflammatory changes of the lumbar spine in children and adolescents with enthesitis-related arthritis: magnetic resonance imaging findings. Arthritis Care Res (Hoboken) 2014;66:40-6.

56. Al-Shwaikh H, Urtane I, Pirttiniemi P, et al. Radiologic features of temporomandibular joint osseous structures in children with juvenile idiopathic arthritis. Cone beam computed tomography study. Stomatologija. 18(2):51-60, 2016.

57. Hara GF, de Souza-Pinto GN, Brasil DM, et al. What is the image appearance of juvenile idiopathic arthritis in MRI, CT, and CBCT of TMJ? A systematic review. Clinical Oral Investigations. 27(5):2321-2333, 2023 May.

58. Measuring Sex, Gender Identity, and Sexual Orientation.

59. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: https://edge.sitecorecloud.io/americancoldf5f-acrorgf92a-productioncb02-3650/media/ACR/Files/Clinical/Appropriateness-Criteria/ACR-Appropriateness-Criteria-Radiation-Dose-Assessment-Introduction.pdf.

Disclaimer

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

[a]Cleveland Clinic Imaging Institute, Cleveland, Ohio. [b]Seattle Children's Hospital, Seattle, Washington. [c]Panel Chair, Children's Mercy Hospital, Kansas City, Missouri. [d]Riley Hospital for Children at IU Health and Indiana University School of Medicine, Indianapolis, Indiana. [e]Texas Children's Hospital, Houston, Texas. [f]RWJBarnabas Health, Newark, New Jersey; American Academy of Pediatrics. [g]Nemours Children's Hospital, Orlando, Florida; Committee on Emergency Radiology-GSER. [h]Medical University of South Carolina, Charleston, South Carolina. [i]Children's Hospital Los Angeles and Keck School of Medicine USC, Los Angeles, California. [j]Hospital for Special Surgery, New York, New York; American College of Rheumatology, Rheumatologist. [k]Children's Mercy Hospital, Kansas City, Missouri, Rheumatologist. [l]Vanderbilt University Medical Center, Nashville, Tennessee. [m]Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; Commission on Nuclear Medicine and Molecular Imaging. [n]Lincoln Medical Center, Bronx, New York; American College of Emergency Physicians. [o]Children's Mercy Hospital, Kansas City, Missouri, Primary care physician. [p]Geisinger Health System, Danville, Pennsylvania. [q]Specialty Chair, Seattle Children's Hospital, Seattle, Washington.