American College of Radiology
ACR Appropriateness Criteria®
Nonatherosclerotic Peripheral Arterial Disease

Variant 1: **Suspected popliteal entrapment syndrome. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
MRA lower extremity without and with IV contrast	Usually Appropriate	O
US duplex Doppler lower extremity	Usually Appropriate	O
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
MRA lower extremity without IV contrast	May Be Appropriate	O
Arteriography lower extremity	May Be Appropriate	☢☢☢
US intravascular lower extremity	Usually Not Appropriate	O

Variant 2: **Suspected external iliac artery endofibrosis. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler lower extremity	Usually Appropriate	O
MRA lower extremity without and with IV contrast	Usually Appropriate	O
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
MRA lower extremity without IV contrast	May Be Appropriate	O
Arteriography lower extremity	May Be Appropriate	☢☢☢
US intravascular lower extremity	Usually Not Appropriate	O

Variant 3: **Suspected or known lower-extremity inflammatory vasculitides. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Arteriography lower extremity	Usually Appropriate	☢☢☢
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
MRA lower extremity without and with IV contrast	Usually Appropriate	O
MRA lower extremity without IV contrast	May Be Appropriate	O
US duplex Doppler lower extremity	May Be Appropriate	O
US intravascular lower extremity	Usually Not Appropriate	O

Variant 4: **Suspected or known dissection or connective tissue lower-extremity vascular diseases. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
MRA lower extremity without and with IV contrast	Usually Appropriate	O
MRA lower extremity without IV contrast	May Be Appropriate	O
Arteriography lower extremity	May Be Appropriate	☢☢☢
US duplex Doppler lower extremity	Usually Not Appropriate	O
US intravascular lower extremity	Usually Not Appropriate	O

Variant 5: **Suspected or known other noninflammatory lower-extremity vascular diseases (such as fibromuscular dysplasia, segmental arterial mediolysis). Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
MRA lower extremity without and with IV contrast	Usually Appropriate	O
Arteriography lower extremity	Usually Appropriate	☢☢☢
MRA lower extremity without IV contrast	May Be Appropriate	O
US duplex Doppler lower extremity	May Be Appropriate	O
US intravascular lower extremity	May Be Appropriate	O

Variant 6: **Lower-extremity vascular trauma. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CTA lower extremity with IV contrast	Usually Appropriate	☢☢☢
Arteriography lower extremity	May Be Appropriate	☢☢☢
US duplex Doppler lower extremity	May Be Appropriate	O
MRA lower extremity without and with IV contrast	Usually Not Appropriate	O
MRA lower extremity without IV contrast	Usually Not Appropriate	O
US intravascular lower extremity	Usually Not Appropriate	O

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Summary of Literature Review

Introduction/Background

Lower-extremity vascular diseases span a diverse range of etiologies and may be autoimmune, congenital, degenerative, inflammatory, infectious, metabolic, neoplastic, or traumatic in nature. Examples of such conditions include, but are not limited to, aneurysm formation, atherosclerosis, Buerger disease, cystic adventitial disease, dissection/transection, deep vein thrombosis, external iliac artery endofibrosis (EIAE), fibromuscular dysplasia (FMD), popliteal arterial entrapment syndrome (PAES), segmental arterial mediolysis (SAM), and genetic syndromes such as Marfan syndrome (MS), Loeys-Dietz syndrome (LDS), and vascular Ehlers-Danlos syndrome (EDS). Because of the plethora of potential underlying disease processes, imaging is often employed to secure a diagnosis and assist in guiding clinical management. Accurate vascular imaging relies upon visualization of the vessel lumen, vessel wall, and surrounding soft-tissue structures, with some modalities also offering the ability to characterize blood flow direction and velocity. Furthermore, nonvascular findings are often paramount in supporting a suspected clinical syndrome [1-4] or guiding surgical management [5-8].

The most common pathology affecting the arteries of the lower extremity is atherosclerosis, the incidence of which increases with age and relates to underlying risk factors, such as family history, smoking, hypertension, diabetes, hyperlipidemia, and obesity. Progression of atherosclerotic burden throughout the lower extremities may result in varying degrees of stenosis or occlusion and is most often multifocal [9,10]. Varicose veins and deep vein thrombosis are common venous diseases of the lower extremities, with deep vein thrombosis having an estimated annual incidence of 5 per 10,000 in the general population [11]. Guidelines addressing lower-extremity atherosclerotic vascular disease and deep vein thrombosis have been addressed in previously published ACR Appropriateness Criteria®: "Vascular Claudication–Assessment for Revascularization" [12], "Lower Extremity Arterial Revascularization–Post-Therapy Imaging" [13], Sudden Onset of Cold, Painful Leg" [14], and "Suspected Lower-Extremity Deep Vein Thrombosis" [11].

Guidelines proposed in this document focus on nonatherosclerotic, arterial lower-extremity vascular disease. PAES is the most common cause of surgically correctable lower-extremity vascular insufficiency in young adults and consists of anatomic and functional subtypes. Patients with PAES present with calf claudication, paresthesia, and swelling during exercise. In anatomic PAES (Types I, II, III, and V), the extravascular structures within the popliteal fossa compress the popliteal artery and/or the popliteal vein, which results in compression and stenosis or occlusion during plantar flexion. Functional PAES (Type IV) results in compression of the popliteal artery despite the presence of an anatomically normal popliteal fossa; its etiology remains unclear. Either subtype may lead to aneurysm or pseudoaneurysm formation, thrombosis or distal thromboembolism [5-8,15-19].

EIAE is a rare cause of performance-limiting claudication that occurs primarily in endurance athletes. Although EIAE typically occurs in cyclists, it has been described in other groups of elite endurance athletes. Symptoms include lower-extremity weakness, thigh pain, and symptom resolution after cessation of exercise [20]. Its etiology is poorly understood and may be multifactorial. Suggested mechanisms include repeated mechanical

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trauma upon the external iliac artery by a hypertrophied psoas muscle during hip flexion with subsequent arterial kinking [21] and vasospasm [22]. Arterial-brachial pressure indexes typically decrease following exercise [20].

Buerger disease is a nonatherosclerotic inflammatory vasculitis that most commonly involves the small- and medium-sized distal arteries of the hands and feet. It is almost always associated with heavy tobacco smoking and predominantly occurs in patients between 25 and 45 years of age with a reported incidence of 12.6 per 100,000 in North America. It presents clinically with progressively worsening superficial thrombophlebitis, intermittent claudication, paresthesias, rest pain, and ulceration. Imaging classically demonstrates "corkscrew" collateral vessels representative of pathologically dilated vasa vasorum [2,23].

Connective tissue diseases are multisystem disorders, several of which profoundly involve the vascular system. MS is an autosomal-dominant (AD) connective tissue disorder caused by a mutation in the *FBN1* gene that codes for fibrillin-1 and occurs in 1 in 20,000 individuals. The systems typically affected by MS are cardiovascular, ocular, and skeletal. MS is classically associated with aortic root aneurysms and dissection; however, the dissection flap may extend into the iliac arteries resulting in pain, pallor, paresthesias, and pulselessness [1,24]. LDS results from an AD heterozygous mutation in either of the genes that encode transforming growth factor beta. LDS has a much more aggressive clinical course than MS, with a mean survival of 26 years. Like MS, LDS is associated with aortic root aneurysm and dissection [3]. Vascular EDS, formerly known as EDS type IV, is an AD disease caused by a heterozygous mutation in the *COL3A1* gene that encodes type III collagen. Vascular EDS can affect any vessel and carries a poor prognosis that is due to risk of life-threatening arterial rupture [4].

FMD is a nonatherosclerotic, noninflammatory vascular disease that most commonly affects the renal and carotid arteries; however, involvement of arteries within the lower extremities can occur. The medial fibroplasia subtype of FMD demonstrates the classic "string of beads" appearance on imaging, representing regions of alternating stenosis and dilatation. FMD involving the external iliac arteries is rare but can result in clinical presentations that include episodic claudication, pain, and pallor from peripheral microemboli and critical limb ischemia [25,26].

SAM is a nonatherosclerotic, noninflammatory vascular disease that most commonly affects the visceral abdominal vessels, although involvement of the iliac arteries has been reported [27]. Lysis of the medial layer of the arterial wall in SAM results in dissection, stenosis, occlusion, or aneurysm formation; it commonly presents with catastrophic hemorrhages within the abdominal cavity or retroperitoneum as a result of spontaneous aneurysm rupture [28-30].

Cystic adventitial disease is a rare vascular disease predominantly affecting healthy young men with no cardiovascular risk factors. Arterial involvement is more common than venous involvement, with most cases seen involving the popliteal artery. Cystic adventitial disease affecting the lower extremity typically results in claudication or pain of sudden onset, while imaging demonstrates adventitial cysts localized to the site of symptomatology. Surgical resection is usually curative thereby obviating follow-up [31].

Injury to the lower-extremity vasculature is not an uncommon occurrence in the setting of penetrating or blunt trauma. Rapid diagnostic imaging is paramount to exclude or confirm vascular injury in these potentially unstable individuals.

Discussion of Procedures by Variant

Variant 1: Suspected popliteal entrapment syndrome. Initial imaging.

CTA Lower Extremity

CT angiography (CTA), including multiplanar reformation and 3-D volume-rendered reconstructions, is helpful in depicting popliteal vascular changes (vessel deviation, stenosis, occlusion, aneurysm formation) and abnormal musculotendinous structures in the setting of PAES [5,19]. Following revascularization for PAES, CTA is recommended to assess graft patency after an abnormal ultrasound (US) [17]. The use of dynamic CTA has also been proposed for the initial workup of PAES, as images of both lower extremities can be obtained at both rest and plantar flexion in a single examination requiring only one contrast bolus [15]. However, MRA and US duplex Doppler are typically preferred because they do not require ionizing radiation.

MRA Lower Extremity

MR angiography (MRA) can be used to evaluate vascular abnormalities and the dynamic changes in the popliteal artery during plantar flexion [16]. MRA is typically performed as a confirmatory test after US duplex Doppler. However, many patients are unable to maintain steady forced plantar flexion throughout the duration of lengthy MR sequences, resulting in excessive motion and degradation of image quality [7,8,15]. Despite this, a recent

study demonstrated superiority of MRA over digital subtraction angiography (DSA) in confirming PAES [6]. MRA can be particularly helpful in defining abnormal musculotendinous structures. Furthermore, the T1-weighted and T2-weighted sequences done as part of the MRA study are currently the gold standard for defining the complete anatomy of the popliteal fossa and are therefore most appropriate for determining the anatomic abnormality in suspected PAES [7,15]. MRA without intravenous (IV) contrast is typically not used because the long acquisition times required cause challenges for their performance during stress maneuvers. However, the anatomic imaging used to determine the etiology of PAES can be done without IV contrast.

Arteriography Lower Extremity
Selective arteriography is regarded as the gold standard in identifying dynamic arterial deviation and/or occlusion during plantar flexion in addition to identifying vascular occlusion/stenosis, aneurysm, and thrombosis. [5,7,15]. In addition to being an invasive modality, arteriography is limited by its inability to depict extravascular anatomy. One study comparing the use of DSA and MRI in the evaluation of PAES found DSA to be nonspecific and unable to determine the etiology of patient symptoms [6], thereby obviating the need for cross-sectional imaging. Selective arteriography is therefore often used as a confirmatory modality when PAES is suspected on cross-sectional imaging or US [7,16].

US Duplex Doppler Lower Extremity
US duplex Doppler is heavily relied upon in the initial workup of PAES, where real-time visualization of flow occlusion and changes in segmental Doppler pressures upon provocative plantar flexion is crucial in confirming a suspected diagnosis [16,18]. This is extremely beneficial in the setting of functional PAES, where lack of an anatomic abnormality limits the sensitivity of cross-sectional modalities like CTA and MRA [18]. In PAES patients treated with popliteal bypass, US duplex Doppler is the first-line modality of choice in assessing graft patency; CTA, MRA, and selective arteriography are reserved for postoperative patients with abnormal US duplex Doppler examinations [17].

Several studies have found the use of US in the diagnosis of PAES to be potentially problematic, as the necessary use of transducer pressure applied during the examination may result in velocity changes that are difficult to interpret [7]. Provocative maneuvers may also shift the popliteal artery out of the Doppler region of interest, giving the artifactual appearance of occlusion [7,8]. US duplex Doppler has been found to have a particularly high false-positive rate in the workup of PAES, especially in athletes [5]. MRA is recommended to confirm the etiology of PAES in patients with a positive US duplex Doppler study and in patients with a negative US duplex Doppler study with a high index of clinical suspicion.

US Intravascular Lower Extremity
The use of intravascular US (IVUS) has been reportedly beneficial in confirming and assessing extent of popliteal artery compression in PAES. IVUS is often used as a confirmatory modality when PAES is suspected on cross-sectional imaging. One study lauded IVUS for its ability to evaluate the arterial lumen for intimal change and potential irreparable mural damage that may be missed with conventional US [16]. In functional PAES, IVUS is beneficial in determining the magnitude of extrinsic muscular compression [16].

Variant 2: Suspected external iliac artery endofibrosis. Initial imaging.

CTA Lower Extremity
CTA is uncommonly used in the diagnosis of EIAE and has not demonstrated diagnostic superiority to MRA combined with US [21]. CTA allows assessment of arterial kinking, arterial wall thickening, stenosis, and extent of involved arterial segment.

MRA Lower Extremity
The superior contrast resolution inherent to MRA allows for optimal visualization of extravascular anatomy in suspected EIAE. Like CTA, MRA allows assessment of arterial length and kinking, albeit with improved soft-tissue characterization. MRA is less sensitive than US for detecting intravascular lesions. MRA has proven useful in diagnosing EIAE when used in conjunction with US, a combination that was found to be superior or equal to CTA alone [21].

US Duplex Doppler Lower Extremity
The ability to visualize changes in both flow dynamics and vessel caliber in real time has been paramount in diagnosing EIAE in endurance athletes [21,22]. Dynamic use of US duplex Doppler and segmental Doppler pressures in both hip flexion and extension can accurately depict flow disturbance [21], while its use pre- and

postexercise may demonstrate associated exercise-induced vasospasm [20,22]. US duplex Doppler has been found to be superior to MRA in detecting intravascular lesions; however, its sensitivity may be limited in patients with only mildly symptomatic disease [21].

US Intravascular Lower Extremity
There is no relevant literature regarding the use of IVUS in the evaluation of EIAE.

Arteriography Lower Extremity
The role of DSA in the evaluation of EIAE is not as well established. The most frequent finding of EIAE at DSA is smooth, long, and eccentric stenosis, with thrombosis and dissection present less frequently [1]. Although the external iliac artery is most frequently affected, the common iliac artery can be involved in approximately 15% of patients [32]. A benefit of arteriography, relative to other modalities, is that the pressure gradient across the narrowing can be measured at baseline as well as during various maneuvers, including following the administration of vasodilators [33]. Acquiring images during hip flexion frequently reveals a kink in the iliac arteries at the site of stenosis [32].

Variant 3: Suspected or known lower-extremity inflammatory vasculitides. Initial imaging.

CTA Lower Extremity
While the spatial resolution of CTA is relatively high, some authors have suggested that it may not be sensitive enough to resolve the fine collateral vessels seen in thromboangiitis obliterans and other small-vessel pathologies [2]. Evaluation of subtle vascular findings may also be limited by beam hardening artifact related to adjacent bone or metal [34]. CTA is helpful in identifying vessel wall thickening, stenosis, occlusion and collaterals when large- or medium-sized vessels of the lower extremities are involved.

MRA Lower Extremity
MRA has lower spatial resolution than CTA, a factor that makes it less than ideal in adequately characterizing distal small vessels. Despite this, additional sequences acquired during an MRA examination may be helpful in evaluating for associated nonvascular findings, such as osteomyelitis or septic arthritis [2]. The sensitivity for detecting these soft-tissue abnormalities is greater with contrast-enhanced MRA than noncontrast-enhanced MRA.

Arteriography Lower Extremity
Because of its high inherent spatial resolution, selective arteriography with DSA is considered the gold standard in the diagnosis of thromboangiitis obliterans [2].

US Duplex Doppler Lower Extremity
US duplex Doppler can identify the typical corkscrew collateral vessels in the walls of the lower-extremity vessels in patients with thromboangiitis obliterans [35].

US Intravascular Lower Extremity
There is no relevant literature regarding the use of IVUS in the evaluation of lower-extremity inflammatory vasculitides.

Variant 4: Suspected or known dissection or connective tissue lower-extremity vascular diseases. Initial imaging.

CTA Lower Extremity
CTA is highly recommended in the workup of MS, LDS, and vascular EDS, as it offers comprehensive whole-body imaging and high spatial resolution in a single study. This allows for evaluation of the entire vascular system and identification of typical musculoskeletal malformations that may assist in the initial diagnosis of a heritable connective tissue disease [1,3,4]. CTA is valuable for defining the true and false lumen and can be used for longitudinal follow-up. Although the initial diagnosis of these diseases is most commonly made in the pediatric population, this document addresses imaging in adults (18 years of age and older) only. Because of the high risk of vascular complications inherent to LDS and MS, CTA surveillance is recommended at least every 1 year [3] and 2 years [1], respectively.

MRA Lower Extremity
MRA has been suggested for evaluation of the lower extremities in patients with connective tissue disorders, such as MS, LDS, and vascular EDS. However, the lower spatial resolution inherent to MRA limits the evaluation of small arterial branches [1,2,36] compared to CTA.

Arteriography Lower Extremity
Given its invasive nature, the use of selective arteriography should be avoided in patients with congenitally weakened vessels (eg, collagen vascular diseases, such as vascular EDS) where the risk of catastrophic vascular perforation is high [1,4]. In such patients, it has been suggested that this modality only be performed if it is part of a planned interventional procedure (eg, coil embolization of remote bleeding arteries, etc) [4].

US Duplex Doppler Lower Extremity
There is no relevant literature regarding the use of US duplex Doppler in the evaluation of lower-extremity connective disease.

US Intravascular Lower Extremity
There is no relevant literature regarding the use of IVUS in the evaluation of lower-extremity connective disease, but the same concerns regarding arterial puncture would apply.

Variant 5: Suspected or known other noninflammatory lower-extremity vascular diseases (such as fibromuscular dysplasia, segmental arterial mediolysis). Initial imaging.

CTA Lower Extremity
While selective arteriography is considered the gold standard in diagnosing FMD, CTA has proven helpful in the initial diagnosis and follow-up of FMD within the lower extremities [25,37]. Because of its high spatial resolution, several studies have demonstrated the superiority of CTA over MRA in visualizing vascular lesions in FMD [4,36]. Despite this, one study found CTA to have limited sensitivity in the evaluation of small vessels in patients with mild FMD [36]. CTA may be helpful in the workup of cystic adventitial disease [31]. It has also been advocated as a first-line imaging study in the diagnosis of SAM [28,29] with follow-up recommended at 1-year intervals [27].

MRA Lower Extremity
The improved contrast resolution inherent to MRA renders superior characterization of the extravascular soft tissues. This is of particular importance in the workup of cystic adventitial disease, where T1-weighted and T2-weighted sequences may demonstrate connections between adventitial cysts and the adjacent joint capsule. It has been recommended as the modality of choice in preoperative planning for cystic adventitial disease [31]. MRA has also been found useful for annual follow-up in SAM [27].

Arteriography Lower Extremity
Because of its high inherent spatial resolution, selective arteriography with DSA is considered the gold standard in the diagnosis of FMD [25,26,36,38-40], with many authors claiming that CTA and MRA may lack the spatial resolution necessary to detect small-artery pathology [36]. Arteriography is susceptible to standing waves. Therefore, caution must be exercised to accurately distinguish standing waves from true arterial beading characteristic of FMD [15]. This modality may simultaneously be therapeutic in FMD, as angioplasty is currently the preferred treatment of choice [25,38,39]. Selective arteriography is considered the reference standard in the diagnosis of SAM while also having therapeutic potential [28].

US Duplex Doppler Lower Extremity
A recent study found US duplex Doppler to be helpful in diagnosing cystic adventitial disease, where numerous anechoic cysts are seen scattered throughout the adventitia at a site of vessel stenosis [31]. While much has been published about the use of US duplex Doppler in renal artery FMD, no literature is currently present to support its use in the diagnosis of FMD affecting the lower-extremity arteries.

US Intravascular Lower Extremity
IVUS has been reported to be useful in diagnosing cystic adventitial disease [31]. In FMD, other authors have concluded that IVUS is likely more accurate than other modalities in characterizing the hemodynamic severity of encountered stenosis [39,41].

Variant 6: Lower-extremity vascular trauma. Initial imaging.

CTA Lower Extremity
CTA is considered especially important in the setting of trauma to the lower extremities. Several studies recognize its use as a first-line investigation in all patients with suspected vascular injury [42], demonstrating a sensitivity of 95% to 100% and a specificity of 87% to 100% [34,43]. Sensitivity for vascular injury in equivocal cases can be increased by using reconstructed images. The use of CTA is associated with lower morbidity than that of selective arteriography and has resulted in a precipitous decrease in negative surgical exploration rates in the post-traumatic

patient [43]. One study has suggested that the critical time saved by CTA in diagnosing lower-extremity vascular injury translates to decreased morbidity, thereby reducing hospital costs while improving outcomes [34].

MRA Lower Extremity

MRA is not indicated after trauma, as long requisite imaging times are precarious in a potentially unstable patient. Underlying shrapnel or bullet fragments pose significant safety concerns within the confines of the magnetic field, in addition to degrading image quality [43].

Arteriography Lower Extremity

Arteriography is recommended for vascular evaluation in patients with hard signs of vascular injury requiring immediate repair [44,45]. This can be done in the operating room with a C-arm or in a hybrid suite [44,45]. Selective arteriography is invasive and unable to depict extravascular anatomy [34]. In addition, it is time-consuming and could delay treatment of other traumatic injuries. However, it accurately detects active bleeding, pseudoaneurysms, arteriovenous fistula, and vascular thrombosis. A recent retrospective review advocates the use of arteriography if CTA is equivocal [43].

US Duplex Doppler Lower Extremity

While portability and lack of nephrogenic contrast administration make US duplex Doppler an attractive option for evaluating the lower-extremity vessels after trauma, significant injury to the superficial soft tissues may limit its accuracy in assessing vascular integrity [43]. A recent meta-analysis reported that the post-test probability of arterial injury was 89% with a positive US and 5% with a negative US [46].

US Intravascular Lower Extremity

There is no relevant literature regarding the use of IVUS in the evaluation of lower-extremity vascular trauma.

Summary of Recommendations

- **Variant 1:** MRA lower extremity without and with IV contrast or US duplex Doppler lower extremity or CTA lower extremity with IV contrast is usually appropriate for the initial imaging of suspected popliteal entrapment syndrome. These procedures are equivalent alternatives.
- **Variant 2:** US duplex Doppler lower extremity or MRA lower extremity without and with IV contrast or CTA lower extremity with IV contrast is usually appropriate for the initial imaging of suspected EIAE. These procedures are equivalent alternatives.
- **Variant 3:** Arteriography lower extremity or CTA lower extremity with IV contrast or MRA lower extremity without and with IV contrast is usually appropriate for the initial imaging of suspected or known lower-extremity inflammatory vasculitides. These procedures are equivalent alternatives.
- **Variant 4:** CTA lower extremity with IV contrast or MRA lower extremity without and with IV contrast is usually appropriate for the initial imaging of suspected or known dissection or connective tissue lower-extremity vascular diseases. These procedures are equivalent alternatives.
- **Variant 5:** CTA lower extremity with IV contrast or MRA lower extremity without and with IV contrast or Arteriography lower extremity is usually appropriate for the initial imaging of suspected or known other noninflammatory lower-extremity vascular diseases (such as FMD, SAM). These procedures are equivalent alternatives.
- **Variant 6:** CTA lower extremity with IV contrast is usually appropriate for the initial imaging of lower-extremity vascular trauma.

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 go to www.acr.org/ac.

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 [47].

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 (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

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