American College of Radiology
ACR Appropriateness Criteria®
Radiologic Management of Iliac Artery Occlusive Disease

Variant 1: **Nonsmoker, sedentary lifestyle. No symptoms at rest but mild left lower-extremity claudication on walking, asymmetrically diminished left femoral pulse. Next steps on initial physician visit.**

Treatment/Procedure	Rating	Comments
US duplex Doppler lower extremity	8	
Plethysmography and pulse volume recording	6	
CTA abdomen and pelvis with bilateral lower extremity runoff with IV contrast	7	
MRA abdomen and pelvis with bilateral lower extremity runoff with IV contrast	7	
Catheter directed angiography	5	This procedure should be performed only at the time of endovascular therapy.
Risk factor analysis, lipid profile and ABIs	9	
No further treatment or evaluation needed	1	
Best medical management including supervised exercise program only	9	
Anticoagulation adjunctive therapy	3	
Antiplatelet adjunctive therapy	7	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 2: **Long history of mild claudication. Acute-onset left lower-extremity pain. Absent left femoral pulse on palpation, faint dorsalis pedis and posterior tibial pulses by Doppler. Next steps.**

Treatment/Procedure	Rating	Comments
Ankle brachial index	8	
US duplex Doppler lower extremity	8	
Plethysmography and pulse volume recording	5	
CTA abdomen and pelvis with bilateral lower extremity runoff with IV contrast	8	
MRA abdomen and pelvis with bilateral lower extremity runoff with IV contrast	7	This procedure takes longer to perform.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 3: **Known atrial fibrillation and spine surgery 3 weeks ago. Sudden-onset right lower-extremity pain. Diminished pulses in right lower extremity. CTA demonstrates isolated filling defect in right common iliac artery.**

Treatment/Procedure	Rating	Comments
Anticoagulation adjunctive therapy	7	Anticoagulation is potentially contraindicated in the setting of recent spinal surgery; clinical assessment of relative risk is imperative.
Antiplatelet adjunctive therapy	5	
Catheter directed thrombolytic therapy	3	This procedure is probably not indicated but needs to be individualized depending on patient parameters.
Catheter directed mechanical thrombectomy	7	This procedure needs to be individualized depending on patient parameters. It is less appropriate for larger clot burdens.
Surgical revascularization	9	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 4: **Past medical history of heavy smoking. Severe claudication and no symptoms at rest. Angiogram demonstrates bilateral 90% common iliac artery stenosis (TASC A).**

Treatment/Procedure	Rating	Comments
Anticoagulation adjunctive therapy	3	
Antiplatelet adjunctive therapy	8	
Best medical management including supervised exercise program only	5	This procedure may be appropriate for initial therapy with intervention for refractory patients.
Bilateral percutaneous transluminal angioplasty only	8	This procedure is performed with selective stenting for suboptimal result.
Bilateral stent placement	8	This procedure is done primarily for some lesions depending on lesion morphology and length.
Surgical revascularization	4	This procedure may be useful as secondary therapy, especially in the event of failed endovascular procedures.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 5: **Past medical history significant for diabetes mellitus, hypertension, and smoking. Increasing claudication of right lower extremity involving right buttock for last 3 months. CTA pelvis with runoff reveals short-segment occlusion of right common iliac artery (TASC B).**

Treatment/Procedure	Rating	Comments
Best medical management including supervised exercise program only	2	
Primary percutaneous transluminal angioplasty alone	8	
Primary stenting	8	
Surgical revascularization	4	This procedure may be useful as secondary therapy, especially in the event of failed endovascular procedures.
Anticoagulation adjunctive therapy	2	
Antiplatelet adjunctive therapy	8	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 6: **Past medical history significant for diabetes mellitus, hypertension, and heavy smoking. Gradually increasing claudication of bilateral lower extremities for at least 2 months. CTA pelvis with runoff reveals bilateral common iliac artery occlusion without any involvement of the external or internal iliac artery (TASC C).**

Treatment/Procedure	Rating	Comments
Best medical management including supervised exercise program only	2	
Primary percutaneous transluminal angioplasty alone	6	
Primary stenting	8	
Surgical revascularization	7	
Anticoagulation adjunctive therapy	3	This procedure is not likely beneficial in the more chronic setting. It may be beneficial in addition to revascularization.
Antiplatelet adjunctive therapy	8	
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Variant 7: **Worsening claudication and small ischemic ulcers on digits of both feet. Angiogram demonstrates diffuse disease involving distal aorta and both iliac vessels, with multiple stenoses >50%, bilateral 75% mid–superficial femoral artery stenosis, and 2-vessel tibial runoff bilaterally (TASC D).**

Treatment/Procedure	Rating	Comments
Anticoagulation adjunctive therapy	3	
Antiplatelet adjunctive therapy	8	
Best medical management including supervised exercise program only	2	This procedure may be used as an adjunct to more definitive therapy.
Percutaneous transluminal angioplasty (aortoiliac only)	6	This procedure may be a first step. TASC C/D lesions may require stents or surgery.
Catheter directed stent placement (aortoiliac only)	7	
Catheter directed stent placement (aortoiliac plus femoral angioplasty)	8	This procedure should be part of a complete surgical plan for the patient.
Surgical revascularization	6	This procedure needs to be individualized depending on patient parameters.
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

RADIOLOGIC MANAGEMENT OF ILIAC ARTERY OCCLUSIVE DISEASE

Expert Panel on Interventional Radiology: Alexander Z. Copelan, MD[a]; Baljendra S. Kapoor, MB, BS[b]; Ali F. AbuRahma, MD[c]; Thomas R. Cain, MD[d]; Drew M. Caplin, MD[e]; Khashayar Farsad, MD, PhD[f]; M-Grace Knuttinen, MD, PhD[g]; Margaret H. Lee, MD[h]; Joseph J. McBride, MD[i]; Jeet Minocha MD[j]; Stephen P. Reis, MD[k]; Paul J. Rochon, MD[l]; Colette M. Shaw, MB[m]; Jonathan M. Lorenz, MD.[n]

Summary of Literature Review

Introduction/Background

This discussion of iliac artery occlusive disease reviews the broader topic of peripheral vascular disease. Consensus documents provide a comprehensive overview of this complex topic [1-3]. The consensus recommendations can be modulated by more recent literature with specific attention to iliac disease. Additionally, more recent literature review has allowed for evidence-based management in the surgical and endovascular approach of aortoiliac occlusive disease [4,5].

Iliac artery occlusive disease can present as a sudden-onset acute thrombotic event or a chronic, progressive atherosclerotic process. History and physical examination rapidly establish this distinction and determine the most appropriate application of further clinical and imaging examinations. Suspected acute thrombotic events often require rapid evaluation for limb salvage, and the methods and urgency of clinical and imaging examinations in this setting differ from those applied to progressive atherosclerotic disease. In all cases, initial physical examination by a vascular specialist should include evaluation of extremity pulses; capillary refill; skin quality, color, and qualitative temperature; and evidence of tissue compromise. Lower-extremity noninvasive physiologic studies such as pulse volume recording (PVR) and ankle brachial index (ABI) are simple and valuable tools in the screening and management of the patients with chronic limb ischemia. ABI is measurement of the ankle-to-brachial systolic blood pressure ratio. Plethysmography, another uncommonly used test, detects the changes in the limb volume by PVR. Over a period of time, use of plethysmography and PVR has fallen out of favor because of their lack of reliable and reproducible quantitative data [6].

Overview of Diagnostic Imaging and Therapeutic Options

Diagnostic imaging is tailored to the clinical presentation and may include ultrasound (US) with Doppler vascular US, computed tomographic angiography (CTA), magnetic resonance angiography (MRA), and catheter-directed digital subtraction angiography (DSA). When considering CTA in patients with marginal renal function, dilute iso-osmolar contrast, hydration with sodium bicarbonate solution, and pretreatment with *N*-acetylcysteine sodium bicarbonate drip may be beneficial, although application of these options is controversial. When considering MRA, time-of-flight sequences may be used when contrast cannot be administered [2]. Depending on the pathophysiology and clinical presentation, therapeutic options for acute thrombotic causes include supportive care, anticoagulation, thrombolytic therapy, either surgical or catheter-directed mechanical thrombectomy, and surgical bypass. Therapeutic options for atherosclerotic disease include supportive measures such as behavior modification, a supervised exercise program, adjunctive anticoagulation and antiplatelet medications, angioplasty, stent placement, stent-graft placement, surgical or catheter-directed endarterectomy or plaque excision, and surgical bypass.

[a]Research Author, Beaumont Health System, Royal Oak, Michigan. [b]Principal Author and Panel Chair, Cleveland Clinic, Cleveland, Ohio. [c]West Virginia University, Charleston, West Virginia; Society of Vascular Surgery. [d]Yuma Regional Medical Center, Yuma, Arizona. [e]Hofstra Northwell School of Medicine, Manhasset, New York. [f]Dotter Interventional Institute, Oregon Health & Science University, Portland, Oregon. [g]Mayo Clinic, Phoenix, Arizona. [h]David Geffen School of Medicine at UCLA, Los Angeles, California. [i]University of Nebraska Medical Center, Omaha, Nebraska. [j]University of California San Diego, San Diego, California. [k]Columbia University Medical Center, New York, New York. [l]University of Colorado Denver, Anschutz Medical Campus, Aurora, Colorado. [m]Thomas Jefferson University Hospital, Philadelphia, Pennsylvania. [n]Specialty Chair, University of Chicago Hospital, Chicago, Illinois.

The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.

Reprint requests to: publications@acr.org

Discussion of Procedures by Variant

Variant 1: Nonsmoker, sedentary lifestyle. No symptoms at rest but mild left lower-extremity claudication on walking, asymmetrically diminished left femoral pulse. Next steps on initial physician visit.

Chronic iliac artery occlusive disease resulting from atherosclerosis may be asymptomatic or incidentally identified on diagnostic imaging studies or may present with claudication, reproducible lower-extremity pain that is brought on by walking or exercise and relieved by rest. Typically, noninvasive screening begins with US and measurement of ABI or segmental arterial pressures in the outpatient clinic setting. ABIs may be normal at rest in the setting of isolated iliac occlusive disease [3]. Arterial imaging is indicated in patients with abnormal resting ABIs or abnormal postexercise ABIs in whom revascularization would be performed if an amenable lesion was identified. Plethysmography and PVR are becoming less commonly used in most modern laboratories because of their lack of reliability and reproducibility. If findings suggest peripheral artery disease, further confirmation with CTA or MRA is usually required to determine the best application of endovascular or surgical intervention. The notion that CTA unnecessarily increases contrast load and related risks may not hold true because the CTA findings usually facilitate a marked decrease in contrast dose required for endovascular interventions. In most cases, catheter-directed DSA is performed only at the time of endovascular intervention, but in some cases, DSA may augment cross-sectional imaging options before intervention by providing diagnostic information regarding the patency of medium and small runoff arteries. Ultimately, catheter-directed DSA is performed in most patients before revascularization [2]. Intra-arterial pressure measurements may be of value, with systolic gradients >10 mm Hg at rest or after pharmacologic challenge considered significant.

In all cases of chronic limb ischemia, medical management is a key component of treatment and should include risk factor modification such as smoking cessation and control of hyperlipidemia, diabetes, and hypertension. A lipid profile should be obtained covering total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglyceride, and (in younger patients) homocysteine levels. Medical strategies such as a supervised exercise program and antiplatelet therapies such as cilostazol or aspirin should be considered in appropriate patients, but patients with iliac lesions, as opposed to infrainguinal disease, may be considered for revascularization without undergoing extensive medical therapy [2,3]. The CLEVER study demonstrated superior treadmill walking performance at 6-month follow-up in the supervised exercise cohort versus the primary stenting cohort for patients with claudication resulting from aortoiliac peripheral artery disease [7].

Variant 2: Long history of mild claudication. Acute-onset left lower-extremity pain. Absent left femoral pulse on palpation, faint dorsalis pedis and posterior tibial pulses by Doppler. Next steps.

Variant 3: Known atrial fibrillation and spine surgery 3 weeks ago. Sudden-onset right lower-extremity pain. Diminished pulses in right lower extremity. CTA demonstrates isolated filling defect in right common iliac artery.

Acute iliac artery ischemia can occur because of thromboembolism, atheroembolism, in situ native arterial thrombosis, or thrombosis of a surgical bypass graft. The goal is prompt restoration of distal blood flow. Acute-onset iliac occlusive disease typically presents as sudden-onset pain in the lower limb(s). Prompt determination of the duration and severity of symptoms [1] and any prior surgical and endovascular procedures is essential. On clinical examination, pulses are usually diminished or absent depending upon the level of thrombosis and the severity of any coexisting atherosclerotic disease. Considering the acute nature of the presentation, screening tools such as plethysmography and PVR are usually not the diagnostic tests of choice. CTA is fast and reveals the exact nature and level of both thrombosis and underlying atherosclerotic plaque to plan an appropriate treatment strategy. MRA is an alternative when time permits. ABI and Doppler US may be considered in patients who are not suitable for CTA, such as patients with renal dysfunction or knee or hip prosthesis.

Patients presenting with acute limb ischemia without contraindications to anticoagulation should receive anticoagulated therapy immediately, usually with heparin. All patients, particularly those with atypical presentations, should be evaluated for hypercoagulability. This assessment may be initiated concurrently with anticoagulation therapy and may include prothrombin time, partial thromboplastin time, platelet count, and levels of factor V Leiden, factor II (prothrombin) C-20210a, anticardiolipin antibody, protein C, protein S, and antithrombin III [1,3]. In addition to systemic anticoagulation, treatment options include a glycoprotein IIb or IIIa antagonist, catheter-directed thrombolysis, and mechanical thrombectomy. Ultimately, treatment of any causative underlying lesion by endovascular or surgical means is extremely important to prevent or delay the recurrence of the symptoms.

The most extensively studied and commonly used endovascular option is catheter-directed pharmacologic thrombolysis. Alteplase, reteplase, and urokinase are the most frequently used agents, and a wide variety of infusion protocols have been described. There is evidence that the glycoprotein IIb or IIIa antagonist abciximab may reduce distal emboli [8,9]. US-assisted pharmacologic thrombolysis [10], suction embolectomy, and rheolytic therapy [11] are broadly accepted options and may be used in conjunction with other therapies. US-assisted techniques may reduce the duration of thrombolysis infusion; suction embolectomy and rheolytic options may be particularly useful when thrombolysis is contraindicated. Surgical options include catheter embolectomy and bypass. Although there is no convincing evidence for the universal superiority of either endovascular or surgical approaches [12], distinguishing embolic from in situ lesions may help in planning therapy. Furthermore, the severity of ischemia and ability to tolerate surgery are important factors for consideration.

For native-vessel thrombosis, a trial of thrombolytic therapy is recommended for viable limbs. In cases where a guide wire can be passed across the lesion, catheter-directed thrombolysis may be instituted. In cases where a guide wire cannot be successfully passed, regional thrombolysis should be attempted [1,2]. Prospective, randomized trials demonstrated that 1-year limb salvage rates with endovascular techniques are similar to those after surgery, with lower mortality rates but higher rates of recurrent ischemia and amputation [3,13]. The endovascular approach allows treatment of the underlying lesion after thrombolysis, and gradual low-pressure reperfusion may avoid reperfusion injury [14]. The use of mechanical techniques may allow more prompt restoration of flow and expanded use of endovascular techniques in the threatened limb. Surgical approaches should be reserved for patients in whom thrombolysis or endovascular thrombectomy failed, for situations in which an unacceptable delay due to attempted endovascular techniques jeopardizes the viability of a limb, or for nonviable limbs.

For embolic occlusions, a consensus document recommends that isolated suprainguinal emboli be removed surgically [1]. If embolic fragmentation and distal embolization into peripheral vessels have occurred, endovascular thrombolytic therapy is the preferred therapeutic option. Echocardiography is not necessary before thrombolytic therapy for embolic disease [14].

For occluded aortoiliac or aortofemoral bypass grafts, catheter-directed thrombolysis is the preferred option in grafts occluded <14 days [1]. Despite a higher risk of amputation [3], catheter-directed therapy allows underlying lesions to be defined and treated. Furthermore, surgical risks related to reoperative anatomy and wound complications can be avoided [15]. After management of an acute thrombotic event, these patients should undergo consultation for appropriate medical management of risk factors, a supervised exercise program, and initiation of antiplatelet therapy.

Variant 4: Past medical history of heavy smoking. Severe claudication and no symptoms at rest. Angiogram demonstrates bilateral 90% common iliac artery stenosis (TASC A).

Variant 5: Past medical history significant for diabetes mellitus, hypertension, and smoking. Increasing claudication of right lower extremity involving right buttock for last 3 months. CTA pelvis with runoff reveals short-segment occlusion of right common iliac artery (TASC B).

Variant 6: Past medical history significant for diabetes mellitus, hypertension, and heavy smoking. Gradually increasing claudication of bilateral lower extremities for at least 2 months. CTA pelvis with runoff reveals bilateral common iliac artery occlusion without any involvement of the external or internal iliac artery (TASC C).

Variant 7: Worsening claudication and small ischemic ulcers on digits of both feet. Angiogram demonstrates diffuse disease involving distal aorta and both iliac vessels, with multiple stenoses >50%, bilateral 75% mid–superficial femoral artery stenosis, and 2-vessel tibial runoff bilaterally (TASC D).

Chronic iliac arterial occlusive disease is chronic, progressive atherosclerosis that may remain asymptomatic or present with claudication. In severe cases (ABI <0.4), patients present with rest pain or critical limb ischemia (CLI) with associated ulcers or gangrene. Although iliac occlusive disease is commonly a contributing factor to CLI, it seldom exists as an isolated lesion. Noninvasive evaluation includes ABI, segmental arterial pressures, US, and either CTA or MRA to plan either endovascular or surgical intervention. The Trans-Atlantic Inter-Society Consensus (TASC) Management of Peripheral Arterial Disease document described anatomic classification and therapeutic recommendations for iliac occlusive disease. TASC II has modified these recommendations [3] for consistency; the TASC II classification scheme was used to describe Variants 4 through 7. Endovascular therapy is the treatment of choice for TASC A and B lesions, and may play an expanded role for endovascular therapy in TASC C and D lesions, which were historically treated with surgical options.

Percutaneous Transluminal Angioplasty Versus Stent

The Dutch iliac stent trial concluded that percutaneous transluminal angioplasty (PTA) with selective stent placement yielded patency rates similar to those occurring with primary stenting [16]. More recent stratified studies have documented that primary angioplasty with selective stenting is effective for TASC A and B lesions [17-19]. However, stenting has demonstrated significant benefits over angioplasty alone in TASC C and D lesions [17,19,20]. A recent large meta-analysis demonstrated significantly higher 12-month primary patency rates for primary stenting (92.1%; 95% confidence interval, 89.0%-94.3%) in comparison to selective stenting (82.9%; 95% confidence interval, 72.2%-90.0%) for TASC C and D lesions [20]. Other authors have found patency rates for primary stenting of TASC C and D lesions to be similar to those for TASC A and B lesions [21,22]. Finally, a recent study found no significant difference in the patency rates of iliac artery stents among all TASC categories, questioning the utility of the TASC classification and associated endovascular and surgical recommendations in iliac disease [23]. Primary stenting seems to be the preferred treatment for most patients with TASC A-D lesions [24]. However, primary stenting has demonstrated significantly higher complication rates in TASC C and D lesions in comparison with TASC A and B lesions [25].

Bare Metal Versus Covered Stent

With respect to the role of stents covered with polytetrafluoroethylene in treating iliac occlusive disease, two studies have confirmed its technical feasibility, and both demonstrated 1-year primary patency rates of 91% [26,27]. One report described a significant benefit of using covered balloon-expandable stents in type C and D lesions as compared with bare metal stents at 18-month follow-up with respect to binary restenosis (95.4% versus 82.2%), amputation rate (1.2% versus 3.6%), and clinical improvement (94.2% versus 76.7%) [28]. Another study demonstrated significantly higher 5-year primary patency rates with the use of stent grafts as compared with bare metal stents (87% versus 53%) in patients undergoing simultaneous common femoral artery (CFA) endarterectomy and iliac revascularization [29]. Additional information regarding patency rates of covered stents will also be provided by long-term review of aortic endograft experience.

Surgery Versus Endovascular Therapy

For TASC C and D lesions, surgery has historically been recommended; however, more recent data suggest an expanded role for endovascular therapy. Meta-analysis of long-term results for aortofemoral bypass grafts for iliac disease demonstrated 5-year limb-based patency rates of 90% in claudicants and 87% in patients with CLI [30]. Two recent studies comparing surgical aortofemoral bypass to aortoiliac angioplasty and stenting demonstrated similar results. Surgical bypass yielded higher 3-year primary patency rates and greater improvement in ABIs but at the cost of increased surgical complication rates, including the need for emergency surgery, infection, transfusion, and lymph leak. Endovascular therapy shortens the initial hospitalization stay and is associated with half the number of readmissions [31,32]. Importantly, neither study demonstrated a significant difference in secondary patency rates, limb salvage, or long-term survival [33,34].

The durability of endovascular recanalization of the iliac arteries has been established, although primary patency is generally less than that of surgery. A recent study involving iliac recanalization demonstrated 1-, 2-, and 3-year primary patency rates of 86%, 76%, and 68%, respectively. Secondary patency rates were 94%, 92%, and 80%, respectively [35]. Another study has reported 3-, 5-, 7-, and 10-year primary patency rates of 90%, 85%, 80%, and 68%, respectively [36]. Despite substantial variation between these studies, the long-term patency of recanalized iliac segments has proven satisfactory. The more recent BRAVISSIMO study demonstrated primary patency rates at 24 months for TASC A, B, C, and D lesions of 88.0%, 88.5%, 91.9%, and 84.8.2%, respectively, with no statistical difference when comparing the four groups, suggesting endovascular therapy is the preferred treatment for patients with TASC A to D aortoiliac lesions [24]. Additionally, a recent meta-analysis comprising 16 studies and 958 patients evaluated endovascular therapy for TASC D lesions and demonstrated technical success and 12-month primary patency rates of 90.1% and 87.3%, respectively [20]. Bifurcated endografts demonstrated a technical success rate of 100% and promising long-term results in TASC C and D lesions in a recent study [37].

Surgical intervention incurs higher morbidity, including risk of impotence and retrograde ejaculation; endovascular therapies allow greater ease of reintervention. With perpetual improvements in both technology and operator experience, several recent studies have further demonstrated adequate evidence of safety and efficacy with subintimal recanalization and re-entry into the true lumen, with success rates ranging from 71% to 100% [38,39]. Additionally, subintimal revascularization has demonstrated success and safety in chronic total iliac artery occlusions, including long-segment (>5 cm) occlusions [35,40,41]. The TASC authors have noted that when choosing between endovascular and open-surgical or bypass therapies with equivalent short-term and long-term outcomes, endovascular techniques should be used first.

Endovascular Adjunct to Other Procedures

Endovascular therapy may be an adjunct to a separate surgical or endovascular procedure. It has been demonstrated that an ipsilateral stenotic, but not occluded, superficial femoral artery (SFA) is a predictor of iliac intervention failure and that SFA stenoses should be addressed at the time of iliac intervention [42]. When iliac intervention is performed in conjunction with infrainguinal surgical bypass, graft patency is significantly greater with stenting as compared with angioplasty alone and is similar to that of aortofemoral bypass at 5 years [43]. For external iliac artery disease that extends into the CFA, external iliac artery stent placement with CFA endarterectomy and patch angioplasty has produced durable results with less extensive surgery than conventional bypass [44]. One study evaluating the combined CFA endarterectomy with stenting of the common or external iliac artery demonstrated a 5-year primary patency rate of 60% and a secondary patency rate of 98% [29]. Endovascular repair and femoral-femoral bypass may be useful in patients with a stenotic segment <5 cm in the inflow limb and contralateral iliac occlusion but not in patients with stenoses >5 cm (primary patency rates at 3 years are 85% and 31%, respectively) [45].

Predictors of Success and Failure

Multivariate analysis of independent predictors for iliac intervention failure has described a 3-year primary patency rate of iliac intervention of 36% for untreated stenotic (>50%) SFAs in the setting of iliac artery angioplasty or stent. SFAs that are occluded, patent, or receiving concomitant angioplasty at the time of iliac intervention demonstrated 3-year primary patency rates of 84%, 81%, and 75%, respectively. Occluded SFAs can be observed, but stenotic SFAs should be repaired at the time of iliac intervention [42]. Hypertension, hypercholesterolemia, chronic renal insufficiency, poor tibial runoff [18], external iliac artery disease, female gender [46], smoking, gangrene, ulcer [19], diabetes mellitus, presence of a distal bypass [34], and hormone replacement therapy in female patients [47] are all independent predictors of failure. Immediate hemodynamic improvement and the presence of two-vessel femoral or two-vessel tibial runoff have been found to be predictors of favorable outcome [18]. In addition, these patients should undergo consultation for medical management of risk factors, a supervised exercise program, and initiation of antiplatelet therapy.

Summary of Recommendations

- For patients with mild claudication, noninvasive screening with US and measurement of ABI or segmental arterial pressures followed by confirmation with CTA or MRA, if indicated, are recommended on the initial physician visit. Once the diagnosis of peripheral vascular disease is confirmed, a supervised exercise program and risk factor modification such as smoking cessation and control of hyperlipidemia, diabetes, and hypertension are recommended.
- For the diagnosis of the acute thromboembolic event, CTA is fast and reveals the exact nature and level of both thrombosis and underlying atherosclerotic plaque. MRA is an alternative when time permits. Doppler US may be considered in patients who are not suitable for CTA, such as patients with renal dysfunction or knee or hip prosthesis.
- An isolated acute embolic event involving the common iliac artery is best treated by surgical revascularization. Catheter-directed mechanical thrombectomy is usually appropriate. Anticoagulation is usually indicated except in situations such as recent surgery.
- For TASC A lesions, bilateral PTA alone or in combination with stent placement in patients with suboptimal results after PTA and adjunctive antiplatelet therapy is usually appropriate.
- For TASC B lesions, bilateral PTA alone or in combination with stent placement in patients with suboptimal results after PTA and adjunctive antiplatelet therapy is usually appropriate.
- For TASC C lesions, primary stenting combined with antiplatelet therapy is usually the first choice, followed by open surgery if endovascular therapy fails.
- For TASC D lesions, catheter-directed aortoiliac stent or stent-graft placement with or without femoral angioplasty combined with antiplatelet therapy is usually the first choice, followed by open surgery if endovascular therapy fails.

Summary of Evidence

Of the 47 references cited in the *ACR Appropriateness Criteria® Radiologic Management of Iliac Artery Occlusive Disease* document, 43 are categorized as therapeutic references including 10 well-designed studies, 25 good-quality studies, and 1 quality study that may have design limitations. Additionally, 2 references are categorized as diagnostic references. There are 9 references (including the 2 diagnostic references) that may not be useful as primary evidence. There are 2 references that are meta-analysis studies.

The 47 references cited in the *ACR Appropriateness Criteria® Radiologic Management of Iliac Artery Occlusive Disease* document were published from 1989 to 2015.

Most of the references are well-designed or good-quality studies and provide good evidence.

Supporting Documents

For additional information on the Appropriateness Criteria methodology and other supporting documents go to www.acr.org/ac.

References

1. Thrombolysis in the management of lower limb peripheral arterial occlusion--a consensus document. *J Vasc Interv Radiol.* 2003;14(9 Pt 2):S337-349.
2. Hirsch AT, Haskal ZJ, Hertzer NR, et al. ACC/AHA Guidelines for the Management of Patients with Peripheral Arterial Disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Associations for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (writing committee to develop guidelines for the management of patients with peripheral arterial disease)--summary of recommendations. *J Vasc Interv Radiol.* 2006;17(9):1383-1397; quiz 1398.
3. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *Eur J Vasc Endovasc Surg.* 2007;33 Suppl 1:S1-75.
4. Rossi M, Iezzi R. Cardiovascular and Interventional Radiological Society of Europe guidelines on endovascular treatment in aortoiliac arterial disease. *Cardiovasc Intervent Radiol.* 2014;37(1):13-25.
5. Ruggiero NJ, 2nd, Jaff MR. The current management of aortic, common iliac, and external iliac artery disease: basic data underlying clinical decision making. *Ann Vasc Surg.* 2011;25(7):990-1003.
6. Cao P, Eckstein HH, De Rango P, et al. Chapter II: Diagnostic methods. *Eur J Vasc Endovasc Surg.* 2011;42 Suppl 2:S13-32.
7. Murphy TP, Cutlip DE, Regensteiner JG, et al. Supervised exercise versus primary stenting for claudication resulting from aortoiliac peripheral artery disease: six-month outcomes from the claudication: exercise versus endoluminal revascularization (CLEVER) study. *Circulation.* 2012;125(1):130-139.
8. Ouriel K, Castaneda F, McNamara T, et al. Reteplase monotherapy and reteplase/abciximab combination therapy in peripheral arterial occlusive disease: results from the RELAX trial. *J Vasc Interv Radiol.* 2004;15(3):229-238.
9. Tepe G, Hopfenzitz C, Dietz K, et al. Peripheral arteries: treatment with antibodies of platelet receptors and reteplase for thrombolysis--APART trial. *Radiology.* 2006;239(3):892-900.
10. Wissgott C, Richter A, Kamusella P, Steinkamp HJ. Treatment of critical limb ischemia using ultrasound-enhanced thrombolysis (PARES Trial): final results. *J Endovasc Ther.* 2007;14(4):438-443.
11. Kasirajan K, Gray B, Beavers FP, et al. Rheolytic thrombectomy in the management of acute and subacute limb-threatening ischemia. *J Vasc Interv Radiol.* 2001;12(4):413-421.
12. Berridge DC, Kessel D, Robertson I. Surgery versus thrombolysis for acute limb ischaemia: initial management. *Cochrane Database Syst Rev.* 2000(4):CD002784.
13. Ouriel K, Veith FJ, Sasahara AA. A comparison of recombinant urokinase with vascular surgery as initial treatment for acute arterial occlusion of the legs. Thrombolysis or Peripheral Arterial Surgery (TOPAS) Investigators. *N Engl J Med.* 1998;338(16):1105-1111.
14. Beyersdorf F, Matheis G, Kruger S, et al. Avoiding reperfusion injury after limb revascularization: experimental observations and recommendations for clinical application. *J Vasc Surg.* 1989;9(6):757-766.
15. Nehler MR, Mueller RJ, McLafferty RB, et al. Outcome of catheter-directed thrombolysis for lower extremity arterial bypass occlusion. *J Vasc Surg.* 2003;37(1):72-78.

16. Klein WM, van der Graaf Y, Seegers J, et al. Dutch iliac stent trial: long-term results in patients randomized for primary or selective stent placement. *Radiology.* 2006;238(2):734-744.
17. AbuRahma AF, Hayes JD, Flaherty SK, Peery W. Primary iliac stenting versus transluminal angioplasty with selective stenting. *J Vasc Surg.* 2007;46(5):965-970.
18. Galaria, II, Davies MG. Percutaneous transluminal revascularization for iliac occlusive disease: long-term outcomes in TransAtlantic Inter-Society Consensus A and B lesions. *Ann Vasc Surg.* 2005;19(3):352-360.
19. Kudo T, Chandra FA, Ahn SS. Long-term outcomes and predictors of iliac angioplasty with selective stenting. *J Vasc Surg.* 2005;42(3):466-475.
20. Ye W, Liu CW, Ricco JB, Mani K, Zeng R, Jiang J. Early and late outcomes of percutaneous treatment of TransAtlantic Inter-Society Consensus class C and D aorto-iliac lesions. *J Vasc Surg.* 2011;53(6):1728-1737.
21. Balzer JO, Gastinger V, Ritter R, et al. Percutaneous interventional reconstruction of the iliac arteries: primary and long-term success rate in selected TASC C and D lesions. *Eur Radiol.* 2006;16(1):124-131.
22. Leville CD, Kashyap VS, Clair DG, et al. Endovascular management of iliac artery occlusions: extending treatment to TransAtlantic Inter-Society Consensus class C and D patients. *J Vasc Surg.* 2006;43(1):32-39.
23. Park KB, Do YS, Kim DI, et al. The TransAtlantic InterSociety Consensus (TASC) classification system in iliac arterial stent placement: long-term patency and clinical limitations. *J Vasc Interv Radiol.* 2007;18(2):193-201.
24. de Donato G, Bosiers M, Setacci F, et al. 24-Month Data from the BRAVISSIMO: A Large-Scale Prospective Registry on Iliac Stenting for TASC A & B and TASC C & D Lesions. *Ann Vasc Surg.* 2015;29(4):738-750.
25. Ichihashi S, Higashiura W, Itoh H, Sakaguchi S, Nishimine K, Kichikawa K. Long-term outcomes for systematic primary stent placement in complex iliac artery occlusive disease classified according to Trans-Atlantic Inter-Society Consensus (TASC)-II. *J Vasc Surg.* 2011;53(4):992-999.
26. Bosiers M, Iyer V, Deloose K, Verbist J, Peeters P. Flemish experience using the Advanta V12 stent-graft for the treatment of iliac artery occlusive disease. *J Cardiovasc Surg (Torino).* 2007;48(1):7-12.
27. Wiesinger B, Beregi JP, Oliva VL, et al. PTFE-covered self-expanding nitinol stents for the treatment of severe iliac and femoral artery stenoses and occlusions: final results from a prospective study. *J Endovasc Ther.* 2005;12(2):240-246.
28. Mwipatayi BP, Thomas S, Wong J, et al. A comparison of covered vs bare expandable stents for the treatment of aortoiliac occlusive disease. *J Vasc Surg.* 2011;54(6):1561-1570.
29. Chang RW, Goodney PP, Baek JH, Nolan BW, Rzucidlo EM, Powell RJ. Long-term results of combined common femoral endarterectomy and iliac stenting/stent grafting for occlusive disease. *J Vasc Surg.* 2008;48(2):362-367.
30. de Vries SO, Hunink MG. Results of aortic bifurcation grafts for aortoiliac occlusive disease: a meta-analysis. *J Vasc Surg.* 1997;26(4):558-569.
31. Aihara H, Soga Y, Iida O, et al. Long-term outcomes of endovascular therapy for aortoiliac bifurcation lesions in the real-AI registry. *J Endovasc Ther.* 2014;21(1):25-33.
32. Davenport DL, Zwischenberger BA, Xenos ES. Analysis of 30-day readmission after aortoiliac and infrainguinal revascularization using the American College of Surgeons National Surgical Quality Improvement Program data set. *J Vasc Surg.* 2014;60(5):1266-1274.
33. Burke CR, Henke PK, Hernandez R, et al. A contemporary comparison of aortofemoral bypass and aortoiliac stenting in the treatment of aortoiliac occlusive disease. *Ann Vasc Surg.* 2010;24(1):4-13.
34. Kashyap VS, Pavkov ML, Bena JF, et al. The management of severe aortoiliac occlusive disease: endovascular therapy rivals open reconstruction. *J Vasc Surg.* 2008;48(6):1451-1457, 1457 e1451-1453.
35. Chen BL, Holt HR, Day JD, Stout CL, Stokes GK, Panneton JM. Subintimal angioplasty of chronic total occlusion in iliac arteries: a safe and durable option. *J Vasc Surg.* 2011;53(2):367-373.
36. Gandini R, Fabiano S, Chiocchi M, Chiappa R, Simonetti G. Percutaneous treatment in iliac artery occlusion: long-term results. *Cardiovasc Intervent Radiol.* 2008;31(6):1069-1076.
37. Zander T, Blasco O, Rabellino M, et al. Bifurcated endograft in aortoiliac type C and D lesions: long-term results. *J Vasc Interv Radiol.* 2011;22(8):1124-1130.
38. Etezadi V, Benenati JF, Patel PJ, Patel RS, Powell A, Katzen BT. The reentry catheter: a second chance for endoluminal reentry at difficult lower extremity subintimal arterial recanalizations. *J Vasc Interv Radiol.* 2010;21(5):730-734.
39. Rezq A, Aprile A, Sangiorgi G. Pioneer re-entry device for iliac chronic total occlusion: truly a paradigm shift. *Catheter Cardiovasc Interv.* 2013;82(3):495-499.

40. Ko YG, Shin S, Kim KJ, et al. Efficacy of stent-supported subintimal angioplasty in the treatment of long iliac artery occlusions. *J Vasc Surg.* 2011;54(1):116-122.
41. Minko P, Katoh M, Opitz A, Jager S, Bucker A. Subintimal revascularization of chronic iliac artery occlusions using a reentry-catheter. *Rofo.* 2011;183(6):549-553.
42. Kudo T, Rigberg DA, Reil TD, Chandra FA, Ahn SS. The influence of the ipsilateral superficial femoral artery on iliac angioplasty. *Ann Vasc Surg.* 2006;20(4):502-511.
43. Timaran CH, Stevens SL, Freeman MB, Goldman MH. Infrainguinal arterial reconstructions in patients with aortoiliac occlusive disease: the influence of iliac stenting. *J Vasc Surg.* 2001;34(6):971-978.
44. Nelson PR, Powell RJ, Schermerhorn ML, et al. Early results of external iliac artery stenting combined with common femoral artery endarterectomy. *J Vasc Surg.* 2002;35(6):1107-1113.
45. Aburahma AF, Robinson PA, Cook CC, Hopkins ES. Selecting patients for combined femorofemoral bypass grafting and iliac balloon angioplasty and stenting for bilateral iliac disease. *J Vasc Surg.* 2001;33(2 Suppl):S93-99.
46. Timaran CH, Stevens SL, Freeman MB, Goldman MH. External iliac and common iliac artery angioplasty and stenting in men and women. *J Vasc Surg.* 2001;34(3):440-446.
47. Timaran CH, Stevens SL, Grandas OH, Freeman MB, Goldman MH. Influence of hormone replacement therapy on the outcome of iliac angioplasty and stenting. *J Vasc Surg.* 2001;33(2 Suppl):S85-92.